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Power Takes Skill and Luck

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Making the Financial System Safer and Fairer

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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.

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Special Column on Recent Development of RMB

Internationalization

Editor's Note:

The RMB Internationalization Report is a yearly report released by International Monetary Institute since 2012. It introduces thorough discussions and systematic researches on major topics such as currency internationalization & macro-financial risk management, high-quality development & high-level financial opening up, and the opportunities and challenges of low-carbon development.

The Report initiates the RMB Internationalization Index (RII), a comprehensive quantitative indicator, firstly disclosed in the 2012 Report. It objectively describes the actual use of RMB in international economic activities, including trade, financial transactions and foreign exchange reserves. According to the RMB Internationalization Report 2022, RII reached 5.05 by the end of 2021. Since the beginning of this year, RII has shown a cyclical retracement, with a preliminary rough calculation of 4.66 at the end of the first quarter of 2022, which remained at a relatively high level. The scale of international use and market recognition of RMB kept growing overall, giving RMB full play as an international currency and securing its position as one of the world's top currencies.

In order to discuss the recent development of RMB internationalization and look into the future path, we have Mr. Herbert Poenisch and Mr. Jaya Josie, members of IMI International Committee, to share their opinions in our Special Column on Recent Development of RMB Internationalization.

New Geopolitical Environment and Internationalization of RMB

By HERBERT POENISCH*

Until the beginning of the Pandemic, goods, services as well as finance were moving mostly unimpeded round the world. Globalisation was ticking round like a Swiss clock. President Xi Jinping of China presented his country as the champion of globalization at Davos in early 2017. However, signs were appearing on the horizon that not all is well.

In geopolitics, the signs were set by Russia, China and the USA. In 2007 President Putin spoke out against the leadership of the USA and proposed a multipolar system. President Xi did not express it in such a clear way but it became increasingly clear after 2017, that China was aiming

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to become the world leader, casting aside the paradigm of Deng Xiaoping, ‘hiding your strength and biding your time’.

The Make America Great Again strategy of President Trump was a clear signal to the world that the US was moving away from unfettered globalization. The beginning of the war in Ukraine brought sanctions from the US and its allies which severely affected global trade and capital movements. In addition, covid19 necessitated lockdowns in China which severely affected supply chains which had already been strained during the pandemic.

This article will explore how the internationalization of renminbi will be affected by new geopolitical realities. After outlining the new paradigm in geopolitics, the recent development of RMB use in global finance according to the PBoC, IMI, SWIFT and BIS statistics and analysis will follow, and finally round off with the outlook for RMB use under these changed circumstances.

1. The new paradigm in geopolitics

The dominance of the US world order since WWII has brought peace and stability to the world. Isolated wars flared up but the basic order and institutions were never challenged, most importantly by the permanent members of the UN Security Council. They were grudgingly accepted. However this changed with Russia becoming more assertive during Putin’s second presidency. Equally, China under President Xi became increasingly assertive, particularly during his second period in office as from 2017. This not only affected the global political order but also economics and finance.

China’s steps towards establishing its own economic and financial order were boosted by its Belt and Road Initiative (BRI). By early 2022, some 164 countries had joined this plan amounting to close to USD 1tr. Under the BRI, China not only provided funds for infrastructure investment, thus bypassing the World Bank but also liquidity support, thus bypassing the IMF. The funds were provided by the Chinese policy banks and major commercial banks, each one of which has more financial assets than the established World Bank or IMF. China played its economic clout to underpin its global ambitions.

Russia’s global ambitions are far more modest and provide mainly military support for some countries. However, it set a new geopolitical paradigm by launching the invasion of Ukraine, thus furthering its imperial ambitions by breaking many international rules. Since the war Russia has demonstrated its part in a multipolar global system, which is not part of the Western global order.

The response of the USA and its allies was the imposition of broad sanctions which affected the global economic and financial functioning. The sanctions covered a wide array of financial transactions, starting with freezing the assets of the Bank of Russia, boycotting Russian banks to excluding Russian banks from SWIFT. This came on top of US led trade sanctions and technology protection against China.

2. Recent indicators of RMB Internationalisation

According to available statistics from the PBoC, IMI (see summary of RMB Internationalisation Report), the BIS 2022 foreign exchange triennial report and the monthly SWIFT RMB tracker, RMB use has increased steadily in 2020 and 2021, but not in leaps and bounds. However, these published indicators do not include bilateral settlement in RMB, mostly of goods and services thus potentially understating the comprehensive use of RMB.

One of the notable conclusion in the 2021 PBoC RMB Internationalisation report is that financial transactions up by 58.7% contributed mostly to the rising use of RMB in 2019 and 2020, while RMB use for current account transactions rose by only 12.1% yoy (figure 2-1).

Another pertinent conclusion was that in relations with Belt and Road countries settlement for goods and services in RMB increased by 18.8% yoy, whereas settlement of direct investment was

RMB 434.12 billion yuan, a yoy increase of 72.0%. This would suggest a reversal from previous financing of Chinese BRI projects in USD.

Altogether, direct investments, portfolio investments and other cross-border financing accounted for 17.7%, 76.4% and 4.3% of the total settlement in RMB under the capital account respectively. It is noteworthy that 2020 still showed net portfolio inflows of RMB 578.39 billion yuan, contributing to the sharp rise in RMB use. This trend was reversed in the 1H2022, with consequences for RMB.

In 2020, the Cross-border Interbank Payment System (CIPS) operated steadily, handling a total of 2.21 million cross-border RMB transactions with an overall volume of RMB 45.27 trillion yuan, up 17.0% and 33.4% respectively yoy. In 2020, 9 new direct participants (4 of which were overseas RMB clearing banks) and 147 new indirect participants joined the CIPS. By the end of 2020, a total of 1,092 domestic and foreign institutions had linked to the CIPS through direct or indirect means.

In recent years, the RMB clearing business of overseas clearing banks has steadily increased, with an average RMB clearing amount of 344.76 trillion yuan and an average annual growth rate of 8.2% in the past three years. By the end of December 2020, altogether 907 participating banks and other institutions opened clearing accounts in overseas RMB clearing banks. In 2020, the RMB clearing amount of overseas RMB clearing banks totalled RMB 369.49 trillion yuan, increasing by 6.1% yoy.

The onshore RMB bond market has been attractive for foreign issuers (Panda bonds). By the end of 2020 the outstanding amounts have totalled USD 40bn. Main issuers are not only official borrowers such as IFC and ADB, governments such as of Hungary and the Philippines, but also private borrowers such UOB, BMW and Daimler and recently Rosneft.

In 2020, the offshore RMB deposits steadily increased. By the end of 2020, the RMB deposits in major offshore RMB markets exceeded 1.27 trillion yuan. The overall scale of offshore RMB loans remained generally stable, and the amount of outstanding RMB loans in major offshore markets was RMB 528.55 billion yuan. It can be assumed that the net RMB 500 billion was absorbed by issues in the offshore bond market, or flowed back into the onshore financial market.

Recently, the offshore RMB-denominated bond market has picked up after stagnating since 2015. Incomplete statistics showed that the total issuance of the RMB-denominated bonds in countries and regions, where overseas RMB clearing arrangements are established, amounted to RMB 331.96 billion yuan in 2020, with a yoy increase of 14.2%. The market is dominated by mainland issuers, such as the China Development Bank and other Chinese financials, but also Chinese property developers. They have been joined by foreign issuers such as McDonalds, Unilever and others, such as Australia National Bank and Maybank which raised funds for their China operations. Foreigners in total made up 20% in 2021.

The PBoC and BOC continued to intervene in the offshore RMB market. They are unlike the US authorities which never intervened in the offshore Eurodollar market. In 2020, the PBoC issued RMB-denominated central-bank bills in Hong Kong SAR of China markets regularly, further optimized the issuance structure of central-bank bills of different maturities, and improved the market activity of offshore RMB denominated central-bank bills. The PBC issued 12 batches of RMB-denominated central-bank bills including maturities of 3-month bills, 6-month bills and 1-year bills, with total amounts of 155.00 billion yuan in Hong Kong SAR of China.

On January 27, 2021, Bank of China (Hong Kong) launched the market-making mechanism for the repurchase of RMB-denominated central-bank bills in Hong Kong SAR of China, providing quotations for overnight, one-week, two-week, one-month, two-month and three-month repurchase and reverse repurchase of RMB-denominated central-bank bills.

In 2020, the RMB clearing amount of overseas RMB clearing banks had totalled in RMB 369.49 trillion yuan with a yoy increase of 6.1%, among which the clearing amount on behalf of clients

and for the interbank had been RMB 37.63 trillion yuan and RMB 331.86 trillion yuan respectively, with each yoy increase respectively at 15.0% and 5.2%. By the end of 2020, 907 participating banks and other institutions had opened clearing accounts in overseas clearing banks.

The IMI RMB internationalisation index has fluctuated in the recent past. After reaching a high of 6 in early 2020 it declined to 4 during the course of the year, reaching 5.05 at the end of 2021. In early 2022 it receded again to 4.66. The RMB share in global trade (excluding finance) reached 2.85% at the end of 2021, whereas the RMB share of FDI, due to BRI investments reached 27.38%. The share of RMB in official forex reserves increased slightly from 2.8% at the end of 2021 to 2.88% in 1Q22.

The SWIFT RMB tracker reports that in July 2022, the RMB has retained its position as the fifth most active currency for global payments by value, including payments for goods and services as well as finance with a share of 2.20%, an increase compared with its share of 1.86% in July 2020. However, in the trade finance market, the RMB moved up to third position with a share of 3.07% in July 2022, compared to 1.84% in July 2020. The clearest recent indicator yet is the share of RMB in foreign exchange trading which nearly doubled between April 2019 and April 2022 from 4% to 7% according to the BIS.

3. Outlook for global use of RMB in the new environment

All three functions of money, denomination and reference currency, transactions and store of value were fundamentally affected by the new geopolitical scenario. China has put in place the basic infrastructure for denominating commodities, such as oil and gold in RMB, clearing transactions in RMB through the CIPS payments system and offer onshore as well as offshore RMB as borrowing and investment currency.

Whereas during the USD era, major traded goods and services as well as invoices were denominated in USD, thus providing a reference currency, transactions mainly in USD through USD clearing system with notification through SWIFT messaging, and global lending and borrowing by non-US entities denominated mainly in USD. The major currency of issue of international equity and debt securities was also in USD. This process was helped by the deep and liquid Eurodollar market, which is a truly global financial market. Until very recently, both Chinese and Russian borrowers have benefitted from this global financial market.

The USD based global payments systems had two pillars, standard messages through SWIFT with membership of 200 countries and 11,000 participants, payments were cleared through the official FedWire with close to 10,000 participants or the private CHIPS with 47 member banks. Liquidity of USD payments is assured by the FED.

China operates its own global payments system, the official CIPS with 76 direct and 1228 indirect participants from 103 countries in early 2022. The system uses SWIFT messaging standards ISO 20022 but has to manage the risks of any payment system, such as credit risk and liquidity risk. The PBoC offers implicit RMB liquidity guaranty to the major Chinese banks.

CIPS is not China's carbon copy of SWIFT as they have core technical and contextual differences. Technically, CIPS clears and settles RMB transactions, whereas SWIFT is a secured messaging protocol that lets banks "talk" to one another. Contextually, CIPS was created to improve the efficiency of RMB transactions, whereas SWIFT was created nearly 50 years ago by institutions from the U.S., the European Union and G-7 countries to enhance global financial messaging.

SWIFT and CIPS play different roles in international finance. SWIFT is a global secured messaging system that allows banks to communicate with each other with high efficiency and low costs. It does not move funds. Instead, it facilitates the secured flow of financial information across borders to support transactions. CIPS is different from SWIFT, as it is an RMB clearing and settling institution that utilizes SWIFT messaging to facilitate RMB transactions with the rest of the world. China's CIPS is more similar to the United States' CHIPS, which clears and settles

domestic and cross-border U.S. dollar transactions and is plugged into SWIFT for cross-border messaging. Its volume is still a fraction of transactions settled in USD.

But the U.S. should keep a watchful eye on CIPS because it is a crucial piece of China's broader ambition in international finance. China's desire to lead in global finance is a stated goal, most recently enshrined in the Financial Standardization Five Year Plan (2021- 2025) released in February 2022. China can lay the groundwork for its ambition by strengthening the efficiency of CIPS, which could pave the way for RMB internationalization, but only if China first makes the whole suite of political and economic structural changes that would make the RMB a safer asset. International trust in the RMB as a safe asset and China as a reliable player in global finance is a necessary ingredient before CIPS can prop up China's influence in the global financial ecosystem. Financial policymakers should study the growth in CIPS participation, as it is one indicator of RMB internationalization for China's potential monetary ascendance.

Chinese policymakers have to contend with a policy paradox—China wants CIPS to be connected to the world yet also be a viable alternative to existing financial institutions. This is because CIPS needs SWIFT to operate in international finance. However, China simultaneously feels the powerful reach of American sanctions. Chinese academics have openly discussed that SWIFT is a point of contention between the United States and Russia. Russia has set up its own financial messaging system.

Moreover, China has been collaborating with other countries in providing alternatives to mainstream financial institutions. For example, China has a financial alliance with Russia. In 2010, the two countries agreed to use their currencies to settle bilateral trade instead of using the U.S. dollar. In 2014, the two opened their first currency swap line, which was renewed in 2017 and 2020 with the latest renewal entitling 150 billion yuan over three years. With a 35.9 percent increase in total bilateral trade in 2021, the continuing currency swap would be even more economically important to Russia (although most of China-Russia trade is still settled with the euro). Most recently, the Russian Mir card network was looking to further integrate with China's UnionPay as Visa and Mastercard suspended their services to Russia. China has been replicating alternative financial arrangements across many other economies in the developing world. If more foreign banks join the CIPS (as either indirect or direct participants), that could be a sign that a China-led alternative channel could become stronger.

The introduction of the digital eCNY as a domestic currency will not boost the internationalisation of RMB. Only once the eCNY will be available for cross-border settlement, involved in multi CBDC projects, such as mBridge comprising eCNY, HKD, AED and THB can the international use of RMB be boosted by digitalisation. There are many economic and technical obstacles on the way to a cross-border use of CBDC.

Regarding savings and investment, China has limited its residents from investing freely in global markets including the offshore RMB market. Rather than dismantling the remaining capital controls, these restrictions are here to stay and more strictly enforced. It remains to be seen how much Chinese entities will use the Southbound Bond Connect to have access to a greater pool of financial instruments available in Hong Kong SAR.

Foreign borrowers have been allowed to issue RMB debt securities in the onshore (Panda bonds) and offshore RMB markets (DimSum bonds). However, the volumes are still low, in the Panda bond market USD 40bn compared to total domestic bond issues of close to USD 12tr. The dimsum issues in Hong Kong amounted to RMB 110bn or USD 18bn in 2021.

Foreign investors from outside China and Russia are free to buy RMB securities issued in China, either as direct investors or through stock and bond connect schemes. This is part of the internationalization of RMB as are investments of foreign exchange reserves in RMB, such as by the Bank of Russia, which has substantially increased its holdings of RMB instruments.

Regarding raising funds, China has encouraged its residents to issue in offshore RMB markets, notably Hong Kong. Bond issues which were tightly controlled by Chinese authorities have been relaxed as have been issues of IPOs. Recently, the Hong Kong Mortgage Corporation and Cathay Pacific have joined other foreign corporations as issuers.

Chinese enterprises which had to delist in US equity markets due to accounting verification have issued IPOs in the offshore RMB market. It remains to be seen, how attractive these issues are for foreign investors, comparing the onshore and offshore returns as well as liquidity of investments in addition to assessing trust in RMB. It also remains to be seen, how access for various foreigners will converge. Will the Qualified Investor schemes such as QFII or QRII remain or will any foreign institutional investor be allowed equal access?

Conclusion

Policymakers would be remiss not to consider the alternative case, one in which China becomes a more prominent actor in global finance. Imagine a world where blocs have become more defined, where authoritarian countries have become accustomed to working with one another to mitigate the political and economic penalties from international condemnation. There might be just enough competitive pressure for China to make some painful structural changes to its political economic model, such as opening its capital account and embracing financial volatility. This might not happen for a while, but there might be an inflection point where the RMB becomes more attractive and is on the cusp of becoming a more influential currency. At that point, China will have had years to refine its financial plumbing, such as the Financial Standardisation Plan and cross-border eCNY mentioned above. CIPS and other financial mechanisms and digital innovations native to China could embolden China to contend with current mainstream financial mechanisms such as SWIFT. Then, China will be one step closer to meaningfully countering U.S. and allied sanctions. This is a big if, all contingent on whether China is willing to change its political economic model. Admittedly, China is highly unlikely to do just that in the foreseeable future, as long as the leadership's calculus around social control and financial stability outweighs its ambition for a more internationalized RMB. However, U.S. policymakers should still keep a close eye on even a mildly successful expansion of the RMB. Because if the RMB becomes a more attractive asset, then CIPS, eCNY, Blockchain-based Services Network (BSN), and many other traditional and emerging financial mechanisms could get China to a position of strength to challenge leaders in the global financial order.

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Internationalization of the Renminbi Offers an Opportunity for an Alternative Payment Mechanism in Developing and Emerging Economies

By JAYA JOSIE*

While the current geopolitical crisis and the threat of sanctions against China may seem like an opportunity to raise the issue of the internationalization of the Renminbi. However, this climate of war in Europe and sanctions, and the threat of more US and European sanctions against the China provides an ideal opportunity to review the progress of the internationalization of the Renminbi. The currency disputes between the Renminbi, US Dollar and the Euro can be traced back to 2002 after China formally joined the World Trade Organization (WTO). The 2002 Sixteenth National Congress of the Chinese Communist Party (CCP) made several decisions for further economic reforms. Among other decisions these included lowering tariffs as a way to stimulate the economy and promote export growth. In this period there was great pressure on China to compensate for the increasing trade deficit faced by the USA. China made some adjustments but the problem persisted and the USA became more aggressive in trying to pressurize the People's Bank of China. These pressures eventually led to the CCP deciding to take proactive positions on the issue of the Renminbi.

In China's 13th Five Year Plan (2015) for the period 2016 to 2020 there was a commitment to promote the internationalization of the Renminbi (RMB). One of the key reasons for the internationalization of the RMB was to avoid falling into the US monetary policy trap of dollar shortages and lowering borrowing costs. Furthermore from 2006 there was extreme pressure for China to lower the value of its currency so that the USA could avoid a growing trade deficits with China. Thus a key reason for the internationalization of the RMB was an attempt to avoid US monetary policy obstacles, such as shoring up against dollar shortages, and gaining lower borrowing costs. In the ten years from 2009 to 2019 almost 20 trillion yuan was exchanged across borders although this amount only made up 2% of global foreign reserves. To promote the internationalization of the RMB China met all the preconditions to becoming an international reserve currency. China's currency was now backed by a large economy; it had a high global trade volume, and net creditor status with its international investments being larger than its foreign debt. These preconditions were strengthened by China's membership of the WTO.

Despite China's advantageous economic position, the US dollar and the Euro still have foreign currency hegemony because foreign investors and traders still prefer to use the US dollar. This maybe because the use of China's currency is governed by rule of law and the perception that its economy is too tightly controlled by government. What, then, is China's path to an internationally formidable RMB? For the BRICS group, emerging and developing economies there is still preference for the use of the Dollar and the Euro for financial transactions despite the high rate of volatility of these currencies in the foreign exchange markets. In such a scenario the internationalization of the RMB for use as a reserve currency may eventually present with the same dilemma and instability as the US dollar and the Euro are currently facing in world markets today. In this article we briefly discuss the dilemma and instability of using a reserve currency for international transactions and we propose an alternative to mechanism for international payments and transactions.

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In 22-23 March 2017 (*Josie, 2017*), we presented, in a paper, the possibility of using an alternative means of international payments for BRICS, developing and emerging markets to mitigate the risks of high volatility in foreign exchange markets. We argued that following the 2008 global financial crisis two consequences emerged for BRICS and developing and emerging market economies (DEME); volatile international capital flows and recognition of the risks of dollar dependence in trade & growth. In addition, we argued, that there was the real risk of the reemergence of the so-called *Triffin's Dilemma* due to the increasing evidence of the *financialization* of the global economy & low productive investment. *Triffin's Dilemma* is a well known paradox developed in the 1960s by Robert Triffin. Although the paradox initially related to the capital account of international transactions other monetary economists argue that the paradox has become prevalent in the current account and is now ubiquitous in the financial markets because of the increasing financialization of the global economy and the lack of regulation in exchange controls as was advocated by Triffin (*Faudot 2022*).

The paradox of the *Triffin's Dilemma* as applied to the US dollar can best be explained in the following way; if the USA stops issuing US dollar balances for international finance this will lead to global stagnation and deflation; on the other hand, if the USA continues to issue more US dollars as an international reserve, the US dollar risks losing confidence in the currency (*Rojas, 2016*). In a more recent article *Faudot (2022)* suggests that Triffin in the 1960s highlighted the unsustainability of the Bretton Woods international monetary system because the world economy uses a national currency for international settlements, however, the national economy issuing the reserve currency for international settlements must record a balance of payment deficit. This arrangement is unsustainable in the long run as the external accounts of the issuing country will gradually deteriorate and undermine the confidence in its currency and create global volatility perturbations. The definition of the balance of payments implies that it cannot be in deficit as deficits have to be always financed. In the USA conventionally, the deficit is represented by the sales from the US gold stock, additions of foreign dollar balances and other liquid claims on the USA (*Faudot, 2022*). The global economy is caught between the need to end the balance of payment deficits and the need to provide the world economy with an international reserve currency.

According to *Faudot (2022)* Triffin's work is more than just about this paradox. Triffin's thesis goes to the heart of exchange control policy. *Fuadot (2022)* argues that Triffin advocated for effective exchange control policies as a way of overcoming the paradox. Although exchange control policy is essential in controlling money supply, used as a reserve currency for international transactions Triffin's work also exposes the shortcomings of exchange control policies in the internationalization of reserve currencies. Today in China the internationalization of the RMB and its use for international transactions risks presenting a similar dilemma that the US dollar and the Euro is experiencing.

The current conflict in Europe is already putting the EU in general, and Germany in particular under great strain. In a recent essay in the *Monthly Review Online (Posted Oct 08, 2022)* *Michael Hudson (2022)* asks the question *What will happen to the Euro without Germany?* The author paints a gloomy picture for Germany following the blowing up of the Northstream Gas pipelines and the possibility of Germany having to pay Russia for gas that it cannot receive. According to *Hudson (2022)* the next decade will be a disaster for Europe as the strength of the Euro was based upon Germany's industrial exports. The Euro was the mechanism that helped Germany avoid an export surplus and price its goods and services out of world markets. Now with sanctions against Russia raising the prices of imported gas, oil, aluminium and fertilizer and, as industrial production requires higher energy this will likely mean declining Euro value against the dollar and a squeeze on multinational profits. In this scenario what is the alternative for emerging markets and the

developing world for coping with the rising cost of living and exchange rate instability? Our paper (*Josie, 2017*) was an attempt to propose an alternative approach for the BRICS group and developing and emerging economies.

In the paper (*Josie, 2017*) we argued that the international finance system can't keep pace with changes in the developing world. Short-term capital flows transmit instability and fails to provide liquidity management to deal with volatility. In cross-border transactions there is a shortage of good quality safe assets. Furthermore, US\$ dominance limits the ability to mitigate capital flow volatility, credit or legal risk to strengthen the liquidity safety net for developing countries. In addition the IMF's financing with liquidity-driven balance of payments contingencies did not achieve its intended objectives. In such a context the BRICS should have considered the feasibility of its own mechanisms for settling financial transactions and removed the necessity for payments in two-way foreign exchange trades via the US\$. In 2017 and beyond BRICS cooperation between China and Russia grew substantially through using own currency settlements as two-way trade increased and negotiations on a package of currency swaps began. China promoted the use of RMB and investment via the China-Russia Investment Fund targeting greenfield investment, equity investment, bond issuance, mergers & acquisitions.

In the paper (*Josie, 2017*) we suggested that BRICS should move to a more multilateral functional development approach to trade, integrating value chains, and include services to advance intra-BRICS economic cooperation. Multilateral financial cooperation in a time of crisis requires systemic liquidity management tools to deal with extreme episodes of volatility. The BRICS and developing economies could consider their own currencies for financial relationships. Developing and emerging economies in general could consider swap arrangements for supporting liquidity to move away from a unipolar currency dominance towards a multi-currency world. As more and more developing and emerging economies are joining the BRICS New Development Bank (NDB) the CRA mechanism could be strengthened using gold reserve commitments. One option that developing and emerging economies may wish to consider is the adoption of using the RMB as an international reserve currency for financial transactions. However, China is wary of the risk that an international reserve currency may also fall into the trap of the Triffin dilemma. In view of this risk China is seriously considering moving towards using multiple Central Bank Digital Currencies (mCBDC) for international financial transactions. China, India, and Russia have already started piloting retail CBDC platforms for transactions. While this system is being developed BRICS and, developing and emerging markets could deepen financial integration and introduce instruments such as collateralised lending arrangements and credit rating systems to mitigate credit risks.

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Global Economy

A Story of Tailwinds and Headwinds: Aggregate Supply and Macroeconomic Stabilisation*

By AGUSTIN CARSTENS*

Introduction

In recent decades, and especially under Esther George's leadership, this forum has laid the groundwork for many key global monetary policy debates. This year's event certainly is not the exception.

My remarks today will reflect on aggregate supply's importance for macroeconomic stabilisation. We are used to viewing the economy mainly through the lens of aggregate demand, with supply assumed to adjust smoothly in the background. But we need a more balanced approach. Signs of fragility in supply have been ignored for too long. Recent events have shown the dangers of doing this. Reinvigorating productivity growth and enhancing the flexibility and resilience of supply will have to play a larger role in policy debates going forward.

Let me elaborate on these thoughts.

An era of supply tailwinds

In the three decades leading up to the pandemic, four criss-crossing tailwinds made aggregate supply highly responsive to shifts in aggregate demand: a relatively stable geopolitical environment, technological advances, globalisation and favourable demographics.

A relatively stable global political landscape arose around the broad consensus that free markets and cooperation would support economic growth. At an international level, this helped forge trade agreements that drew more countries into global production networks. At a domestic level, it helped strengthen market forces through privatising state enterprises, deregulating labour, product and financial markets, and legal improvements, including more secure property rights. Liberalised and globalised markets, in turn, disciplined policymaking, as they made it harder to deviate from prudent approaches and helped spread best practices, such as inflation targeting.

At the same time, technological advances pushed down costs, made time and physical distance less of a constraint on economic activity and thus provided the basis for a lift in global productivity.¹

Intertwined with these political and technological developments, globalisation expanded the world production frontier. Globalisation in goods and factor markets gave firms access to a larger consumer base, a wider pool of resources, access to international know-how and chances for

*This speech was given at Jackson Hole Economic Symposium on 26 August 2022.

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¹ Intermodal standardised freight containers, introduced in the 1950s and widely adopted over the subsequent decades, drastically lowered shipping costs and boosted international trade (Bernhofen et al (2016)). In the meantime, the information and communication technology (ICT) revolution made it easier for firms to operate on a global scale (Baldwin (2016)), while improving production processes and opening up new business opportunities.

specialisation. Financial globalisation alleviated constraints. As a result, more productive capacity was brought online and opportunities for efficiency gains and cost reductions were exploited on a global scale.

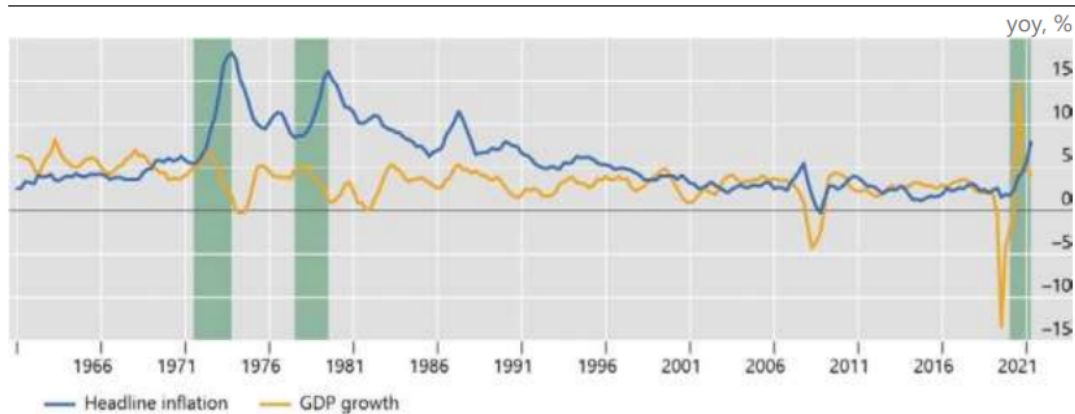
Meanwhile, demographic trends were favourable. The working age share of the global population grew rapidly from 1970 onwards. In advanced economies, baby boomers injected a large cohort of workers into the job market from the 1980s. And trade brought the previously untapped young workforces of emerging market economies into the global labour pool.

These tailwinds fostered growth alongside low inflation in several ways (Graph 1). A key one was by loosening the link between domestic economic activity and inflation (Forbes (2019)). Access to cheaper production locations drove inflation down. More contestable domestic markets and sharper international competition weakened the pricing power of firms and bargaining power of workers. And because countries – especially advanced economies – could more easily tap global resources, domestic supply constraints became less binding. As a result, Phillips curves flattened (Borio (2017))² and global – rather than domestic – slack increasingly became the key driver of inflation (Borio and Filardo (2007), Boissay et al (2021)).

At the same time, the tailwinds also made supply more responsive to changes in demand. Producers could easily access a network of worldwide suppliers. This allowed them to take advantage of the best available prices. After disruptions, supply would generally adjust quickly to new demand patterns.

Mostly solid growth and low inflation characterised much of the decades before Covid-19¹

Graph 1



¹ Weighted averages based on GDP and PPP exchange rates across 10 advanced economies (AU, CA, DK, EA, GB, JP, NO, NZ, SE and US) and 11 emerging market economies (CL, CO, IN, KR, MX, MY, PH, SG, TH, TR and ZA). Green shaded areas represent persistent inflation periods, where the cumulative rise in inflation was above 5.5 percentage points.

Sources: OECD; World Bank; Global Financial Data; national data; BIS.

A build-up of fragilities

The supply tailwinds produced a business cycle distinct from that seen in the post-war period. With inflation low and stable, monetary policy had less need to tighten during expansions than in the past. And in recessions, central banks were usually in a position where they could provide

² Globalisation also affected inflation through commodity prices. The increased importance of emerging market economies and their higher demand for raw materials meant that global commodity prices became more tightly linked to growth in emerging market economies – particularly in China. Given more volatile growth in these economies, this development contributed to sharper commodity price swings. As a result, global commodity price movements came to explain a larger share of the variance in inflation. See Forbes (2019) for more on this effect.

forceful stimulus, confident that inflation would remain under control. Fiscal policy also had more leeway, as nominal and real interest rates fell to their lowest levels since records began.

But, even though macroeconomic conditions remained benign, fault lines emerged.

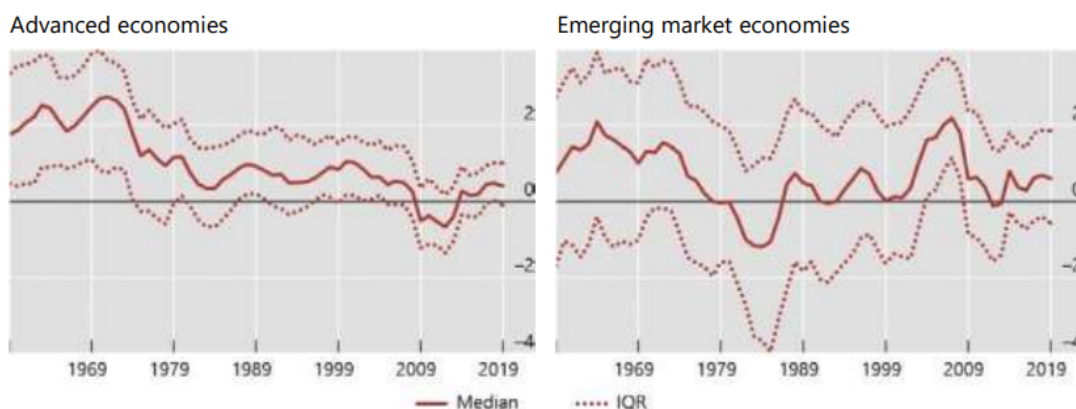
Low productivity growth was a key warning sign. In advanced economies, it plunged during the Great Financial Crisis (GFC) and never fully recovered, part of a longer decline going back at least to the late 1990s (Graph 2). In emerging market economies, the productivity boost from integration into global networks and structural reforms proved to be fleeting. The post-GFC slowdown has been the steepest and most prolonged of the past three decades.

In retrospect, some slowdown in productivity growth was probably inevitable. Liberalising reforms that improve the quality of institutions³ can deliver rapid productivity gains. But these naturally slow as countries exploit them and approach the productivity frontier. Incremental improvements in institutional quality become harder to achieve.

Productivity growth has been difficult to keep up¹

In per cent

Graph 2



¹ Five-year moving averages of median and interquartile ranges of year-on-year changes in total factor productivity at constant national prices. Advanced economies: AT, AU, BE, CA, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IS, IT, JP, LU, MT, NL, NO, NZ, PT, SE and US; emerging market economies: AR, BR, CL, CN, CO, CZ, EE, EG, HK, HR, HU, ID, IL, IN, KR, LT, LV, MA, MX, MY, PE, PH, PL, PY, RO, RU, SA, SG, SI, SK, TH, TN, TR, UA, UY and ZA; where data are available.

Sources: Penn World Table, version 10.0; BIS.

That said, there is no hiding the fact that the growth-enhancing structural reform drive prevalent during the 1990s and early 2000s slowed significantly in many countries (Graph 3). There are many possible explanations for this. Vested interests resist changes. And, as the benefits of structural reforms accrue only in the longer term, they usually rank low in governments' priority lists.

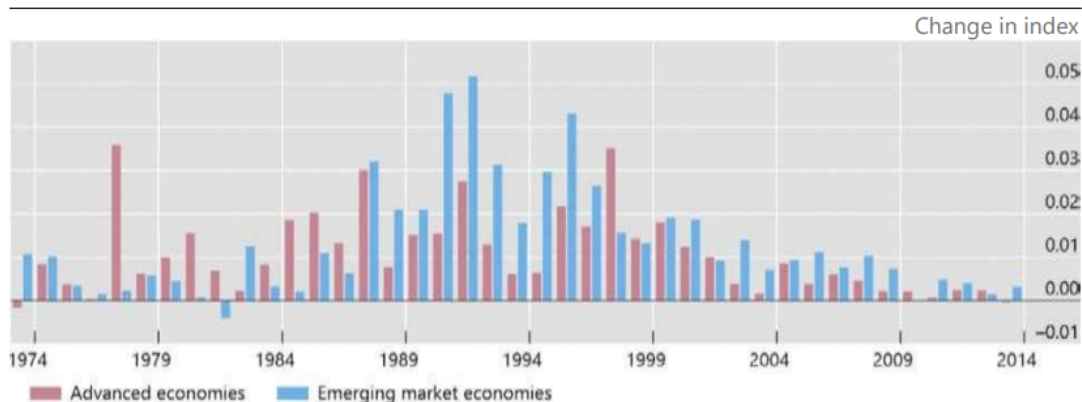
Paradoxically, the supply side tailwinds may also have played a role. Plentiful global supply and low inflation concealed the costs of low productivity. In consequence, governments lost the appetite for technically difficult – and often politically unpopular – structural reforms. The can was kicked down the road.⁴

³ These institutions include the rule of law, property rights, competition and human capital. The importance of each factor may vary across countries. For instance, in emerging market economies rule of law and property rights are key to the development of a stable financial system for intermediating domestic savings and to making the most of foreign capital to benefit supply, not least through diffusion of know-how. For advanced economies, competition, labour market and education policies are instrumental to remain on the knowledge frontier and ensure that gains from global integration and technological advances are distributed evenly.

⁴ Meanwhile, the productivity-enhancing promise of many technological developments – particularly in the information and communications technology

Structural reforms largely stalled in the 2000s¹

Graph 3



¹ Change in average reform index computed as the arithmetic average of indicators capturing liberalisations in five areas: domestic finance (regulation and supervision), external finance (capital account openness), trade (tariffs), product market (network industries) and labour market (job protection legislation). The index ranges from 0 to 1, with higher scores indicating greater liberalisation.

Sources: IMF, BIS.

Missing the lift that robust productivity growth could have provided, economies had to rely on other sources of growth. Expanding financial systems provided an impetus, at least until the GFC – when the engine of growth fuelled by debt and driven by demand sputtered. Crucially, this was not neutral for potential growth, as indicated by the break in productivity patterns I mentioned earlier. And fiscal and monetary policies were increasingly called upon to sustain output. Although obscured by acceptable growth, the constraints were increasingly visible, even before the pandemic. Economies were becoming fragile as private and sovereign debt levels reached historical highs (Graph 4) and inequality rose. The room for policy manoeuvre was eroding, with policymakers forced to do ever more to bring economies back to trend after each downturn.⁵

Nonetheless, with supply side tailwinds still lending support, increased reliance on demand management did not lead to higher inflation. Indeed, in many parts of the world, the key challenge for central banks on the eve of the pandemic was to bring inflation back up to target. The winds were about to change, however.

A rude awakening

The pandemic and the war in Ukraine have been a rude awakening both in an economic and humanitarian sense. To be sure, both were exceptional shocks that arose from exogenous causes.

But they painfully revealed that the supply side could only be stretched so far. This made demand side policy responses far harder to calibrate. I draw several lessons from this experience.

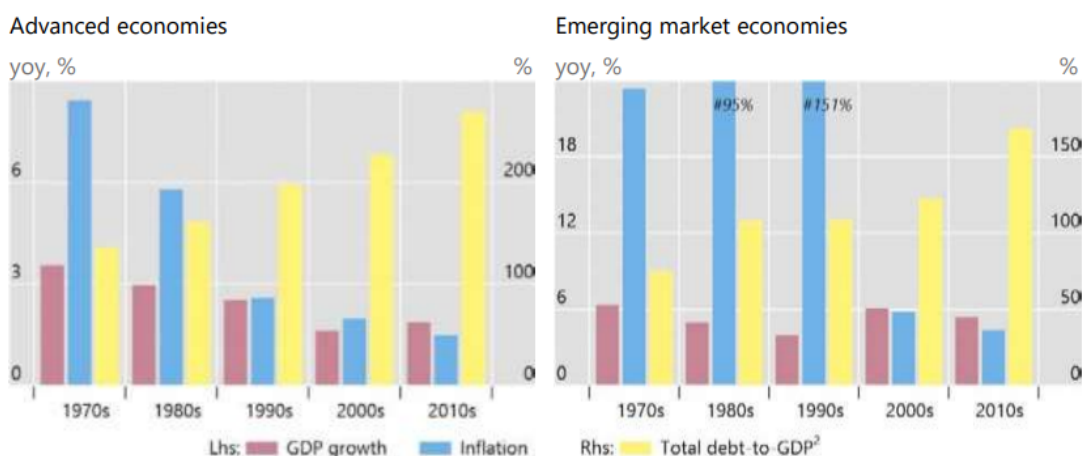
(ICT) sphere – has not been realised. Indeed, many new technologies such as big data and artificial intelligence seem to have favoured incumbents and further encouraged concentration, limiting the spread of productivity across the economy. Other explanations for the puzzling discrepancy between rapid ICT innovation and slow aggregate productivity growth include the arguments that the economic benefits of these new technologies are overblown, that productivity is mismeasured or that the gains will take time to emerge given the necessary investment for adoption, including training of current and prospective workers to acquire the skills needed for the digital workplace. See Mihet and Philippon (2019) for a detailed discussion.

⁵ Aggressive monetary policy easing could create conditions that make it necessary to maintain extraordinary accommodation. One possibility is the potential link between monetary policy and the natural interest rate, eg due to the former's effect on debt (Mian et al (2021)) or because the act of policy easing leads the public to believe that the natural interest rate has declined and save more as a result (Rungharoenkitkul and Winkler (2021)).

First, to fight the pandemic it was decided to bring the global economy intentionally to an immediate standstill in mid-air. But turning on and off supply is not like turning on and off demand. With the benefit of hindsight, it was perhaps naïve to expect that it would be possible to easily reignite the growth engine, quickly recover speed and again fly smoothly. We now know better.

Debt levels climbed as inflation came down¹

Graph 4



¹ Decade average of respective variables where regional aggregates are computed as weighted averages based on GDP and PPP exchange rates. Advanced economies: AU, CA, CH, DK, EA, GB, JP, NO, NZ, SE and US; emerging market economies: AR, BR, CL, CN, CO, CZ, HK, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SG, TH, TR, TW and ZA; where data are available. ² Sum of public and non-financial private sector debt.

Sources: IMF; World Bank; Global Financial Data; national data; BIS.

The second lesson is that we cannot take the availability of aggregate supply for granted. The global supply networks that adjusted smoothly to changes in aggregate demand turned out to be far less resilient than we thought. Seemingly robust supply chains broke down in the face of disruptions to a few key production inputs.

The final lesson is the sensitivity of inflation to supply constraints. Policymakers had grown accustomed to decades of ample supply, and, with no experience in calibrating stimulus to restart an engine that had been intentionally switched off, reached for their familiar demand side tools. These had boosted growth in the past, without stoking inflation. The consequences for inflation when supply could no longer keep up caught many of us off guard.

As tailwinds turn into headwinds

Looking further out, a key challenge I see is that even if the specific supply disruptions caused by the pandemic and the war fade, the importance of supply side factors for inflation is likely to remain high. This is because the global economy seems to be on the cusp of a historic change as many of the aggregate supply tailwinds that have kept a lid on inflation look set to turn into headwinds. If so, the recent pickup in inflationary pressures may prove to be more persistent. Let me consider three of the forces I noted earlier: geopolitics, globalisation and demographics.

Even before the war in Ukraine, the political environment had been growing tense and less friendly to the principle of international cooperation. This backlash reflects, in part, the course globalisation has taken: the perceived uneven distribution of benefits within and across

countries and discontent with local and global governance mechanisms. Greater inequality has given rise to populism, which has threatened the rules-based international trade and finance system, and more broadly democratic norms and institutions, including independent central banks (Goodhart and Lastra (2018), Borio (2019)).

Thus, it is not surprising that globalisation has been losing steam.

Other, more structural, factors have also weighed on global trade integration. As emerging market economies converge to their richer trade counterparts, comparative advantage on the basis of wages narrows. Advances in robotics and information and communications technology (ICT) that decrease the relative importance of labour in production processes could also favour local production and discourage global goods trade.⁶

Recent developments could accelerate this trend further. The pandemic revealed the fragility of global supply chains that prioritised cost reduction above all else. The war in Ukraine has rattled commodity markets and threatened energy and food security. It has also accelerated the realignment of geopolitical alliances. As a result, access to global production networks and international financial markets can no longer be taken for granted. A reconfiguration of global value chains could well follow. Some of these developments may be warranted. But we should not imagine that they will be costless.

Meanwhile, demographic tailwinds are set to reverse, and labour may not be as abundant as it used to be. The baby boomers are retiring. The pandemic may leave a persistent imprint on both the quantity and quality of workers. Labour force participation rates remain below pre-pandemic levels in many countries, signalling a potential shift in attitudes towards work. Lost schooling and disruptions to regular healthcare services during the pandemic could scar human capital. International labour mobility also faces increasing obstacles.

Moreover, even as these tailwinds turn into headwinds, new headwinds are emerging. In particular, the threat of climate change calls for an unprecedented policy-induced reallocation of resources. And it will only intensify war-induced food and energy bottlenecks. Increasing extreme weather events and an interconnected global food supply system raise the risk of disruptions and higher, more volatile prices, not to mention human costs.⁷ Expectations of a shift away from fossil fuels have deterred investment (Meyer (2022)), threatening energy shortages before clean energy options can catch up to meet demand. This pushes up inflation.

Policies to deliver the lift needed and avoid the stall

This new and more hostile supply environment has sobering implications for economic policy. We may be approaching what in aviation is called a “coffin corner”, the delicate spot when an aircraft slows to below its stall speed and cannot generate enough lift to maintain its altitude. It takes skilled piloting to get the aircraft back to a safer, stable place. Continuing to rely primarily on aggregate demand tools to boost growth in this environment could increase the danger, as higher and harder-to-control inflation could result.

So what needs to be done?

Getting the economy back to a durable path starts with a reset to macroeconomic policymaking. As demand side policies cannot substitute for supply tailwinds, we need to be realistic about what these policies can deliver and more keenly aware of the associated costs. When economic disturbances come from supply as well as demand, the “divine coincidence”

⁶ Conversely, technological advances could facilitate an increase in trade in services and intangibles. Such a shift away from tangibles to intangibles has already taken place in several economies and could explain some of the productivity slowdown. Bailey (2022) shows that, between 2000 and 2007 in six advanced economies, intangible-intensive industries had a more pronounced slowdown in productivity growth than tangible-intensive industries did.

⁷ The global food system involves production, transport, processing, packaging, storage and retail. It feeds the great majority of the world population and supports the livelihoods of over 1 billion people (Mbow et al (2019)).

breaks down. In this environment, central banks cannot hope to smooth out all economic air pockets, and must instead focus first and foremost on keeping inflation low and stable (BIS (2022)). Monetary policy needs to meet the urgent challenge of dealing with the current inflation threat.

Fiscal policy should also be aware of tighter limits on what demand management policies can deliver. In a world of unforgiving supply, what fiscal stimulus adds to demand may need to be taken away by monetary policy tightening. Scarce fiscal resources should instead be used to tackle supply constraints head on, including those imposed by climate change, ageing populations and infrastructure, through growth-friendly actions and support for broad structural reforms. Such a focus on reinvigorating growth through the supply side could also create scope to rebuild fiscal buffers.

The aim should be to create a dynamic, nimble environment encouraging innovation, enhancing resilience and supporting the required institutional, technological and ecological transitions.

Policymakers should focus on fostering investment in healthcare to better protect human capital. They should also promote investment in climate-friendly industries and all types of infrastructure, including digital. Priority areas of action should involve competition, labour and education policies to provide and sustain the much-needed innovative impetus. At the same time, reaping the benefits of technological innovation requires a favourable regulatory and legal environment. Efforts to make the financial system more balanced yet more innovative go hand in hand with reforms on the real side.

Sustaining international cooperation in the face of rising protectionist and populist impulses will also be important. One solution could be to promote a “better” and more sustainable form of globalisation, rather than scaling back trade integration in a major way.⁸ This would strike a balance between resilience, sustainability and efficiency.⁹ We can achieve it by giving businesses incentives to set up shorter or more diversified supply chains when the social benefit exceeds the private cost, and by leveraging new technologies to monitor and stress-test systems. These new arrangements would also have to recognise the redistributive implications of integration and offer concrete remedies, taking to heart the lessons that not all members of society have benefited from globalised trade and finance.

Let me conclude. As any pilot will tell you, when the warning lights flash, there is a premium on timely and decisive action. The sooner policymakers recognise the need for a reset and commit to sustainable growth strategies focused on revitalising the supply side, the stronger and more resilient the global economy will be. If we manage to do that, new tailwinds may well develop, with substantial benefits for both growth and price stability.

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Global Recession is not Inevitable Despite Looming Risks*

By BEN MAY*

The global economy will narrowly avoid a recession. This is what we (at Oxford Economics) continue to believe, although the United States, Canada, and most European nations are likely to fall into recession at some point over the next year or so.

Avoidance of a global contraction despite several large economies slipping into recession is not necessarily an unusual outcome. Since the 1980s, there have been nine advanced economy recession clusters, but only five of those coincided with two or more consecutive quarterly declines in global per capita GDP — the benchmark for a global recession.

Global contraction can be avoided

It's worth noting that all five US technical recessions since 1980 have coincided with a global recession. But we expect the upcoming peak to trough fall in the US' GDP to be far smaller than in any of the previous five slumps. Therefore, it is reasonable to believe a global contraction could be avoided.

Although it wouldn't take much additional advanced economy weakness to mechanically push the world into recession, risks aren't solely tilted to the downside. In particular, a sharp drop in European energy prices and/or decisive action by governments to protect the economy from the energy shock could lead to milder recession in Europe.

Our recently revised forecasts assume that 14 of a sample of 25 advanced economies will slip into recession in late 2022 or early 2023. And while most of Europe, along with the US and Canada, will fall into recession, the Asia-Pacific will be the only region to escape two quarters or more of declining economic activity. Also, all the quarterly contractions in activity in the advanced economies will take place between the third quarter of this year and the second quarter of 2023.

Despite this broad-based weakness across the advanced economies, we don't think a global recession — defined as shrinking of global per capita GDP for more than two quarters — is inevitable. On balance, this view does not look inconsistent with historical experience.

Stress periods in historical context

Since 1980, about 80 percent of recessions recorded by advanced economies have occurred in nine distinct periods: two in the early 1980s, two in the early 1990s, the 1997 Asian financial crisis, the early 2000s dotcom bust, the global financial crisis, the eurozone crisis, and the novel coronavirus pandemic.

During the global financial crisis and pandemic periods, most advanced economies fell into recession. But these two stress periods should not be considered as standard. In other recession clusters, less than half of the advanced economies typically fell into recession.

During six of the stress periods, only 40-50 percent of advanced economies contracted for two consecutive quarters — a touch lower than the number of recessions we anticipate in late 2022-early 2023. During the Asian financial crisis, recessions were mostly experienced in Asian economies included in the advanced economy aggregate.

The average peak to trough falls in GDP during the global financial crisis and pandemic periods were substantially larger than in the remaining seven stress episodes. The Asian financial crisis

*This article was published on China Daily on 28 September, 2022.

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also saw large decline in GDP, but these contractions occurred among a small group of economies. And at 1.6 percent, the dotcom bust stress period had the smallest average peak to trough decline in GDP.

As such, we assume the average recession size during the second half of 2022 and the first half of 2023 will be even smaller.

Advanced economy weakness doesn't always push the global economy into recession, for only five of the previous nine advanced economy stress periods have been associated with a global recession. Of those five, the global financial crisis and the pandemic were exceptionally large shocks, though.

The other three were in the earlier stages of our sample period when the advanced economies' share of world GDP was larger. Since the mid-1980s, the advanced economies' share of global GDP has fallen from more than 75 percent to around 57 percent. As a result, the dotcom, Asian financial and eurozone crises in the late 1990s and early 2000s didn't push the global economy into recession.

Given this and our assumption that the average GDP declines during the upcoming recession phase will be smaller, our baseline forecast, which assumes that a global recession will be narrowly avoided, seems reasonable.

When the US sneezes, world catches a cold

However, there is truth in the old adage that when the US sneezes the rest of the world catches a cold. During the four advanced economy stress periods that haven't been associated with a global recession, the US economy avoided a recession (based on the two consecutive quarterly falls in GDP definition, as opposed to the National Bureau of Economic Research methodology).

We have also excluded the recession in the first half of 2022 recession. By contrast, the other five advanced economy stress periods have all included the US falling into recession, and each of these episodes has coincided with a global recession.

This suggests our forecast for global economy avoiding recession may not be wrong. But it is worth noting that the expected peak to trough decline in the US' GDP in the first half of 2023 is much smaller than any of the preceding five recessions and well below the median US historical contraction.

The remaining G7 economies that are predicted to fall into recession are also expected to experience relatively small contractions. If the US and other advanced economies are set for particularly mild recessions, at least from the perspective of peak to trough GDP fall, this time around, then the global economy is more likely to avoid recession.

Upside and downside risks to the outlook

While we still don't see a global recession as the most likely outcome, it is fair to say that we expect world GDP growth in the first and second quarters of 2023 to be only just above population growth. If 2020 is excluded, this will mark the worst patch for the global economy since the global financial crisis.

What's more, it wouldn't take much additional bad news to push our global forecast into recession territory. But in the grand scheme of things, whether the global GDP growth is a bit above or a bit below population growth is not too important.

Nonetheless, as we've previously noted, a lack of major imbalances and vulnerabilities in the advanced economies most likely mean short and mild recessions. Economies should then begin to recover as the key drivers behind this year's economic slowdown, such as high inflation and supply chain bottlenecks, ease. But even if the peak to trough falls in GDP are small, the coming quarters could still prove pretty painful for many enterprises and households.

Rising inflation, energy crisis can spell disaster

Given the recent string of bad economic news, it is tempting to focus solely on potential downside risks to our baseline view. Further bad news, more stubborn inflation, and poor management of the energy crisis in Europe could cause some economies to suffer longer and deeper contractions resulting in much greater pain for the real economy and financial markets, rather than the short and mild recessions we forecast.

However, there are substantial risks in both directions, especially for the European economies. Sky-high energy prices, uncertainty over future movements of energy prices, and concerns about possible gas rationing are taking a heavy toll on sentiment.

While building the infrastructure to end European economies' dependency on Russia will take time, governments' actions to cap energy prices and provide greater clarity on the medium-term outlook could limit the income and cost squeeze facing households and businesses. That in turn would bolster confidence and potentially result in milder downturns as Europe enters winter.

And if European governments take more substantive action to support the economy through the energy crisis, the chances of a global recession would be greatly reduced.

Inflation and the Path to a Soft Landing*1

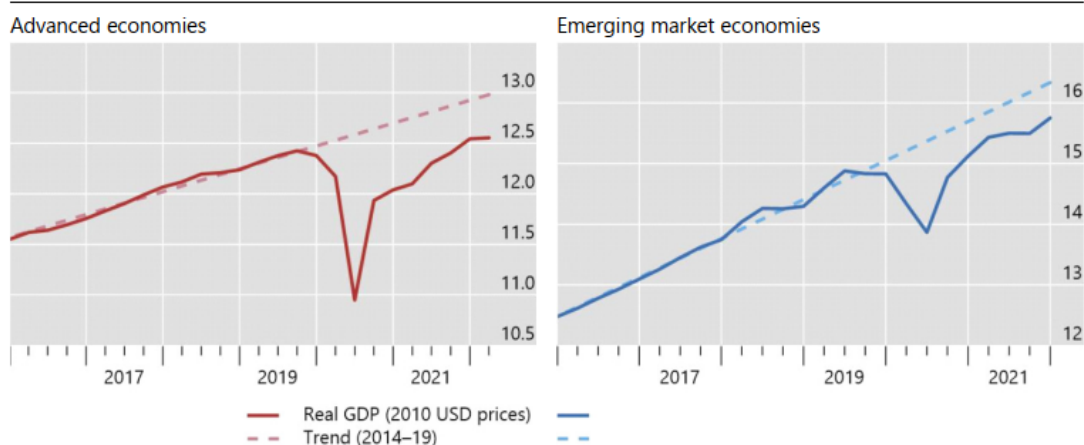
By HYUN SONG SHIN*

For near-term macroeconomic stabilisation of the economy, we are accustomed to viewing the economy mainly through the demand side, with supply adjusting smoothly in the background. However, a more balanced approach between demand and supply is essential in addressing the current inflation challenge. Today, I use this perspective to assess the odds of a soft landing for the global economy by drawing on a BIS Bulletin released this week.²

Real GDP bounced back but has not caught up with pre-pandemic trend

USD trillions (2010 prices)

Graph 1



Sources: Refinitiv Datastream; BIS calculations.

Graph 1 is a dramatic illustration of the importance of the supply side of the economy in explaining the current inflationary episode. Despite a strong recovery from the pandemic-induced downturn, real GDP is still below its pre-pandemic trend. This is true both in developed economies (Graph 1, left-hand panel) and in emerging market economies (EMEs; right-hand panel). In fact, EMEs experienced a renewed GDP growth slowdown already in mid-2021.

The charts in Graph 1 reinforce the message that the recent surge in inflation is not simply a story of excess demand that overwhelmed the pre-pandemic trend supply of the economy. Rather, it is a case of diminished supply capacity that has not kept pace with the recovery to trend. The charts in Graph 1 also reflect the role played by the additional supply shocks to energy and food following Russia’s invasion of Ukraine, as well as the impact of the Omicron wave of Covid-19.

Supply bottlenecks and associated “bullwhip effects” are now showing signs of easing. However, to gauge the likely response of the global economy to monetary tightening, and to assess the

*This article first appeared on G20 High-level Seminar on “Monetary and financial sector policy to support stability and recovery” on 17 July 2022.

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likelihood of a “soft landing”, we need to cast the net wider and bring into view the broader structural elements of the economy, including the labour market.

At our last G20 seminar in December 2021, I laid out the importance of the supply side of the economy, and labour markets in particular, in determining the course of inflation developments:³

Supply bottlenecks have grabbed all the headlines recently, but the theme chosen by the Indonesian G20 Presidency (“Recover together, recover stronger”) also prompts us to consider the longer-term structural changes brought about by the pandemic and the policy measures deployed in response. This is particularly apt now, as we look ahead to future inflation developments. I will argue that longer-term structural issues, especially in the labour market, are crucially important in plotting the course ahead.

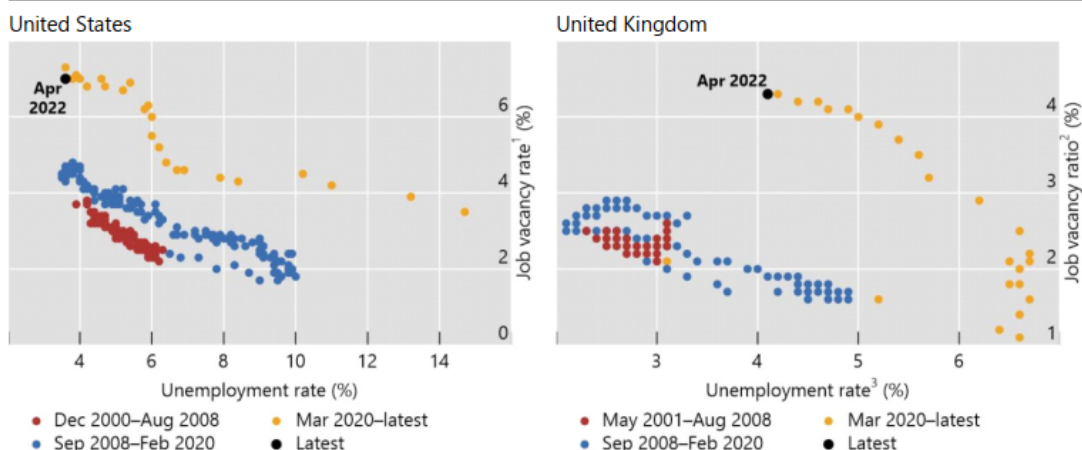
Since I delivered those words, the importance of the labour market in the recent inflation surge has become even more apparent. Labour markets are tight in major economies according to some indicators. Unemployment rates are at or below pre-Covid rates, and vacancy rates are unusually high relative to past recoveries. But not all indicators are fully back to pre-Covid levels.

The special nature of the current surge in inflation can be seen through the lens of the Beveridge curve, which shows the relationship between the unemployment rate and job vacancies. Normally, changes in economic activity would show up as movements along the Beveridge curve, with stronger labour demand going hand in hand with lower unemployment and higher job vacancies during periods of strong economic activity. However, in the United States the Beveridge curve has shifted out since the start of the pandemic (Graph 2, left-hand panel). This means that many more job openings are on offer than previously for the same level of unemployment. The UK Beveridge curve has also drifted out in recent months, resembling the drifting out of the US curve

(right-hand panel). To be sure, the Beveridge curve has not shifted everywhere. In Japan and the euro area, there is no evidence of a rightward shift.

The Beveridge curve has shifted out in some countries

Graph 2



¹ Job vacancy rate computed as ((number of job vacancies) / (number of occupied posts + number of job vacancies))*100. Total non-farm. ² Job vacancy ratio computed as three-month rolling average ratio of vacancies per 100 employee jobs. Industry, construction and services (except activities of households as employers and extraterritorial organisations and bodies). ³ Claimant count.

Sources: Refinitiv Datastream; BIS calculations.

The conventional interpretation of the rightward shift in the Beveridge curve is a labour market mismatch between jobs and skills – exemplified by the reallocation of workers from the real estate sector after the Great Financial Crisis. However, this conventional explanation does not fit with the fact that job vacancies have risen most in service sectors that saw the largest job losses during the pandemic. So, a simple sectoral reallocation story seems inadequate. Instead, it may be more accurate to view the shift in the Beveridge curve as a broad-based adverse supply shock to the labour market, indicating a general decline in the supply of labour.

Getting to the bottom of these labour market developments is an important task for policymakers. Perhaps one way to approach this question is to start from the premise that firms and workers are part of the intricate web of relationships in the economy with relationship-specific capital that acts as the “glue” for the economy as a whole. Barry Eichengreen has written eloquently on this issue.⁴ The ties that bind all of us as colleagues, neighbours, workers and employers arguably go beyond the transactional nature of the weekly payslip. Once these relationships are broken, attempts to put the pieces back together will not be able to draw on the same reservoir of relationship-specific capital that was in place previously. The cross-country differences in the Beveridge curve indicate underlying differences in labour market participation decisions that have been affected by the pandemic (for instance, differences in job retention schemes) and possible shifts in general attitudes towards work itself.

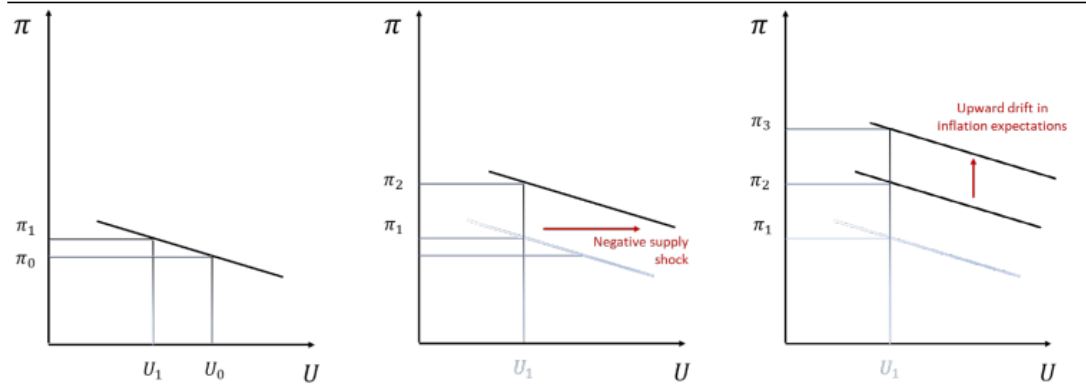
For all these reasons, the record high vacancy rates and tight labour market conditions are best viewed as reflecting an adverse supply shock in labour markets, not just strong demand.

A useful analytical prop is the Phillips curve, which maps out the downward-sloping empirical relationship between inflation and unemployment. The left-hand panel of Graph 3 illustrates a modest increase in inflation associated with a decline in unemployment, in the absence of any supply disturbances to the economy. However, if the decline in unemployment is also accompanied by an adverse supply shock due to supply bottlenecks and diminished worker participation, the inflation rate associated with the lower unemployment rate may be higher due to a rightward shift in the Phillips curve, as shown in the centre panel of Graph 3.

One consequence of the rightward shift is that a previously non-inflationary (or modestly inflationary) level of unemployment would be associated with a high level of inflation. If the higher level of inflation is left to persist, we may even have an upward drift in short-term inflation expectations, and an upward drift in the Phillips curve in the manner described in Milton Friedman’s 1967 AEA address.⁵ The longer inflation is left untamed, the more backward-looking inflation expectations may become, serving to bake in the higher inflation (Graph 3, right-hand panel).

The surge in inflation reflects shifts in the Phillips curve

Graph 3



To bring inflation down, the task is to bring demand back into line with supply. As we laid out in this year’s BIS Annual Economic Report,⁶ central banks need to bring policy rates to more appropriate levels, and do so quickly and decisively to prevent the shift in regime from a low-inflation to a high-inflation regime.

Looking ahead, the key question is whether central banks can achieve a soft landing by bringing inflation down without precipitating a recession. The answer to this question depends on how sensitive inflation is to slack in the economy, and how rapidly inflation expectations respond to a cooling of demand.

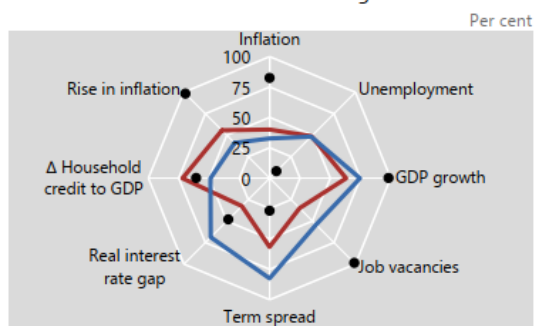
Evidence from past tightening cycles helps us further assess the risk of a hard landing. Here, I will draw on the BIS Bulletin issued this week. The left-hand panel of Graph 4 (the “spider chart”) illustrates an analysis based on 70 tightening episodes for 19 advanced economies (AEs) and six EMEs over 1980–2018, where “tightening episodes” are defined as periods of a rising nominal policy rate for at least three consecutive quarters and ending when the policy rate peaks. The spider chart in the left-hand panel of Graph 4 compares the initial circumstances that led to instances of hard and soft landings. In this comparison, a hard landing is defined as an episode when the tightening resulted in a recession (two consecutive quarters of negative GDP growth) within three years after the interest rate peak; otherwise, the episode is classified as a soft landing.

The grid in the spider chart refers to the percentiles of the variable’s country-specific historical distribution. The black dots show where we are currently, defined as the median across countries for the latest data point available.

Shorter and more front-loaded hiking cycles are associated with softer landings

Graph 4

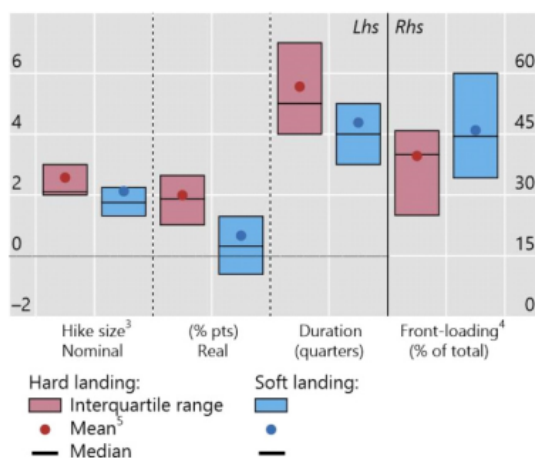
Preconditions for hard and soft landings^{1,2}



Conditions at the start of tightening episodes associated with:

- Hard landing
- Soft landing
- Latest observation (median)

Time profile of hiking cycles for hard and soft landings¹



¹ Statistics based on a sample of 70 tightening episodes for 19 AEs and six EMEs over 1980–2018. Tightening episodes defined as periods of a rising nominal policy rate for at least three consecutive quarters and ending when the policy rate peaks. Hard landing is a recession (two consecutive quarters of negative GDP growth) within three years after the interest rate peak; otherwise, the episode is classified as a soft landing. ² The grid refers to the percentiles of the variable’s country-specific historical distribution. Black dots show the median across countries for the latest data point available. The red (blue) line corresponds to the sample median for each variable taken in isolation for tightening episodes that end with a hard (soft) landing. ³ Overall increase in the nominal (real) policy rate throughout the tightening cycle. ⁴ Share of the overall increase in the nominal policy rate that takes place within the first two quarters of the tightening cycle. ⁵ The differences in the sample means between hard and soft landings are all statistically significant at the 10% threshold.

Sources: IMF; national data; BIS calculations.

The tips of the red polygon in the spider chart correspond to the sample median for each variable (taken component by component) for tightening episodes that end up as a hard landing.

Analogously, the tips of the blue polygon correspond to the sample median for each variable (taken component by component) for tightening episodes that end up with a soft landing.

When we compare today’s circumstances with the red and blue polygons, we find a mixed scorecard on the possibility of a soft landing. On the one hand, past tightening cycles that started with high GDP growth and high job vacancies – typical of current conditions in many economies – have generally been followed by soft landings. However, there are other indicators today that are more consistent with a hard landing, such as a rapidly increasing inflation rate, a low term spread and a rapidly increasing household debt-to-GDP ratio.

The trajectory of the policy rate also matters for whether we will have a soft or hard landing. This is shown in the box chart in the right-hand panel of Graph 4, which compares instances of hard and soft landings in terms of the trajectory of nominal rate increases.

We can draw several lessons from past hiking cycles. We see that larger increases in policy rates over a longer period were generally associated with a greater incidence of hard landings. The first two columns show the overall increase in the policy rate throughout the tightening cycle, both in nominal and in real terms. Unsurprisingly, larger increases in the policy rate were associated with a greater incidence of hard landings.

The rest of the box chart shows the consequences of how front-loaded the rate increases are, where “front-loading” is defined as the share of the overall increase in the nominal policy rate that takes place within the first two quarters of the tightening cycle. We see that front-loaded rate increases were more likely to result in a soft landing than back-loaded rate increases.

Where does all this leave us at the current juncture?

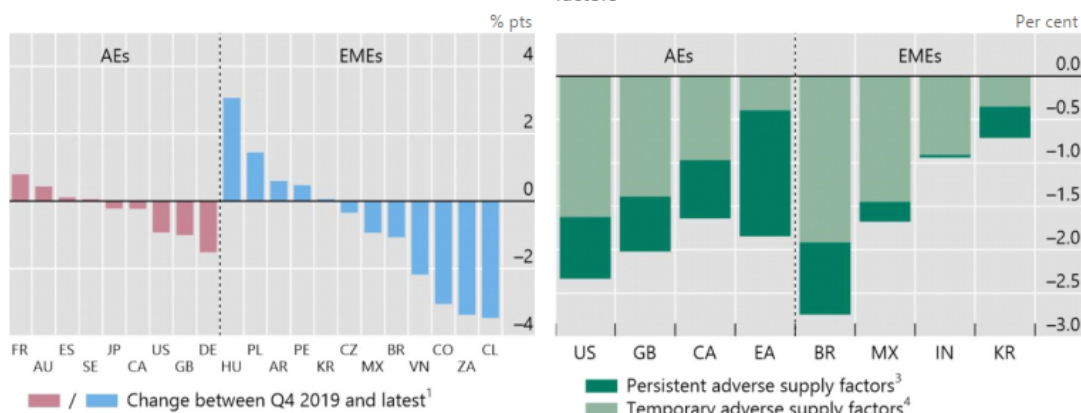
Currently, there are two factors that may lift the odds of a soft landing. For one, the rotation in demand towards interest-sensitive sectors, such as durable goods and housing, may have increased the responsiveness of aggregate demand to monetary policy. Secondly, with record high vacancy rates and subdued participation rates in some countries, a tightening could trim excess labour demand without major contractions in employment.

Low labour force participation and high interest sensitivity of demand raise odds of a soft landing

Graph 5

Labour force participation has not recovered everywhere

Recession risks crucially hinge on persistence of supply factors²



¹ For AR, CO, CZ, DE, HU, PE, PL, SE and VN, Q4 2021; otherwise Q1 2022. ² Estimates computed using an accelerationist Phillips curve where inflation is a random walk with a drift proportional to the current unemployment gap, following Stock and Watson (2019), and an Okun's law parameter of 0.5 following Ball et al (2017): $\pi_t - \pi_{t-1} = -\beta(u_t - u^*)$ and $(u_t - u^*) = -0.5(y_t - y^*)$. Target is 2% for AEs and 4% for EMEs. $\beta = 2/3$, based on Stock and Watson (2019) estimates for the period 1960–83. ³ Headline inflation is brought back to target. ⁴ Non-core inflation wanes after eight quarters.

Sources: Ball, L, D Leigh and P Loungani, "Okun's Law: Fit at 50?", Journal of Money, Credit and Banking, vol 49, no 7, October, 2017; Stock, J and M Watson, "Slack and cyclically sensitive inflation", NBER Working Papers, no 25987, June, 2019; OECD; ILO; Refinitiv Datastream; national data; BIS calculations.

In terms of the previous Phillips curve analysis, the greater interest sensitivity of demand translates to a steeper Phillips curve, so that a moderate tightening can trim inflation where needed, avoiding unnecessary reactions in the broad swathe of economic sectors. Assuming inflation is fairly sensitive to slack (calibrated to the high-inflation period in the 1970s), expectations are backward-looking and supply factors persist, output gaps would need to shrink by 1.6 to 2.3 percentage points for two years in AEs, depending on the country, to bring headline inflation to targets. Furthermore, to the extent that non-core inflation would wane over time, as food and energy prices stabilise, bringing inflation back to target would imply a significantly smaller contraction (0.4 to 1.6 percentage points). This would be the most optimistic scenario.

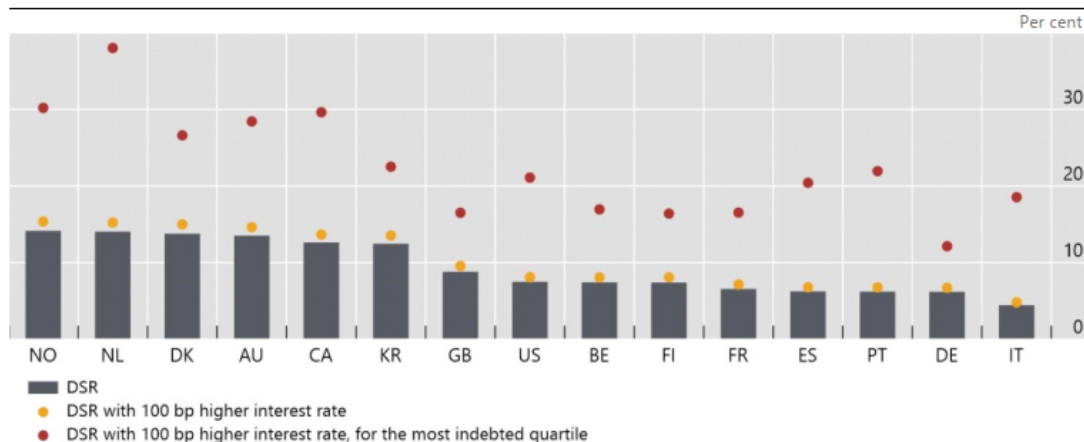
However, recession risks across countries will depend crucially on the slope of the Phillips curve. The right-hand panel of Graph 5 shows illustrative calculations on the output costs of bringing inflation down.

However, while the high interest sensitivity of housing demand is helpful in bringing down inflation, it could prove to be a double-edged sword in that the impact goes through the financial system. As financial conditions tighten with rising policy rates, high debt levels will undoubtedly amplify the reaction of financial markets to a monetary policy tightening. Household debt service

ratios are very high currently, reflecting the long period of loose financial conditions that have prevailed in recent decades. While the countries that found themselves in the eye of the storm during the Great Financial Crisis reduced the level of household debt, those economies that suffered less during the crisis saw their household debt levels continue to rise. For this reason, the debt service ratios of households are at historical highs in many economies, as seen in Graph 6.

Softer landing is challenged by tightening financial conditions and high debt levels¹

Graph 6



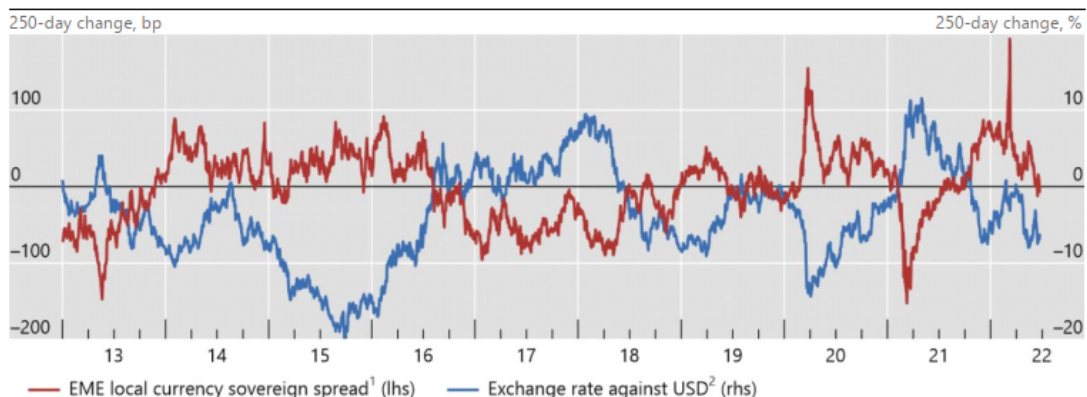
¹ Debt service ratio (DSR) for the most indebted quartile is estimated using the average debt-to-income ratio and the share of households with debt-to-income exceeding 3 (based on data for 2019 or latest available), assuming that the household-level debt-to-income follows the generalised Pareto distribution. The distribution is fitted country by country.

Sources: OECD; Refinitiv Datastream; national data; BIS; BIS calculations.

Global financial conditions have already tightened significantly, while monetary policy normalisation is still in progress. EMEs face additional challenges from a stronger dollar and associated financial tightening. These vulnerabilities of EMEs are reflected in the links between exchange rate movements and macro-financial dynamics. In particular, there is a highly significant systematic negative correlation between changes in the value of an EME's currency and changes in its local currency bond yields. Exchange rate depreciation in EMEs is associated with rising bond yields and vice versa, as seen in Graph 7, which shows the strong empirical association between higher sovereign yields of EMEs and a stronger dollar.

Long-term interest rates in EMEs are sensitive to shifts in global financial conditions, and to dollar exchange rate movements in particular

Graph 7



¹ JPMorgan GBI-EM Broad diversified index spread over the 10-year US Treasury yield. ² Weighted average using the country weights (excluding DO, EG, RO and UY) of the JPMorgan GBI-EM Broad diversified index as of June 2022.

Sources: Bloomberg; JPMorgan Chase; BIS calculations.

The BIS has submitted to the G20 a report on macro-financial stability policy frameworks that outlines how country authorities can put in place policy frameworks that can meet the challenges arising from global financial conditions.⁷ These challenges are undoubtedly more acute for EMEs than for AEs because EMEs tend to have less developed financial markets and shorter history in effective institutional arrangements. As we outline in our recent report, effective macro-financial stability frameworks (MFSFs) combine monetary, fiscal and macroprudential policies with FX intervention and capital flow management measures (CFMs) within a holistic framework.

The aim is to prevent the interaction of macroeconomic and financial forces from derailing the economy and undermining macroeconomic and financial stability. This requires pre-emptive macro-financial stability policies to ward off vulnerabilities and to build policy buffers in good times so that they can be drawn down in bad times. Relying on the full array of policies is essential to achieve a balanced approach and to avoid overburdening individual ones. FX intervention, as well as specifically designed macroprudential policy measures and CFMs, will be especially helpful in addressing the consequences of evolving external financial conditions.

At the current juncture, with the hands of monetary policy tied with the overriding priority of bringing inflation under control, the burden of dealing with the financial consequences falls on other elements of the framework. The challenge is to address the macro-financial vulnerabilities that have built up over the previous decades. All of this highlights the benefit of MFSFs that mitigate the build-up of vulnerabilities in advance and build policy buffers to draw on in times of stress.

EMEs have strengthened their policy frameworks in this vein in recent decades. This should provide some cushion for the bumpy ride ahead. Nevertheless, given the storm that is facing the global economy, the need for strong international cooperation and an effective global financial safety net is as pressing as ever.

Footnotes:

1. The views expressed here are mine, and not necessarily those of the BIS. I am grateful to Stefan Avdjiev, Fiorella De Fiore, Boris Hofmann, Deniz Igan, Enisse Kharroubi and Emanuel Kohlscheen for their efforts in putting together the analysis for this speech; and to Giulio Cornelli and Alexis Maurin for excellent research assistance.
2. See F Boissay, F De Fiore and E Kharroubi, “Hard or soft landing?”, BIS Bulletin, no 59, 14 July 2022, www.bis.org/publ/bisbull59.htm
3. See H S Shin, “Bottlenecks, labour markets and inflation in the wake of the pandemic”, speech at the G20 International Seminar, Bali, 9 December 2021, www.bis.org/speeches/sp211209.htm.
4. See B Eichengreen, “The human capital costs of the crisis”, Project Syndicate, April 2020.
5. See M Friedman, “The role of monetary policy”, Presidential Address delivered at the 80th Annual Meeting of the American Economic Association, Washington DC, 29 December 1967 and published in *The American Economic Review*, vol LVIII, no 1, March 1968.
6. See Bank for International Settlements, Annual Economic Report 2022, June, www.bis.org/publ/arpdf/ar2022e.htm.
7. See Bank for International Settlements, “Macro-financial stability frameworks and external financial conditions”, report submitted to the G20 Finance Ministers and Central Bank Governors, 15 July 2022, <https://www.bis.org/publ/othp53.htm>.

Parity Pains^{*}

By NI SHUHUI/ XIONG AIZONG^{*}

Depreciation of euro will hurt EU economy and could trigger market turmoil in some emerging markets

On July 12, the euro hit parity with the US dollar, which is the first time since December 2002.

The parity between the euro and the dollar will not only hurt the EU economy, but also increase global market turmoil.

The depreciation of the euro is the result of multiple pressures, including the EU's energy crisis, rate spread and the strong dollar.

The chief concern in Europe is the energy crisis. After the outbreak of the Russia-Ukraine conflict, the European Union reduced its imports of oil and natural gas from Russia. This has not only driven up energy prices sharply, but also resulted in an energy crisis in the eurozone. It cannot be ruled out that Russia may suspend energy supplies to Europe. In addition, the energy structure transformation in Europe has led to a continuous decline in traditional energy production, making it difficult to find suitable alternative energy sources in the short term.

The rate spread between the US dollar and the euro is also a driving force. Compared to the US Federal Reserve raising interest rates three times before the end of June, the European Central Bank has been slow to adopt such aggressive policy. The increasingly high Fed interest rate creates a rate spread between the US dollar and the euro, which has put depreciation pressure on the euro. The rate spread between US 10-year government bonds and European 10-year AAA government bonds rose from 1.41 percent in mid-June to 1.7 percent in mid-July.

The strong dollar is exerting additional pressure. At a time when international market risk aversion is on the rise because of the Russia-Ukraine conflict and the entire world is dealing with high inflation and worrying about global recession, the dollar has become a safe haven. Increasing demand for the dollar has led to the US dollar index soaring, which is also the reason for the depreciation of the euro. On July 15, the US Dollar Index rose to a 20-year high of 108.57, up 13.6 percent from the start of this year.

On July 28, the Fed raised interest rates by 75 basis points, which will give the strong dollar further support. In the energy crisis, the euro will weaken further.

The euro-dollar parity will hurt the eurozone's economy in many aspects. For example, it will spike the inflation rate, worsen trade imbalances and create additional difficulties for the ECB.

First, the euro-dollar parity will spike the euro inflation rate that is already out of control. The surging prices of commodities under the Russia-Ukraine conflict combining with the strong dollar, will feed euro inflation level through imports. The Harmonized Indices of Consumer Prices rose to 8.6 percent in June, up from 8.1 percent in May and setting a new record for the eurozone. But excluding energy and food, the eurozone's core inflation index is 3.7 percent in June, down from 3.8 percent in May. And furthermore, within the eurozone, the greater the dependence on the international energy supply, the higher the inflation rate. France, which mainly generates its electricity from nuclear power, reported 6.5 percent inflation in June; while Spain, a big importer of natural gas, has a reported inflation rate of 10.2 percent, and Baltic States that rely heavily on Russian energy, report inflation rates of more than 20 percent.

^{*} The article was published on China Daily Global on 1 August, 2022.

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Second, the euro-dollar parity will worsen trade imbalances and the eurozone economy. In theory, the weaker euro may benefit EU exporters and narrow the trade deficit. But the big increase in the costs of imports driven by the strong dollar and high commodity prices not only offsets the benefits, but also exacerbates the trade deficit.

By May, the EU had run a trade deficit for seven consecutive months. In the same term, Germany imports 126.7 billion euros, up 28 percent year-on-year, and exports 125.8 billion euros, up only 12 percent year-on-year. After excluding seasonal effects, Germany's trade deficit was close to 1 billion euros in May for the first time since January 2008. France is also facing the similar problem. The trade deficit of France hit a record 13.1 billion euros in May, bringing the cumulative trade deficit to 113.9 billion euros over the past 12 months. As the growth "engine" of the eurozone, the performance of the German economy is quite important. With 55 percent of its gas coming from Russia, German's economic model will be unsustainable without cheap Russian energy, which will cause real trouble for the European economy.

Third, the continuing weakness of the euro will undoubtedly create additional difficulties for the ECB. To stop the euro depreciating further, the ECB must raise interest rates more quickly and substantially. But as a single currency, the ECB's decision to raise interest rates needs to weigh and balance the economic fundamentals and prospects of all eurozone members. In addition to the threat of inflation and recession, the ECB also faces the risk of sovereign borrowing costs divergences right now. In June, the yield on 10-year German bonds reached 1.7 percent, while Italian 10-year bonds have risen above 4 percent, which means the rate spreads between different eurozone countries has widened sharply. And when the rate spreads widen, it will become harder for the highly indebted countries in the eurozone to refinance their debt, potentially triggering another sovereign debt crisis. As a result, the ECB has greater difficulty in setting a timetable for raising rates than the Fed.

Besides hurting the eurozone economy, the euro-dollar parity could trigger market turmoil in some emerging markets.

The euro-dollar parity encourages global capital flows back to the United States, which will exacerbate capital outflow pressures on other economies, particularly emerging market economies. And capital outflows will lead to exchange rate volatility and currency depreciation in emerging markets. Figures from the Institute of International Finance show a net outflow of \$4 billion from emerging market portfolios in June, which was the four consecutive months that emerging market countries had faced outflows.

Furthermore, the external debt of emerging market economies is mostly denominated in US dollars, and a strong dollar will inevitably increase their debt repayment pressure and refinancing costs, resulting in a surge in debt risks and, in severe cases, a sovereign debt crisis. On July 26, the latest World Economic Outlook issued by the International Monetary Fund says that, many emerging markets and developing economies are running out of fiscal space, with 60 percent of low-income countries already in or facing high risk of government debt distress.

Yen Spillout^{*}

By ZHANG MING AND CHEN YINMO^{*}

Shockwaves from sharp depreciation of the Japanese currency could trigger a financial crisis in Asia

The Japanese yen, a traditional safe-haven asset, has recently weakened sharply, becoming one of the worst-performing currencies in the global foreign exchange market this year. The exchange rate of the yen against the US dollar has reached its lowest point in the past 24 years. From Dec 31, 2021 to July 19, 2022, the yen against the US dollar has depreciated by up to 20 percent.

The US Federal Reserve's move to raise interest rates and shrink its balance sheet has led to a significantly wider gap in the interests rates between the US dollar and the Japanese yen—the direct reason for the sharp depreciation of the yen against the US dollar. From Dec 30, 2021 to July 14, 2022, the interest rate gap between the two currencies widened from 1.43 percentage points to 2.73 percentage points, marking the largest gap between them since the global financial crisis in 2008.

The Japanese economy is faced with substantial downside pressure under challenges from the COVID-19 pandemic and the Russia-Ukraine conflict. To spur economic growth, the Bank of Japan has adopted a loose monetary policy. The different economic performance and inflationary situation of the United States and Japan has intensified the differentiation in monetary policies between the two nations. As a result, the interest rate gap between the US and Japan has widened, heightening the pressure for Japan in large-scale capital outflows and triggering a sharp depreciation of the yen.

Japan's international balance of payments has gradually worsened as a result of rising commodity prices driven by the Ukraine crisis. Rising global commodity prices have pushed up the cost of Japan's imports, leading to the peaking of its trade deficits. Japan's trade in goods deficit hit 2 trillion yen (\$15.02 billion) in May 2022, marking the second-largest deficit in decades.

The sharp depreciation of the yen has caught the attention of the global market, but the Bank of Japan remains committed to its loose monetary policy. In June, Haruhiko Kuroda, governor of the BOJ, reiterated the stance of loose monetary policy, stating that the Japanese central bank will continue to carry out the ongoing loose monetary policy centered on yield curve control. The goal is to stimulate Japan's economy and achieve a 2 percent inflation target in a sustainable and stable manner. In July 2022, the BOJ said in an announcement that it will continue adhering to an ultra loose monetary policy, maintaining short-term interest rates at minus 0.1 percent, and keeping long-term interest rates at around zero through the purchase of long-term government bonds.

As the former BOJ governor Masaaki Shirakawa says in his book *Tumultuous Times: Central Banking in an Era of Crisis*, no matter which political party is in power, once Japan's economic situation deteriorates, the central bank will be required to implement loose monetary policy. The reason behind this practice is that Japan has long faced serious government debt problems.

In recent years, the balance of Japanese government bonds has amounted to 250 percent to 260 percent of the GDP. Japanese government bonds are basically domestic bonds, and about 90 percent of their holders are domestic institutions and individuals. With the increase of social

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security expenditure because of Japan's aging society, the fiscal balance of payments continues to deteriorate, which, coupled with the slowing of economic growth, may hit the confidence of residents in the capacity of government bonds to repay capital with interests. Fiscal sustainability is the most important precondition for supporting currency stability. The loss of confidence may eventually lead to a debt crisis or even an economic crisis. In other words, the BOJ's lowering of bond yields helps reduce the cost of government debt and avoid the outbreak of fiscal and debt crisis.

The market is now more concerned about two issues. First, will the BOJ change its monetary policy stance and adopt a tightening policy like other countries under the pressure from the international environment? Second, what is the influence of the sharp depreciation of the yen?

We believe that the BOJ will not change its stance of loose monetary policy under the current circumstances. On the one hand, spurring economic growth still tops Japan's agenda. It is reasonable for Japan, a large open economy, to uphold independence in its policymaking and continue putting in place a loose monetary policy.

On the other hand, the depreciation of the yen benefits the Japanese economy. The sharp depreciation of the yen not only benefits Japanese exporters but also encourages companies with overseas investment to repatriate their profits back home. In recent years, the appreciation of the yen has spurred a large number of Japanese companies to move their factories overseas. Japan has long been among the top three sources of foreign direct investment outflows. The sharp depreciation of the yen can give businesses investing overseas greater incentives to turn their retained profits into the yen and send back to their home country.

Even though the depreciation of the yen can usher in more benefits than harm for Japan's economic growth, its negative spillovers cannot be overlooked.

In fact, an important context for the Southeast Asian financial crisis in 1997 and 1998 was the significant depreciation of the Japanese yen against the dollar after the Fed's series of interest rate hikes. Meanwhile, the Thai baht, Indonesian rupiah, Malaysian ringgit and other currencies used the dollar as the benchmark in their exchange rates. This led to a significant appreciation of these currencies against the Japanese yen, which resulted in the over-valuation of the currencies. In the end, shock waves brought about by speculative capital resulted in the sharp depreciation of the currencies, leading to the outbreak of the currency crises and financial crises in these countries.

Recently, the Fed's interest rate hikes and balance sheet shrinking have pushed up the yields of long-term US Treasury bonds and the exchange rate of the US dollar, which has led to massive short-term capital outflows in some emerging markets and developing countries, mounting depreciation pressure on their currencies, a decline in their domestic risky asset prices and economic slowdowns. In this context, the sharp depreciation of the yen against the dollar may exacerbate the negative shocks faced by emerging market countries, especially countries in Southeast and South Asia.

Most of these countries are export-oriented and have close ties with Japan in terms of trade and investment. If their currencies appreciate significantly against the yen, it may reduce the revenue of their exports to Japan, and lead to a withdrawal in investments from these countries by Japanese companies. This means that once the yen depreciates significantly against the dollar, these countries may be forced to follow the yen in depreciating their currencies against the dollar, which could even result in a competitive devaluation. Once the sharp depreciation of currencies triggers domestic economic and financial turmoil, the post-pandemic recovery of Asian countries may come to a stop.

In the first half of this year, economies with persistent current account deficits, overvalued exchange rates in currencies and inflated domestic asset prices, including Pakistan, Sri Lanka, Lebanon and Myanmar, have experienced debt crises and economic crises one after another. The possibility of Asia experiencing a financial crisis and economic stagnation is rising significantly

in the face of the multiple shocks from the sharp depreciation of the yen, the aggressive interest rate hike by the Fed and the conflict between Russia and Ukraine.

Asia

In Search of a Development Plan for Asia^{*}

By ANDREW SHENG AND XIAO GENG ^{*}

It is difficult to argue with the logic behind the Economic Research Institute for ASEAN and East Asia's latest "Comprehensive Asia Development Plan." But no matter how compelling a top-down development plan for Asia might be, it is highly unlikely ever to be implemented.

Can a region as complex and fast-changing as Asia devise and implement a comprehensive development plan? The Jakarta-based Economic Research Institute for ASEAN and East Asia, which just released its third "Comprehensive Asia Development Plan" (CADP), thinks so.

The report deserves serious consideration. Drawing on the research and insights of experts from the ASEAN Secretariat and institutes from 16 countries, including Australia, New Zealand, and East Asian countries, it maps out how Asia could deepen regional economic integration, narrow development gaps, and advance sustainable development.

CADP 3.0 represents a major step forward from its predecessors. CADP 1.0, published in 2010, focused largely on transport infrastructure, from roads to airports. CADP 2.0, released in 2015, recognized that true connectivity – essential to regional integration – also depended on information and communications technology. CADP 3.0 takes this further, examining the role of digitization in supporting integration, innovation, inclusiveness, and sustainability.

This sequence mirrors the "three unbundlings" the economist Richard Baldwin has described, each of which defines a phase of globalization. The first – the separation of production and consumption – occurred when advances in transportation drastically lowered the costs of moving goods. The second – the separation of various parts of the production process – arose when information and communications technologies reduced the costs of moving ideas, enabling coordination across any distance.

The third unbundling is the separation of service delivery and use. From teleconferencing to telerobotics, technologies increasingly enable people to provide services without having to travel. This means that service workers in developing countries can increasingly do knowledge work for advanced-country customers, but at a much lower cost. As Baldwin points out, wage rates in the services sector represent the "greatest remaining global arbitrage opportunities." At the same time, professionals in advanced economies can also provide services to developing-country clients at high rates.

CADP 3.0 seeks to seize the opportunities the third unbundling creates. It urges East and Southeast Asian countries to invest in artificial intelligence and industrial robots, expand 5G broadband networks, and build on the Regional Comprehensive Economic Partnership to improve data standards and digital rules. Ultimately, East and Southeast Asia would create a digital single market, underpinned by shared data infrastructure and common rules and standards.

^{*}The article first appeared on Project Syndicate on 27 September, 2022.

^{*}Andrew Shen is Distinguished Fellow at the Asia Global Institute at the University of Hong Kong. Xiao Geng is President of the Hong Kong Institution for International Finance.

It is difficult to argue with the logic behind this vision. But in a region as diverse as Asia, translating it into reality would be difficult, to say the least, especially at a time of deepening ideological and geopolitical fault lines. The main barrier to success is neither technological nor financial. Instead, it is the implementation capacity – or lack thereof – of local, national, and international institutions.

CADP 3.0 is a broad strategy to advance simultaneously a large number of complex and interconnected goals in areas ranging from rural poverty and population aging to water safety to pollution. The level of on-the-ground coordination this demands may well be beyond the capabilities of most developing-country bureaucracies, not least because of their siloed structures.

Multilateral development banks and aid agencies, for their part, are well equipped to handle large-scale projects and programs. But they have considerable operational weaknesses when it comes to managing large numbers of projects involving diverse micro, small, and medium-size enterprises.

No matter how elegant and compelling a top-down development plan for Asia might be, it is unlikely to be implemented. Instead, we must embrace a bottom-up approach.

Digital technologies should play a central role in such an approach, for example, by providing the data and processing power (through AI) to deliver bottom-up feedback and facilitate coordination. And connectivity hubs – from regional financial centers like Singapore and Hong Kong to new technology platforms – can improve the allocation of funding and knowhow. Direct engagement and consensus-building will be essential to avoid collective-action traps.

Narratives are vital here. Top-down plans often lack the appeal to emotion and sentiment that is needed to change human behavior. But bottom-up efforts reflect people's ideas and aspirations. This supports the creation of narratives capable of inspiring and empowering social movements and triggering a huge number of small changes, thereby creating systemic change.

The relatively slow pace of ASEAN integration is probably frustrating to those who believe that a clear plan is the key to progress. But integration can never be a neat and efficient process in a region comprising highly diverse countries at vastly different stages of development. Actors need time to learn how to work with one another, build local and regional consensus, and develop the necessary design, implementation, and oversight capabilities.

Development is a complex adaptive process, and we are living in a time of profound geopolitical, technological, and environmental change. As attractive as top-down plans like the CADP 3.0 might be, they cannot deliver what Asian integration requires: bottom-up institutions that advance compelling narratives and can respond nimbly to new information and imperatives.

Enhancing East Asia's Regional Financial Safety Net^{*}

By CHANG YONG RHEE ^{*}

Introduction¹

Thank you, Governor Shamsiah. I am honored to participate in this roundtable on East Asia's regional financial safety net. And it is a great pleasure to see my old friends and colleagues again, though I dare not name everyone due to time constraints.

We are living in a time of heightened uncertainty. After a decade of persistently low growth, low inflation, and low interest rates since the Global Financial Crisis (GFC), inflation is back and has soared to levels not seen in recent decades. Central banks in major economies are raising interest rates rapidly, causing unwelcomed spillovers into emerging economies such as capital flow volatility and currency depreciation.

Fortunately, many East Asian economies have strengthened the financial safety net and adopted better macroeconomic policy frameworks following the Asian Financial Crisis (AFC) and the GFC. As a result, the present moment seems different from 1997 or the taper tantrum period, but we cannot be complacent. In this time of heightened uncertainty and market stress, Governor Shamsiah and BNM colleagues have shown very timely leadership in hosting a roundtable on this important topic.

Assessment of multi-layered financial safety nets

As the starting point of my remarks, I would like to briefly review the progress of the multi-layered financial safety nets since the painful experience of the AFC. The first layer is self-insurance, i.e., building up reserves; the second is Regional Financial Safety Nets (RFSNs) such as the CMIM; and the third is Global Financial Safety Nets (GFSNs) including IMF lending facilities and Federal Reserve swap lines.

Data clearly shows that the first line of defense provided by accumulated reserves has got much stronger in Asia. The level of FX reserves in the region has increased nearly tenfold since 1997, and the ratio to GDP rose to 23.5% in 2021 from 8.0% in 1997.² So, this deserves a very strong A grade.

In evaluating the RFSN, I would like to include the Asian Bond Market Initiative (ABMI) together with the CMIM and the AMRO as they were launched to address the same root causes of the AFC, i.e., how to resolve the double mismatch problem in Asia and improve recycling of Asia's savings within the region.

In last two decades, the CMIM has made significant progress such as doubling its lending capacity, introducing the CMIM Precautionary Line, increasing the IMF de-linked portion, and extending program maturities. Despite all the progress, however, no country has turned to this facility and its effectiveness has not yet been market-tested. In contrast, the European Stability Mechanism (ESM), which was launched a decade later than the CMIM, has been actually used and has contributed to preventing several regional contagions.³

^{*}This keynote speech was presented at Roundtable on East Asia's Financial Safety Net on 22 August 2022.

^{*} Chang Yong Rhee is Governor of the Bank of Korea.

¹ The views expressed here are mine, and not necessarily those of the Bank of Korea or the Monetary Policy Board. I would like to thank Sungyup Chung, Hyosung Kwon and Jiwon Lee of the Bank of Korea for their comments and contributions.

² For 9 countries (CN, ID, JP, KR, MY, PH, SG, TH, and VN). (Source: IMF)

³ The ESM and its predecessor, the European Financial Stability Facility (EFSF) have disbursed a total of 295 billion euros to five countries: Ireland, Portugal, Spain, Greece, and Cyprus (Source: www.esm.europa.eu).

As for the ABMI, the size of regional local currency bond markets has increased more than four times since its launch.⁴ And there have been other tangible results too, including improved bond market liquidity.⁵ But the situation is still far from satisfactory. The development of local currency bond markets is very uneven across the region.⁶ And when it comes to recycling of regional savings, intra-regional debt securities investment remains small at around 12% while most FX reserves are still held in US dollars and euros (Arslanalp et al. 2022).⁷

Therefore, I am afraid the progress of RFSNs in Asia hasn't earned a satisfactory grade.

Lastly, the global financial safety nets provided by IMF facilities and the Fed's swap lines have been greatly enhanced in last two decades. Above all, the nature of IMF programs has changed significantly to reflect the many criticisms about their handling of the AFC. The IMF also introduced several lending facilities to strengthen global safety nets such as the Short-term Liquidity Line (SLL) and a number of emergency lending facilities since the outbreak of the COVID crisis. Also, the Fed's temporary swap lines, which were extended to nine additional economies during the GFC and the COVID crisis, played a crucial role in stabilizing global financial markets. Therefore, I think this area deserves high marks, too.

Toward a more accessible CMIM

Whether or not you agree with my not-so-generous assessment of RFSNs in Asia, we are all here today to discuss how to improve them further. So, let me now share my views on what urgently needs to be done to make the CMIM at least as effective as the ESM in the near future.

Transforming into an institutionalized fund

First, it is necessary to convert the CMIM's operational design from the pledge-based system to an institutionalized fund with paid-in capital so that funding uncertainty can be reduced.⁸ I think the institutionalized fund nature of the ESM allowed it to provide financial assistance promptly by making its balance sheet separate from those of the member states.

In contrast, the CMIM's financing through a network of FX reserves swaps comes with a significant political and economic burden, especially when financial stress is mounting in most economies in the region simultaneously due to a common shock. This fundamental weakness is one of the reasons the CMIM remains untapped since its inception and hence untested in the market, raising suspicion that pledges may not be honored promptly when a crisis starts (Rhee et al., 2013).

The recent change in the IMF's FX reserve classification makes this issue more critical. According to the recent IMF policy change, disbursed bilateral swaps are no longer counted as FX reserves. Therefore, if bilateral swaps are disbursed under the current CMIM system, the FX reserves of swap-providing countries will be decreased and, as such, the incentive to honor previous pledge will be reduced. Therefore, to make the CMIM effective, it is critical to transform it into a fund with paid-in capital and develop a proper institutional design so that its paid-in capital can be always regarded as a part of FX reserves.

Prolonging the Maturity

Second, we need to extend the maturity of the CMIM programs. Although the CMIM's original purpose is to respond to a liquidity problem, in many cases, illiquidity can easily develop into

4 The size of LCY bonds increased from \$7.8 trillion at the end of 2003 to \$32.6 trillion at the end of the second quarter of 2022 (Source: AsianBondsOnline).

5 See ADB (2017).

6 China and Korea account for 90.0% of EM East Asia's outstanding LCY bonds as of the end of Q2 2022 (Source: AsianBondsOnline).

7 As of June 2021, ASEAN+3 (including Hong Kong) accounted for only 11.7% of the cross-border debt securities investment assets of 8 regional countries (CN, ID, JP, KR, MY, PH, SG, and TH) (Source: IMF, Coordinated Portfolio Investment Survey).

8 See Hyun and Paradise (2019, 2020) for discussions of the benefits from an institutionalized fund.

solvency problems, which require more time to resolve. Also, the short period of financing assurances reduces the incentive for member countries to turn to the CMIM. Recently, the CMIM has adjusted the maturity of their financial assurances and improved compatibility with IMF programs. However, given that the structure of the facility still requires annual rollovers, the borrower's financing remains uncertain.

One of the factors that made the ESM successful is that its loan maturities have very long terms of 10 years or longer, reducing the borrowing country's burden and uncertainty about the repayment schedule. Admittedly, it would be difficult for the CMIM to use very long-term maturities like the ESM, considering most Asian currencies are not internationalized and convertible unlike the euro, but we could at least consider adjusting the repayment period to those of the IMF's Stand-By Arrangement or Extended Fund Facility.

Strengthening AMRO's capacity

Lastly, for the institutionalized CMIM to be more effective, I hope AMRO is able to play a bigger role in providing first-class policy recommendations and independent and alternative views on Asia with a regional perspective distinct from other global international organizations. If AMRO did not have independent and sufficient surveillance and program design capacities, it might be a more efficient option to rely on global organizations such as the IMF, without having a separate regional safety net. So, I believe well-functioning, professional, highly respected and capable AMRO is a pre-requisite to the success of the CMIM.

New opportunities

The Asian Financial Crisis in 1997 was a wake-up call for us to understand the importance of developing regional safety nets and enhancing recycling of Asian savings. I believe the recent advance of IT technology and the growing interest in improving cross-border payment systems and developing CBDCs provide another great opportunity for us to redouble our efforts.

For example, studies on payment innovations such as Project mBridge, Project Dunbar, and Project Nexus led by Hong Kong, Singapore, and other Asian economies together with the BIS Innovation Hub are proceeding briskly. In addition, Asia is no longer in a position of catching up in blockchain technologies but is now at the forefront of research in this area.

Such innovations in cross-border payments could serve as a catalyst in promoting regional capital markets. More specifically, local currency bonds can be settled on a Delivery versus Payment (DvP) basis using local currency CBDCs, lowering cross-border and cross-currency transaction costs and risks, not to mention the third time zone problem.⁹ And using distributed ledger technology (DLT) may make it possible to settle cross-border securities transactions without relying on global custodian banks and securities depositories. Such changes will allow us to overcome many legal and political issues as well as the insufficient market infrastructure which have been major obstacles to regional capital market development.

For several decades, Asia has been the engine of global growth in real activity, but not in financial markets. If we make good use of technological innovation, it will help to develop our regional financial markets much faster and enable Asia to remain the growth engine of the global economy going forward.

Conclusion

Today, I talked about the multi-layered safety nets to guard against financial crisis in the region. But, before concluding my remarks, let me emphasize that while these safety nets are an insurance mechanism to protect us, the best way to prevent such a crisis is to secure sound macroeconomic

⁹ For the third time zone problem, see Park and Rhee (2006).

management with strong financial supervision and regulation. And although I wish I could have given better grades to the CMIM, AMRO and the ABMI today, please take my assessment as encouragement. I hope that we can work harder together to make Asia regional safety nets more effective and stronger in the future.

My best wishes for very productive roundtable today. Thank you.

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Hainan to Boost China-ASEAN Exchanges *

By CHI FULIN *

The first working meeting of the Hainan Free Trade Port-ASEAN Think Tank Network held on May 13 focused on how to help strengthen China-ASEAN economic and trade cooperation and enable the Hainan Free Trade Port to play the role of a strategic hub promoting trade, investment and cooperation.

At the second working meeting held recently, we discussed how the network can better carry out its work in the future.

A core objective of building the Hainan Free Trade Port is to transform Hainan into an important hub and market for comprehensive cooperation between China and the Association of Southeast Asian Nations, and make full use of its geographical and opening-up advantages, so it can play a pivotal role in promoting broader, higher-level cooperation and exchanges between China and ASEAN, better connect the two most dynamic markets, and advance the process of regional economic integration.

Chinese firms eager to invest in ASEAN

Many Chinese enterprises want to use the Hainan Free Trade Port as a base to invest, and deepen cooperation with their counterparts, in ASEAN member states. According to a survey on Chinese companies, 56 percent of the respondents said they are planning to enter the ASEAN market, and 60 percent said they want to increase investment in the ASEAN market and expand cooperation with ASEAN companies in the next 12 months, indicating that Chinese enterprises are still very eager to consolidate their presence in ASEAN member states.

In fact, the percentage of Chinese companies planning to enter the ASEAN market is likely to increase to 66 percent in the next three years or so, and their investment in ASEAN could increase by 25-50 percent.

In view of this demand, the China Institute for Reform and Development said in March that building "two headquarters bases" in the Hainan Free Trade Port should be considered a major task — one for helping Chinese companies enter the ASEAN market, the other for ASEAN companies to enter China's market.

The feasibility of Chinese enterprises using the Hainan Free Trade Port as a base for investing in ASEAN states and boosting cooperation with their ASEAN counterparts is immense, as the free trade port's opening-up policies such as the "15 percent corporate profits tax rate policy", the "foreign investment income tax exemption policy" and the "zero tariff policy for importing important commodities and parts" are attracting an increasing number of Chinese companies to set up base in Hainan.

Integrating Chinese and ASEAN markets

In the coming years, a more realistic and pragmatic way to stabilize the China-ASEAN industrial and supply chains and achieve higher-level integration of the Chinese and ASEAN markets would be to use the free trade port as a base to provide facilitating services for Chinese enterprises to invest in the ASEAN market.

How to provide intellectual support for Chinese companies to enter the ASEAN market?

*This article is an edited excerpt from the opening speech by Chi Fulin at the Second Working Meeting of Hainan Free Trade Port-ASEAN Think Tank Network, published on China Daily on 24 September, 2022.

* Chi Fulin is President of the China Institute for Reform and Development.

Hainan has been exploring specific measures, and policy and institutional arrangements for building "headquarters bases", but it is yet to resolve some knotty issues. For instance, which Chinese companies can meet the specific needs of which ASEAN member's industries and therefore should invest in the ASEAN market or establish cooperation with ASEAN companies? How large is the ASEAN market space? How can the advantages of the Hainan Free Trade Port in promoting China-ASEAN cooperation be better utilized? What kind of policies will help ASEAN companies to increase their share in the Chinese market through the free trade port?

Objectively speaking, in the short run, the lagging construction of the financial services system remains a weak point of the Hainan Free Trade Port in that it cannot yet ensure Chinese enterprises' entry into the ASEAN market.

Firms can use HK to invest in ASEAN

Hong Kong is the top financial center in the Regional Comprehensive Economic Partnership zone, and its stock market owes about 80 percent of its value to Chinese mainland companies, and more than 80 multinational companies headquartered in ASEAN are already listed on the Hong Kong Stock Exchange. So to enable Chinese enterprises to enter the ASEAN market using the Hainan Free Trade Port as a base, the network should help integrate the Hong Kong Special Administrative Region's financial services with China-ASEAN industrial chains.

There is also a need to intensify joint research on the issue and make the needed policy arrangements and standard alignment.

As a bridge between governments and enterprises, the network's fellow think tanks are urged to conduct policy research especially aimed at helping enterprises meet their business needs and provide them with the necessary help to formulate industrial guidelines for making full use of the free trade port as a platform for helping Chinese and ASEAN enterprises achieve better cooperation results.

How to build institutionalized platforms to help Chinese enterprises enter the ASEAN market?

To begin with, it can be done by the Hainan Free Trade Port and ASEAN co-organizing regular forums on exchange and cooperation. As a matter of fact, the China Institute for Reform and Development, with the support of the China Ocean Development Foundation, is preparing to hold an international forum on "Exchange and Cooperation between Hainan Free Trade Port and ASEAN" at the end of October. The forum will discuss how best the free trade port can be used as a base to facilitate Chinese enterprises' investment in the ASEAN market. The institute is also preparing to hold an offline forum on "Global Free Trade Port Development" at the end of this year or early next year.

Move to realize potential of SMEs

Small and medium-sized enterprises in China and ASEAN states account for more than 90 percent of all enterprises. To mobilize the talent resources of the network and ensure the SMEs fulfill their full potential, and contribute more to regional development and China-ASEAN cooperation, the network aims to co-organize capacity-building training seminars.

As for the China Institute for Reform and Development, it is preparing to hold a training seminar on capacity building for the development of the blue economy under the RCEP framework. We hope the experts attending these forums and seminars will suggest how the governments and enterprises of ASEAN states can better develop their blue economy and boost their capacity building.

The Hainan Free Trade Port-ASEAN Think Tank Network and the China Institute for Reform and Development also suggest that mutual academic visits and exchanges between visiting scholars be organized, and camps for young talents from member think tanks be set up.

Monetary Policy

Inflation Expectations, Inflation Persistence, and Monetary Policy Strategy^{*}

By CATHERINE L. MANN^{*}

1. Introduction

At its meeting last month, the Monetary Policy Committee came together to deliver on its pledge that it would react forcefully in response to more persistent inflationary pressures. A large majority agreed that this condition had been met and that we were indeed seeing persistence so the hike by a half percentage point was the appropriate course of action at that meeting. This sends a strong signal that the MPC is committed to leaning against domestic inflation pressures becoming further entrenched.

Now, some commentators have pointed out that the MPC's central forecast projects a prolonged recession over the next quarters, and that this slack would yield inflation falling below the target in year three. Therefore, they claim inflation to be vanquished already and indeed that monetary policy already has become contractionary. Further, since the shocks hitting the UK economy have come mostly from external sources – supply chain frictions, energy prices, war – they claim that the MPC need not tighten further, but rather can 'look through' these shocks, since they will mean-revert.

In this speech I'm going to argue that, while some elements of this line of argument might hold in normal times, it is based on an incomplete view of the inflation process and of the channels through which monetary policy can achieve our remit. Specifically, in today's environment, inflation expectations take a central role, alongside the standard channel of aggregate demand and slack. Looking through the lens of inflation expectations, achieving the remit depends on ensuring that inflation expectations in the short-term do not become adaptive, and that medium-term inflation expectations do not drift, so that long-term expectations remain anchored.

What most people seem to have in mind when thinking about the determinants of inflation is a variant of the Phillips curve (Phillips, 1958), which relates inflation to some measure of slack in the economy. In the earliest version of this model, inflation today is determined by economic outcomes yesterday – inflation therefore will adjust slowly and with considerable lag. To bring inflation down, when the MPC raises interest rates, it increases borrowing costs for firms and households causing them to spend less, unemployment eventually rises and slack opens up. Only then do companies adjust prices in response to slowing demand for their goods and services. In

^{*}This speech was given at the 53rd Annual Conference of the Money Macro and Finance Society, University of Kent. It was published on 5 September 2022.

^{*} Catherine L. Mann is Member of the Monetary Policy Committee, Bank of England.

Friedman’s (1961) story of “monetary policy having long and variable lags”, this is where the “long” comes from. Importantly, since lagged inflation is pre-determined, the only way to get inflation down from high levels is to depress aggregate demand for an extended period of time. In this formulation, disinflation is costly and necessarily so.

I do not dispute that this mechanism exists, but I hope that the MPC will not have to depend on it alone to bring inflation down to target. In the more nuanced formulation of the Phillips curve discussed below, inflation today does not simply depend on past inflation but depends as well on markets, firms, and household’s expectations, and crucially, how these expectations react to each other, are formed over time, and interact with our and others’ policy choices. The MPCs’ evaluation of inflation expectations therefore should take a central role in monetary policy decisions.

In this more complex and arguably more realistic and relevant version of the inflation model, a fast and forceful monetary tightening, potentially followed by a hold or reversal, is superior to the gradualist approach because doing so is more likely to promote the role that inflation expectations can play in bringing inflation back sustainably to 2% over the medium term. This policy strategy would reduce the risks of a more extended and costly tightening cycle later that depends primarily on shrinking aggregate demand.

2. Micro-foundations and expectations in the Phillips curve

The first expectations-augmented Phillips curve was a crucial innovation in understanding the inflation process. In this formulation, inflation expectations are not just backward-looking, but agents in the model are allowed to anticipate how policy choices today may shape macroeconomic outcomes tomorrow. If we allow for both backward- and forward-looking expectations formation, we arrive at the hybrid Phillips curve (Clarida et al., 1999 and Gali & Gertler, 1999). Here, the non-slack term in the equation becomes a weighted average of past and expected future inflation:

$$\pi_t = (1 - \beta)\pi_{t-1} + \beta\pi_{t+1}^e + \lambda\bar{y}_t$$

Depending on the value of β , this model encompasses the accelerationist Phillips curve (as $\beta \rightarrow 0$) but importantly also encompasses the so-called New Keynesian Phillips curve (as $\beta \rightarrow 1$). In the latter model, inflation is entirely forward-looking and determined only by expectations of future inflation, which is a function of expected future slack or more precisely, to the discounted path of expected future real marginal costs. To see why that is interesting and potentially relevant to the current conjuncture, let me briefly walk through the foundations of the New Keynesian Phillips curve, which makes the bridge between microeconomic fundamentals and macroeconomic outcomes.

By virtue of being “micro-founded”, the New Keynesian model can connect all its macroeconomic equations to some microeconomic (i.e. firm- or household-level) optimisation problem. The key bridge between macro measures of inflation and the micro-foundations is the price-setting problem of the firm. To presage the conclusion: In their pricing strategy, firms face adjustment costs, consider trend inflation and competitor prices, and evidence downward wage and price rigidity. Collectively these yield a non-linear and potentially shifting Phillips Curve, with important implications for the role for monetary policy to influence expectations.

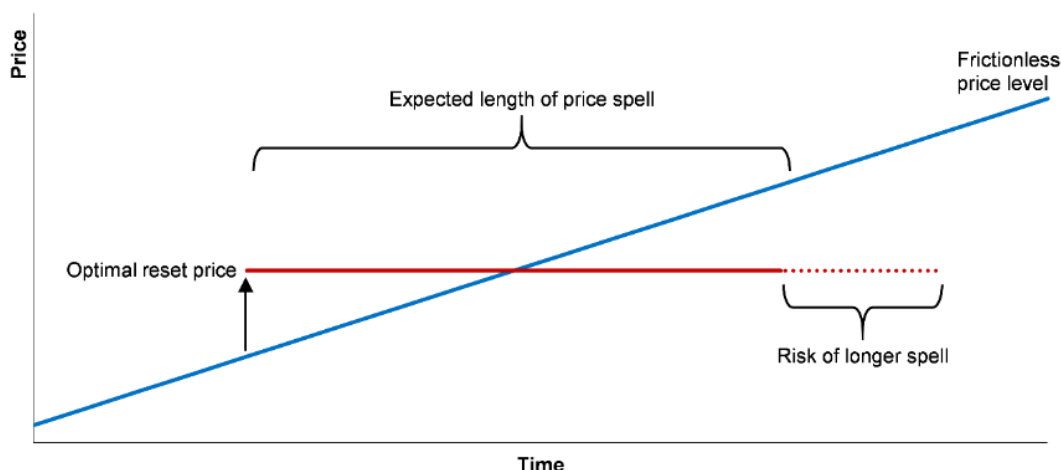
The first crucial point for the inflation model is that prices typically are not infinitely flexible. Firms will only choose to bear costs of changing prices once the adjustment is sufficiently large or because prices are fixed through contractual arrangements (e.g. rent, utilities). Calvo (1983) formulates these various types of stickiness by assuming that a certain proportion of firms is allowed to reset its prices while the rest remain at last period’s. As shown in Chart 1 (adapted from Werning, 2022), if the firm anticipates that prices will go up, it will optimally overshoot the current price level to ensure that it hits the correct price on average. Uncertainty about how long they will

stay at the new price and how fast the frictionless price level is rising will create incentives to overshoot by even more to insure against exceptionally long spells or more rapid rises. Thus, the adjusting prices have momentum above, and can pull up, trend inflation.

Further, when we take seriously the way firms behave in the real world, there may be price coordination between firms. When a firm sees a competitor raise their price, they might be emboldened to do the same even if their marginal costs have not actually moved. If a series of large and salient shocks increase costs for some but not others, this “me-too-ism” would show up as a persistent rise in desired mark-ups, driving inflation upwards with seemingly no connection to cost or demand conditions.

Various firm-level behaviors affect the shape of the Phillips Curve. The optimal reset-price behavior along with me-too-ism induce an upward bias in inflation in the short term. On the disinflationary side, while firms are quick to raise prices when they can, prices rarely outright fall in aggregate.

Chart 1: Firm-price overshooting in sticky price models



- Source: Werning (2022).
- Notes: Adapted from Ivan Werning’s slidepack presented at the NBER Summer Institute 2022.

This downward nominal rigidity can be seen in deep recessions: Even during the Great Financial Crisis or the Covid lockdowns, consumer prices in the UK never actually fell in year-on-year terms. Firms facing bankruptcy may raise prices to generate revenues to pay debtors, even if reducing prices might make more sense in theory (Gilchrist et al., 2017). Nominal wage rigidity is well known and since labour is an important cost this will bolster the downward rigidity of prices (Daly & Hobijn, 2014). All told, for a given change in economic slack, prices will rise more in expansions than they would fall in contractions. The Phillips curve is non-linear.

A second innovation, particularly important now, is that inflation expectations may change over time. In theoretical work, the change between the backward-looking, accelerationist and the forward-looking views often is modelled as a largely exogenous regime shift. However, it is plausible that there is a smoother transition between states, endogenously shaped by macroeconomic outcomes. For example, contemporaneous research from the 1970s suggested that the time away from target was an important determinant of the degree of backward-lookingness: Robert Gordon in 1970 rejected that the US Phillips curve was accelerationist. By 1977 his updated estimates suggested inflation expectations were fully backward-looking.

One plausible mechanism for such endogenous regime shift – proposed by Cornea-Madeira et al. (2019) – arises if we think of two types of firms and households in the economy: forward-

looking “fundamentalists” and backward-looking “random-walkers”. These have different forecasting rules, and firms and households will switch between them when the one rule outperforms the other. If inflation varies modestly around its target, the fundamentalists dominate. This is akin to Alan Greenspan’s desired Central Bank outcome where firms and households ‘ignore’ inflation when making their decisions. The literature formalizes this behavior as ‘rational inattention’.

But, when shocks drive inflation away from target for extended periods and the fundamental rule produces larger forecast errors, more firms and households use the backward-looking rule to form adaptive expectations. In this case, experiences of past high inflation can become embedded in firms’ and households’ price-setting decisions and the aggregate Phillips curve becomes more accelerationist over time.

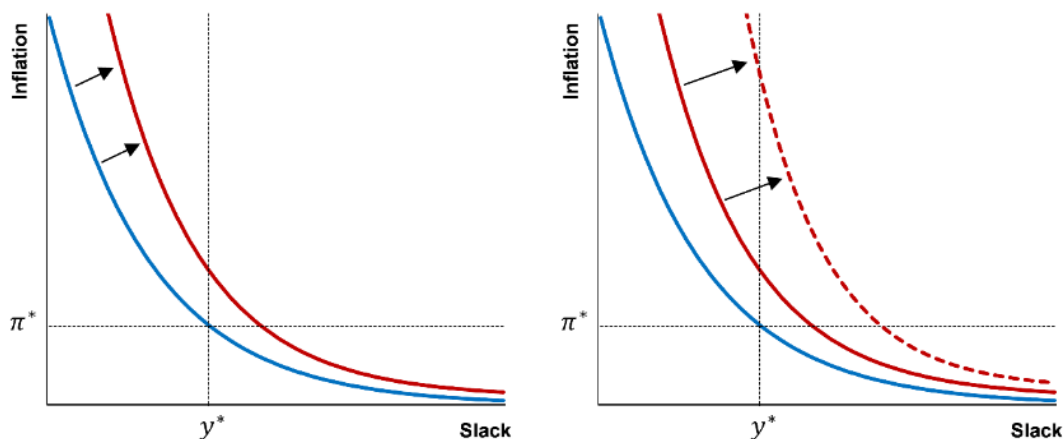
I find this framework useful because it is more nuanced than the discrete switching between “expectations are forever anchored” and “expectations are suddenly unanchored”. Even if long-term expectations remain stable and the central bank’s target is credible, such a model can generate different degrees of backward-lookingness and intrinsic inflation persistence. From the theoretical perspective, this time varying expectations formulation also represents a departure from the strict rational expectations formulation of the canonical New Keynesian Phillips curve. In this more complex formulation, monetary policy, by having an expected effect on macroeconomic outcomes, can feed back to affect the inflation expectations process and therefore current inflation outcomes.

To summarize the importance of this world for monetary policy: Monetary policy does not just focus on demand management, but also on coordinating firms and households to agree on some fundamental equilibrium, in which prices and wages rise at target-consistent rates and the economy is growing at a sustainable pace and any shocks are expected to wash out quickly.

From the standpoint of monetary policy, these variations yield different implications for channels through which monetary policy can affect inflation. In the old, backward-looking, accelerationist version, inflation always follows economic slack. In the rational expectations model, when expectations are forward-looking, inflation can move even before changes in the monetary policy stance have affected real economic activity. And in the time-varying model, monetary policy can influence aggregate inflation expectations via the share of fundamentalists versus random walkers. It follows that, if monetary policy can act on inflation expectations, then the dependence on the aggregate demand channel to discipline firms’ price setting is reduced.

Collecting up the theories points to a Phillips Curve that is both non-linear and can shift. (Chart 2). When we think about it, the Phillips curve is actually a set of isoquants, which trace out all attainable combinations of inflation and slack given a value for expected inflation. When expectations change, so does the location of the curve.

**Chart 2: Shifting Phillips curves due to changing inflation expectations
Modest shift (a) and acceleration (b)**



Here, let the blue line be the Phillips curve of the economy at the outset of any shocks or firm reactions. Given initial conditions for inflation expectations as well as desired mark-ups, there is a level of slack y^* consistent with achieving the inflation target π^* at the intersection of the horizontal dotted line and the blue curve. Small disturbances will push the economy away from that intersection but only by modest amounts and we can always – along the curve – travel back to the same equilibrium.

Now consider the case in which inflation expectations drift up: the newly attainable combinations of inflation and slack are shown by the red curve. Keeping inflation at target requires more slack in the economy, more unemployment, and lower growth (the intersection of the horizontal dotted line with the red curve). On the flipside, holding the level of slack constant at the old y^* will lead to higher inflation (the intersection of the vertical dotted line with the red curve).

If we could be confident that any shift was short-lived and that the red curve would shift back in line with the blue curve by itself, this might be a situation in which MPC could choose to “look through” the shock and tolerate a temporary inflation overshoot. Our remit explicitly allows for this as long as medium-term price stability is not threatened.

If, however, there is a risk of further acceleration of inflation and further drift of expectations, to ‘look through’ the inflation changes, we have to be very confident that inflation does not becoming embedded in expectations and outcomes. If there are such shifts in inflation expectations, more economic pain is required to bring inflation back to target (red dashed curve on the right-hand side of Chart 2). Which situation are we in now? What do we know from the data about the slope and potential shifting of the Phillips Curve?

3. Taking these models to the data

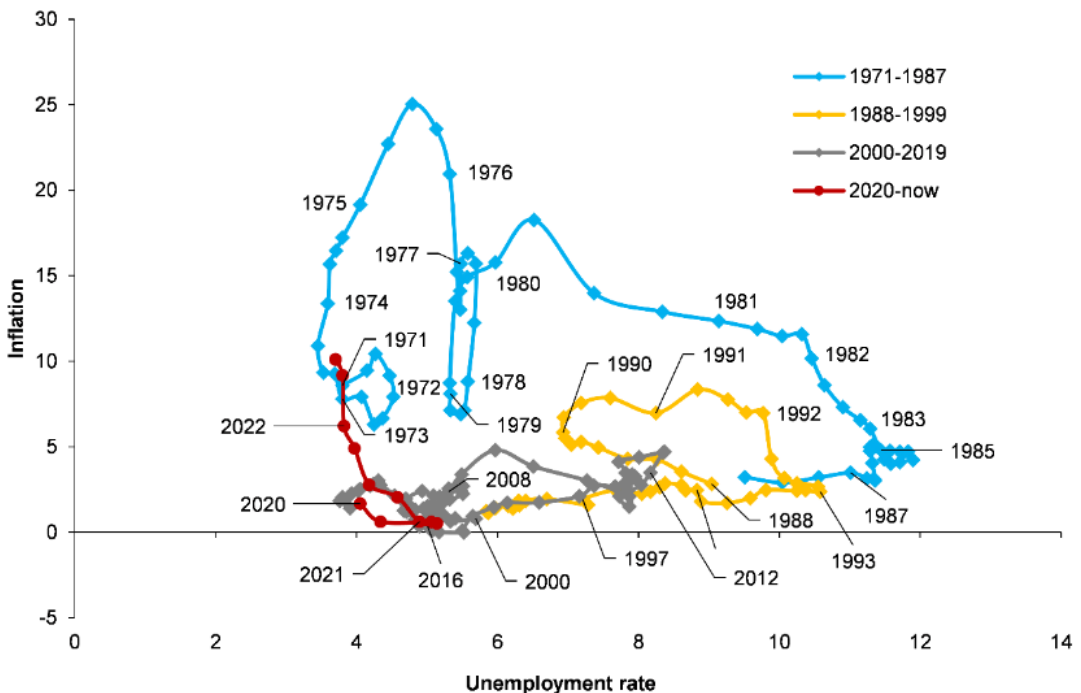
A first observation is that the Phillips curve set ups above are not the same as the correlation between inflation and an output gap measure or unemployment (sometimes dubbed the “Phillips correlation”). Instead, they describe structural, causal relationships between inflation yesterday, today, and tomorrow along with associated economic conditions. This relationship may not be immediately visible from a simple scatterplot. Just as correlation does not imply causation, causation does not imply correlation.

In fact, if one were to simply fit a line through the scatter in Chart 3, which plots UK unemployment against CPI inflation in quarterly frequency, there would be no detectable

relationship. However, if we trace out the time series underneath the point cloud, we can see some interesting patterns:

The first thing that jumps out is of course the high-inflation period of the 1970s and the subsequent moderation of the 80s (in light blue). This moderation in inflation did not come painlessly but instead was only achieved alongside high rates of unemployment. Then, the thirty years thereafter trace out a continuous downward trend in both inflation and unemployment and finally, variation becomes so small that it is barely visible compared to the first twenty years. Finally, compared to the recent history, the Covid period does not look like a particularly egregious outlier.

Chart 3: Unemployment rate (a) and CPI inflation (b) in the UK since 1971
Percent of labour force (a) and year-on-year percentage changes (b)



- Source: Office for National Statistics.
- Notes: The chart shows combinations of CPI inflation and the unemployment in the UK at quarterly frequency. Inflation before 1989 is based on the ONS' historical series for UK CPI available at 'Modelling a Back Series for the Consumer Price Index, 1950 – 2011'.

Now consider the time from 2021 Q4 onwards. The configuration of the most recent data (the final red dot) with July inflation at double digits and unemployment at under 4% looks more like 1973 than any other time, as indeed does the importance of energy prices in both periods. Of course, many things have changed since then – one of which is the recognition of the power of an independent central bank – but this configuration of the data should cause concern.

Strong, independent, and credible central banks may have contributed to why the Phillips correlation has 'disappeared' in recent periods across the world. Although, perhaps the Phillips curve never actually went away and it probably always had been relatively flat (Barnichon & Meesters, 2021). It just became more difficult to identify because monetary policy became more systematic and predictable. As McLeay and Tenreyro (2020) explain, if monetary policy were able to perfectly offset demand shocks, there would be no visible correlation in the data. It may even

be the other way around as the central bank would seek to increase inflation in times of deficient demand and vice versa.

Additionally, to underline the importance of expectations in the inflation process, much of the apparent flattening in more recent samples can be attributed to a better anchoring in inflation expectations (Hazell et al., 2022). But it is probably best if Emi Nakamura explained this all herself tomorrow.

Arguably, this anchoring is what differentiates the 1970s and 80s from the rest of the data in Chart 3: Back then, shifting expectations made it impossible to achieve low inflation without generating a high degree of economic slack. Policymakers were too confident that inflation would eventually return back to target, for example due to the endogenous demand destruction caused by high oil prices. This miscalculation allowed inflation expectations to ratchet up to high levels. The required economic slack can be seen by the long and painful path from the top left to the bottom right in the chart. Between 1980 and 1985, inflation in the UK fell by about 10 percentage points but at the cost of a more-than doubling in the unemployment rate from 5 to nearly 12%.

This is of course put millions of people out of a job with millions of livelihoods ruined – a prospect we would very much like to avoid. There is another way: When inflation expectations are time-varying monetary policy can affect them directly, shifting the curve back towards the fundamental equilibrium π^* and y^* via both movements along the curve but also shifting it.

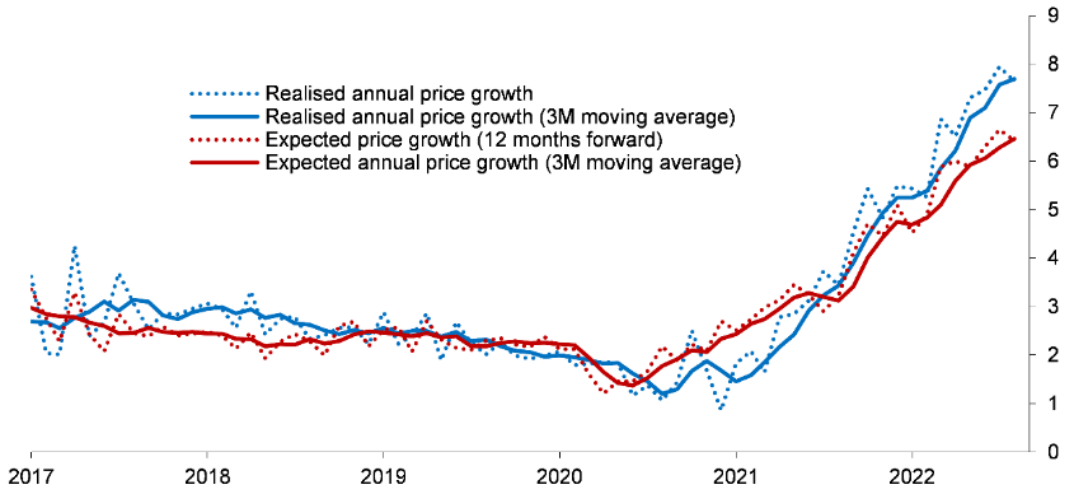
What data help us to evaluate how successful we are in keeping inflation expectations consistent with the fundamental equilibrium? I will argue first: Long-term inflation expectations remain relatively well anchored and the MPC has credibility to be able to fulfil its remit. This is unequivocally a good thing but survey measures do not tell us how we actually get to the objective of 2% – through aggregate demand compression or other ways. Second: Short-term inflation expectations are worryingly elevated but mostly reflect past inflation and are likely not a good guide for policy choices or outcomes in real time. Third, of significant concern: Medium-term measures of inflation expectations have drifted up alongside realized inflation, albeit not by as much. This may indicate a worrying shift in trend inflation, e.g. a shift in the Phillips Curve. A drift in medium-term inflation expectations is the development that monetary policy needs to firmly lean against and it should be a key yardstick for whether the MPC's decisions are effective.

Going to the data on expectations. In general, we can partition different measures of inflation expectations as derived from surveys or financial market pricing in accordance with the distance to some shock that moves inflation off the target. In the very short run, roughly up to the 1-year horizon, they mostly reflect the direct impact of the shock on the economy. As people (and policymakers) observe macroeconomic outcomes in real time, they learn about the nature of the shock and form expectations about how it may play out in the immediate future.

Short-term expectations are, therefore, quite correlated with recent inflation outcomes as can be seen, for example, from price expectations of firms in the Decision Maker Panel. As Chart 4 shows, expectations of price changes over the next 12 months have increased by similar amounts as price changes over the past 12 months. This is certainly not good news and points to a more protracted inflation “hump” than would be implied by one-off shocks to the price level (Mann, 2022a) but it is also could be consistent with a relatively swift return to target thereafter, albeit tempered by downward stickiness.

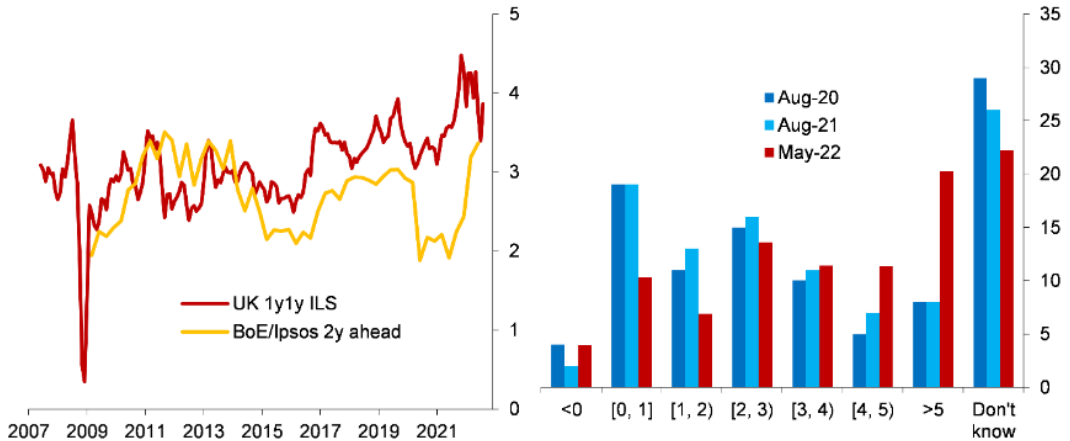
A more nuanced view on inflation expectations comes from looking at expectations for the year after next; that is price changes between 12 and 24 months ahead (what in financial markets would be called 1-year-1-year inflation). At this would be a horizon, we would plausibly expect inflation to reflect policy choices. Chart 5a shows the time series of expectations from the Bank's Inflation Attitudes Survey as well as financial market pricing of inflation at that 2-year mark.

Chart 4: Firms' own-price outcomes and short-term expectations
Year-on-year percentage changes



• Source: Decision Maker Panel and Bunn et al. (2022). Latest observation: August 2022.

Chart 5: Intermediate-term inflation expectations and financial market pricing
Year-on-year percentage changes (a) and share of respondents (b)



• Source: Bloomberg and Bank of England/Ipsos Inflation Attitudes Survey.

• Notes: Red line on the left-hand side shows monthly averages of financial market pricing for inflation extracted from inflation-linked swaps. Yellow line shows the median expectation for inflation 2 years ahead from the household survey, the right-hand side chart snapshots of its distribution. Latest observation: August 2022 for financial market pricing, May 2022 for survey expectations (August data for the BoE/Ipsos survey will become available on 9 September 2022).

The two series' levels are not directly comparable since the financial market instruments behind the red line are based on RPI and likely incorporate risk premia, i.e. they are not a clean measure of the underlying inflation expectation. Nonetheless, comparing each series to its recent history is still instructive. Both measures are somewhat elevated currently, but while household expectations have been on the rise for four quarters in a row now, financial market measures have come off their peak, albeit still holding well above historical average levels. What might be the reason for this difference in evolution of expectations 2 years out? Financial markets, being more forward

looking, anticipate a worsening macro environment resulting from the massive energy price squeeze and also the tightening of financial conditions that they, to a degree, are responsible for.

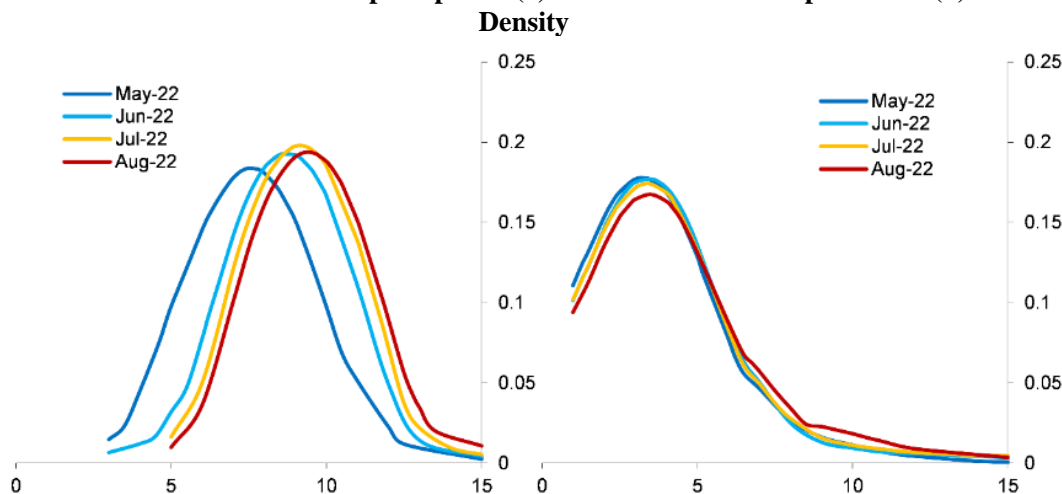
While household price expectations do not reflect these macroeconomic prospects, we can observe a worrying increase in the risk of sustained inflation well in excess of target. Compare the red bars on the right-hand side of Chart 5 with the blue, especially in the larger-than-five-percent bracket. In the latest survey round, more than a fifth of all respondents said that inflation in two years' time would be higher than 5 percent, and another fifth see inflation higher 3%.

Moving now to the solidly medium term, roughly expectations of inflation between 3 and 5 years ahead. At that horizon, direct effects of shocks ought to have already played out. Therefore, expectations at that point mainly reflect possible second- and third-round effects as well as, importantly, the effects of current and anticipated policy choices. We need to pay significant attention to these measures since they can tell us something about the adequacy of our policy strategy.

Of concern is that the measures that we have for this horizon have been drifting up and have remained at levels inconsistent with the target. For example, the DMP introduced a new question in May of this year directly asking for firms' expectations of aggregate consumer price inflation. While their backward-looking perception of consumer price inflation has generally been in line with measured CPI on average (e.g. 9.6 percent for July 2022 over July 2021 in the survey compared with 10.1 percent in the official data), their 3-year ahead expectation has held firmly at 4.2 percent, despite prospects for a significant slowdown in economic activity.

Chart 6 shows the distribution of responses to those questions. Backward-looking perceptions on the left-hand side have, as expected, moved rightward with actual inflation. However, the distribution of 3-year ahead inflation on the right is nearly indistinguishable from what it was in May.

Chart 6: DMP inflation perceptions (a) and medium-term expectations (b)



• Source: Decision Maker Panel and Bank calculations.

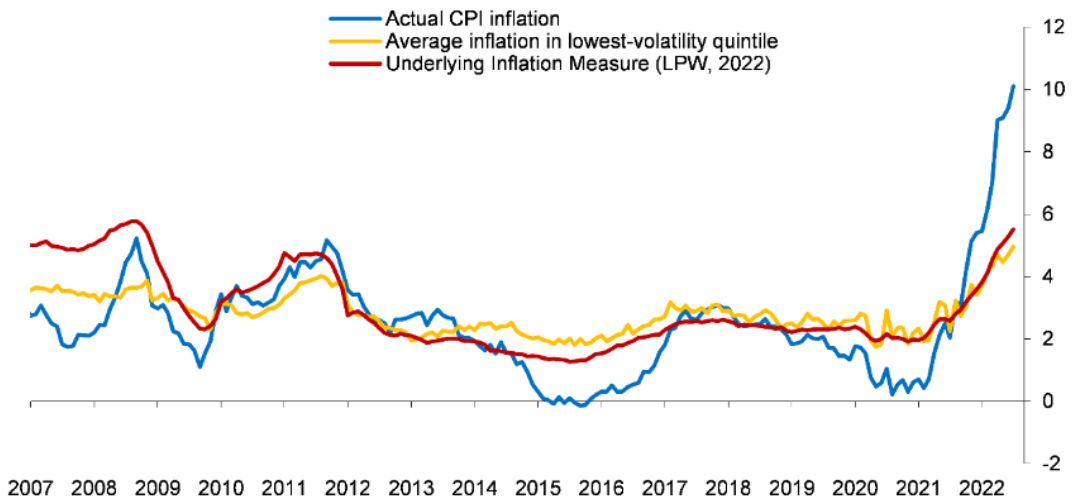
• Notes: The charts show kernel density estimates of the distribution of responses about CPI inflation over the past year (on the left-hand side) and about CPI inflation 3 years ahead (on the right-hand side).

Recall that those months saw a marked deterioration in consumer sentiment indicators, talk of an imminent recession in much of the Western world, and robust monetary tightening by many central banks. Typically, we would expect such an outlook to dampen measured price inflation which should be reflected in the DMP. However, these measures show no such move, neither in the central tendency nor in the tail. If anything, the right tail has even fattened in August – a

worrying sign of embeddedness beyond the short term. Further, although we do not have a long time series of the question of 3-year ahead CPI expectations, that there is no apparent sensitivity to expected macroeconomic conditions should give us pause.

The observation of a firming drift in medium-term inflation expectations is consistent with Bank staff research of underlying trend inflation. One such piece of analysis, the Underlying Inflation Measure of Lam, Potjagailo, and Wanengkirtyo (2022), uses a dynamic factor model of item-level CPI data to extract a common factor of broad-based inflation. In Chart 7 I plot this measure alongside actual CPI inflation and the volatility-based inflation measure from my speech at the start of the year (Mann, 2022a).

Chart 7: CPI inflation and measures of trend inflation
Year-on-year percentage changes



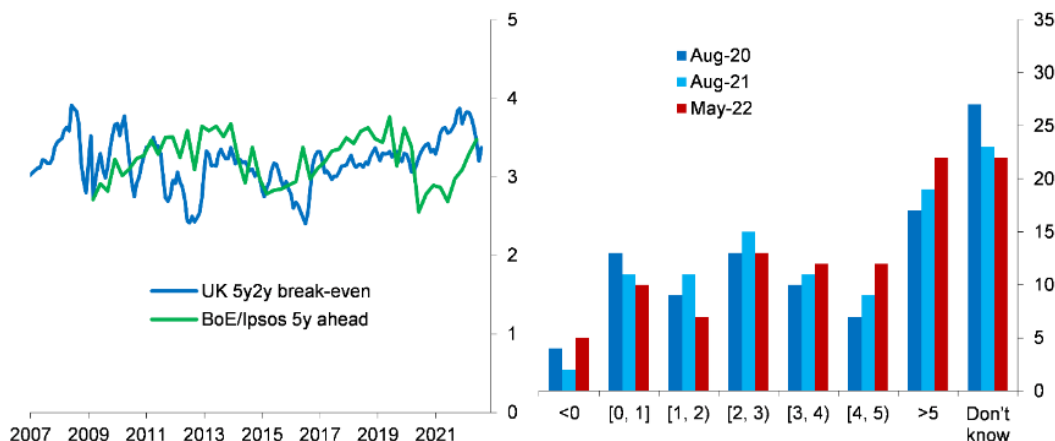
- Source: Office for National Statistics, Lam, Potjagailo & Wanengkirtyo (2022), and Bank calculations.
- Notes: The volatility-based measure is the average of inflation rates of the least volatile 20% of CPI components. See Mann (2022a) and Mann & Brandt (2022) for more details. The underlying inflation measure (UIM) is based on a dynamic factor model that statistically captures broad-based joint co-movement across 438 CPI item series. For more details on its construction, see Lam, Potjagailo & Wanengkirtyo (2022, forthcoming). Latest observation: July 2022.

Both series correlate quite well, indicating that they are measuring the same object: the underlying rate of inflation common to the entire basket. Over the past, this rate has been quite persistent so it could plausibly remain elevated even as headline inflation comes down.

I am worried about the drift in this component since, theoretically, this would be the eventual resting point of inflation once shocks have washed out. As I explained in that earlier speech, the ‘underlying’ rate does not have to equal 2 percent to be consistent with achieving the inflation target. But, if not, there need to be other persistent influences that keep headline inflation on target. Before the GFC, those might have been intensifying globalisation and falling goods prices, the question is what will it be now?

A tighter monetary policy stance, on average, would be one such factor, at least for as long as medium-term inflation expectations and measures of trend inflation are elevated. The financial markets’ evolving yield curve is one metric of how much they think the MPC will have to tighten.

Chart 8: Long-term inflation expectations and financial market pricing
Year-on-year percentage changes (a) and share of respondents (b)



• Source: Bloomberg and Bank of England/Ipsos Inflation Attitudes Survey.

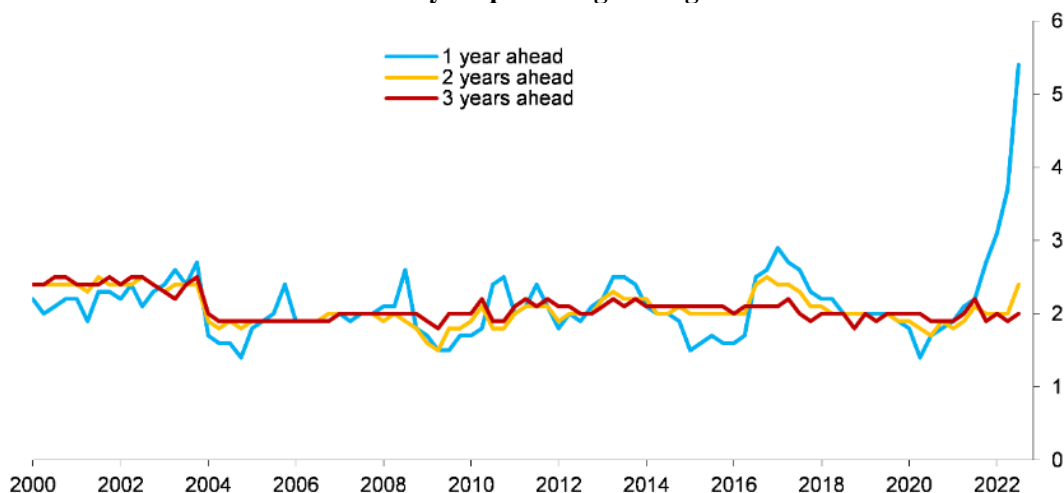
• Notes: Blue line on the left-hand side shows monthly averages of financial market pricing for inflation extracted from inflation-linked gilts. Yellow line shows the median expectation for long-term inflation from the household survey, the right-hand side chart snapshots of its distribution. Latest observation: August 2022 for financial market pricing, May 2022 for survey expectations (August data for the BoE/Ipsos survey will become available on 9 September 2022).

What about long-term inflation expectations? Chart 8 shows these measures for average inflation starting five years ahead. The news is mixed. On the one hand, these measures are in line with their history, consistent with inflation being anchored, and consistent with credibility of the target.

However, the survey measure on the left-hand side masks underlying movements that warrant attention, particularly for households. Households matter because their buying habits either will discipline firms' prices or will allow the me-too-ism that underlies aggregate inflation. For example, since mid-2020 we have seen a steady increase in respondents that say inflation in the long run will be 5% or more on average and a steady decrease in those that expect below-target inflation. Therefore, we need to be vigilant that these long-term expectations do not keep moving higher. Looking over the time-series, aggregate long-term expectations remain below where they were in 2019 and in 2014. So despite the increase in respondents in the larger-than-five-percent bucket, as of now, unanchoring does not appear in the median.

In addition to households, evidence from the corporate sector (specifically professional forecasters), corroborates this assessment: Longer-term expectations remain on target but there is some movement in the medium term. Chart 9 shows average expectations from the Bank's Survey of External Forecasters which usually do not exhibit large time-variation making the uptick in the 2-year-ahead measure even more noteworthy. However, the 3-year ahead measure, which could be interpreted as the most fundamentalist forecast available, shows no such movement. This is consistent with the Consensus panel of professional forecasters: There also, long-term expectations are consistent with achieving the inflation target in the long run while those at medium-term horizons have drifted.

**Chart 9: External forecasters' average expectations
Year-on-year percentage changes**



• Source: Bank of England Survey of External Forecasters. Latest observation: 2022 Q3.

So, people trust us to bring inflation in line with the target – the anchor is holding firm. But, credibility does not tell us how we will ensure that the anchor holds – through the aggregated demand channel alone or also through managing expectations. The worry is that expectations about the medium-term are drifting upwards – the anchor rope is fraying – and keeping the anchor firm with drifting expectations would require more compression of aggregate demand.

Therefore, coming back to monetary policy's role to affect expectations in the Phillips curve. In the worst case, when facing completely backward-looking expectations formation, we would be stuck with only the aggregate demand channel to bring inflation down to target. If expectations are forward-looking, however, there may be scope for monetary policy to affect inflation expectations directly.

A forthcoming working paper by Bank researchers (Mangiante & Masolo, 2022) explores the effect of monetary policy action on price expectations in the DMP. They identify three instances over the recent past in which the DMP field work straddled an MPC decision. They then compare expectations of those firms which responded before the decision with those that responded after.

In all three instances they find a significant effect of the announcement on price expectations in line with theory: on 11 March 2020, when the MPC cut rates, inflation expectations increased within the survey round; conversely, in December 2021 and in March 2022, when the MPC hiked rates, expectations fell within the round. Additionally, in all three cases did price uncertainty decline. To me, this is powerful and plausible evidence for a direct monetary policy effect on the formation of forward-looking expectations.

To summarize: I do not believe we are in that worst-case world where monetary policy needs to rely only on the aggregate demand channel. Long-term expectations remain relatively well-anchored at target. The drift in medium-term expectations is the major cause of concern, and cutting-edge research indicates that monetary policy can directly influence expectations. The MPC has the tools and the independence to return inflation to target once energy prices have stopped rising. We will not tolerate a persistent overshoot and will stay vigilant even when headline rates start to come down. But it is also the case that the more we control medium-term inflation expectations now, the less tight for long monetary policy will need to be.

4. Monetary policy strategy

Turning now to monetary policy: The scale, timing, duration, and direction of the appropriate monetary policy is determined by both the nature of shocks as well as the inter-related channels through which monetary policy affects inflation. As we have seen, this includes both inflation expectations and aggregate demand conditions. Whereas monetary policy arguably can ‘look through’ external shocks that leave expectations unchanged, it most definitely is responsible for leaning against domestic inflation pressures that threaten the objective of price stability.

In a previous speech I detailed why uncertainties about either the persistence of inflationary pressures or the underlying distribution of inflation expectations yielded the conclusion that monetary policy should be front-loaded and forceful (Mann, 2022b). On the first, the rationale was that if the shock is truly persistent, but is misperceived as transitory, the policymaker initially under-reacts, yielding an inflation overshoot both larger and more embedded than under full information. Second, if there is more upside risk to inflation, as judged by the distribution of inflation expectations, then a tighter monetary stance is warranted relative to the case where there is no such asymmetric tail risk.

Today, I deliberately have talked mostly about the medium-term outlook. Clearly, if current wholesale energy prices are allowed to be passed-on to households and firms, this will lead to enormous pain for millions of people over the winter months. And this will be true regardless of the path of Bank Rate. Monetary policy is a relatively blunt instrument and works mostly at the margin, it is ill-equipped and not intended to deal with large relative price movements like the one we’re seeing currently. We do not have in our toolkit the policies that can cushion the blow for those in need or that can spread the weight across time and across the income distribution.

Instead, the framework presented today is an exploration into the theory and data proxies that relate monetary policy to expectations and to aggregate demand where the focus is on the evolution of inflation expectations in the short, medium, and long-term. Recognising the potential for a shift in the Phillips curve shows how acting sooner and more forcefully can short-circuit the embedding of inflation by influencing the π term.

Expectations are formed from inflation outcomes, central bank actions, and from credibility of the target and the institutional setup. To the extent that increases in π are moderated through the expectations channel then the degree of monetary policy tightening needed to achieve the 2% objective is consistent with less of a slowing in aggregate demand and less of a rise in unemployment. Yet, the data suggest that medium-term inflation expectations are drifting upwards. If inflation expectations were to become more backward-looking due to persistent misses of the target, this would require an increased dependence on an aggregate demand slowdown to achieve the 2% inflation target.

What is driving the drift in medium-term inflation expectations? The spikes in short-term inflation expectations matter for medium-term household inflation expectations due to the salience of surging energy and food price dynamics. The sequence of shocks matter, because collectively they extend the duration of time above the 2% target. In such a case, the share of backward-looking agents likely rises leading to more intrinsic inflation persistence. The broadening of categories that show higher-than-target inflation matters for medium-term expectations because of upward-bias to wage negotiations and me-too-ism associated with complementarity in firms’ pricing strategies. The ratcheting-up from short-term to medium-term expectations has been apparent for a while, and could portend a persistent drift higher. This has the potential to cement expectations inconsistent with the 2% target which would necessitate a persistently tighter stance of monetary policy that works through the aggregate demand channel.

When thinking about the tightening undertaken to date, my concern is that the gradual pace of increase in Bank Rate has not tempered expectations enough, allowing the embedding of the short-term inflation overshoot into the persistent drift in medium-term expectations. The stylized

Phillips curve example shows why a shift outward of the curve implies that achieving the 2% target sustainably would be associated with permanently higher unemployment and lower aggregate demand. The 1970s, with ratcheting-up and persistently high inflation, required a long duration of elevated unemployment to bring inflation back down. A tighter policy stance now working through expectations reduces the degree of restraint to aggregate demand in the future.

Like the self-fulfilling prophecy on recessions, if firms believe that monetary policy will keep the Phillips curve from shifting, then they will incorporate that into their price expectations. Complementarity in firms' price setting generates lower macro inflation through firms' micro decisions. On the other hand, if monetary policy does not affect expectations formation – either because it is not forceful enough or if the required path is not credible – the drift in medium-term expectations is more likely to yield that worrisome shift of the Phillips curve.

It is encouraging that long-term expectation metrics apparently remain anchored and consistent with the 2% target. It appears that the credibility of monetary policy is intact. However, just because credibility is intact does not say how the 2% will be achieved – it can be either through acting on expectations or through requiring a long period of slack. As noted, the drift in medium-term expectations is already apparent in the data. We cannot be complacent in the face of the short-term spikes and medium-term drift. Acting more forcefully now, to ensure that the drift does not become the norm, is designed to avoid depending on a deeper and longer contraction to return inflation to target.

Monetary Policy: Past, Present, and Future^{*1}

By CLAUDIO BORIO^{*}

It is a pleasure and an honour to be back at this prestigious conference, if only virtually, and to be on such a distinguished panel.

This event is about the state of monetary policy since the conference series began 40 years ago. Thus, I thought I would reflect on three monetary policy challenges, from the past, the present and the future, respectively.

I will argue that, at each step of the long journey, as monetary policy interacts with the economic environment, the way in which it tackles one challenge helps define the next. The thread underlying my presentation – the *fil rouge*, as it were – is the changing nature of the business cycle and the role that financial forces play.

The past

Where does the story begin? I would say with the change in the nature of the business cycle in the early to mid-1980s – roughly when this conference series began. It was then that, with the fuzziness that inevitably characterises any investigation of this kind, recessions started to evolve from the inflation-induced to the financial cycle-induced kind.^{2,3}

More specifically, until then a rise in inflation prompted a tightening of monetary policy, which in turn triggered a recession. In the background, not much was happening to the behaviour of financial cycle indicators. Thereafter, the picture was quite different. As we know, inflation stayed relatively low and stable, so that monetary policy had little reason to tighten during business cycle upswings. By contrast, large financial expansions turned into contractions, weighing on the economy. I am of course excluding the Covid-19 recession which, as we know, was *sui generis* and entirely exogenous.

Why did this change in the nature of the business cycle take place? I would suggest that this had to do with major changes in policy regimes, which shifted the tectonic plates that shape movements in the economic landscape.

First, the shift from financially repressed to liberalised financial systems across the world. This provided much more scope for the forces behind the financial cycle to play out, both domestically and internationally.

Second, the globalisation of the real economy. This acted as a powerful tailwind, expanding the production possibilities of the economy and generating persistent disinflationary pressures.

Third, the establishment of credible monetary policy regimes focused on near-term inflation, so that little or no attention was paid to monetary and credit aggregates. This was instrumental in bringing inflation down and hardwired the gains. But it also meant that, unless inflation became a threat, there was little reason for monetary policy to tighten during economic expansions and thus to rein in the financial forces.

It is no coincidence perhaps that business cycles came to resemble more closely those during the first globalisation wave – the one that took place under the gold standard between the 1870s and the Great Depression. In that era too, liberalised financial markets and integrated global trade coexisted with relative price stability.⁴

Put differently, inflation arguably became an unreliable signal of unsustainable business cycle upswings. By the same token, it became a less reliable compass for monetary policy. Business

^{*}This article is a remark at the Cato Institute's 40th Annual Monetary Conference on 8 September 2022.

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cycle expansions could proceed for longer, but at the cost of allowing financial imbalances to build, sowing the seeds of the subsequent downturns. And, as most spectacularly illustrated by the Great Financial Crisis (GFC), financial cycle-induced recessions can be especially deep and the recoveries especially drawn out.

Hence two important, and closely related, policy implications.

The first is a progressive loss of room for policy manoeuvre. Since policy was not tightened that much during expansions but was naturally eased, aggressively and persistently, during contractions, it contributed to the decline in nominal interest rates over successive business and financial cycles. In fact, with inflation relatively stable, this was also true of real interest rates.

The second is the unreliability of the natural rate of interest – or r -star – as a policy guide.⁵ I am not referring to the well known practical measurement difficulties. Rather, I am referring to r -star being defined in terms of what happens to inflation when output is at potential. With inflation providing only an unreliable signal of unsustainable expansions, r -star inherited this property.

At the same time, this pattern in business and financial cycles, coupled with the decline in interest rates, helps explain another major long-lasting shift in the economic landscape. Debt levels, both private and public, reached historical peaks globally.⁶

In all this one can see clear elements of a “debt trap”.⁷ Low rates and high debt reinforce each other, making it harder to raise rates without damaging the economy – a burdensome legacy.

The present

The past challenges naturally set the stage for the present ones.

Policymakers are now facing an unprecedented economic configuration. They are tightening monetary policy to quell inflation in the presence of widespread financial vulnerabilities, notably high debt levels and high asset prices, especially property prices. In other words, the two types of forces that lurked behind inflation-induced and financial cycle-induced recessions are coinciding for the first time.⁸

The configuration greatly complicates the calibration of monetary policy.⁹ The economy has become more sensitive to higher interest rates. But by how much? And when will this become apparent? After all, real interest rates are still firmly negative.

Moreover, will there be consequences for financial stability once again? The picture is somewhat mixed, I would say. Crucially, the banking system is much stronger than ahead of the GFC, thanks largely to the subsequent prudential reforms. But the regulation of non-bank financial intermediaries (NBFIs), such as that of the asset management industry, has lagged behind.¹⁰ Strains in the NBFI sector were already in evidence during the GFC, when banks also struggled; they were at the heart of financial stress during the Covid-19 crisis, when banks helped cushion the blow to the economy.

This still leaves open an obvious question: after having been dormant for so long, why did inflation suddenly wake up, and with such vigour, taking most observers by surprise? As discussed in detail in the latest BIS Annual Economic Report, the Covid-19 crisis no doubt played a key role. Global aggregate demand rebounded with surprising vigour. This was not just the natural sequel to its artificial suppression during the lockdowns, but it was also the result of unprecedented fiscal and monetary policy support. In addition, the pandemic-induced rotation of global demand from services to goods turned out to be unexpectedly persistent; notably, it put global supply chains under huge pressure – the so-called bottlenecks. And this major rebound and rotation in demand clashed with inelastic global supply, which proved unable to keep up. Increases in commodity prices, which individual countries tended to treat as “supply shocks” turned out to reflect, to an important extent, global demand pressures – a kind of “fallacy of composition”.

An analogy may help to clarify this. Imagine you turn on a machine that has been switched off for a while. And that you do so after having kicked it hard and added high-octane fuel. The ensuing rumblings resemble those of the global economy once economic activity was no longer artificially suppressed. Less metaphorically, the initial stages of the post-pandemic inflation flare-up in some respects look like those seen in the aftermath of wars: the release of pent-up demand coupled with a massive redirection of production.

But, of course, this is not the end of the story. It never rains, but it pours. No sooner did the global economy seem to be emerging from the pandemic than the tragic Russia-Ukraine war broke out – yet another exogenous shock. The ensuing surge in commodity prices, not least those of energy and food, has greatly added to inflationary pressures.

Regardless of the specific causes, it is essential that monetary policy reacts – which it has – and that it perseveres until the job is done.¹¹ As also discussed in this year's BIS Annual Economic Report, transitions from low- to high-inflation regimes¹² tend to be self-reinforcing. For one, during those transitions, inflation moves out of the zone of rational inattention, where it is hardly noticed by economic agents, and snaps into sharp focus. In addition, it becomes more representative: as prices increase, they become more similar and synchronised, acting as a kind of co-ordinating device for agents' decisions. This increases the likelihood of wage-price spirals, which lie at the heart of the inflation process.

One is reminded of Volcker's and, later, Greenspan's definition of price stability, ie a condition in which inflation does not materially influence economic agents' behaviour. We probably lived in such a world for a good long while.¹³ We took it almost for granted and, paradoxically, did not enjoy it enough. Now, we need to make sure we return to it. Failing to act forcefully might reduce the near-term costs, but at the expense of higher ones down the road: once inflation becomes entrenched, it is all the harder to rein it in.

There is a broader lesson in all this.¹⁴ The long low-and-stable inflation phase may have masked the economy's supply constraints. But those constraints did not go away. Until recently, they emerged in the shape of financial instability, although probably they were not recognised as such at the time. They have now showed up as inflation – a more familiar, if almost forgotten, guise.

The policy levers of demand management cannot be the engine of long-term growth. We need to move away from the de facto debt-fuelled growth model that has brought us here. We need to rediscover the importance of the economy's supply side and of the policies designed to strengthen its resilience and vigour.

The future

So much for the past and present. What about the future? What is the next evolution of the business cycle likely to be? And what are the implications for the challenges monetary policy may face?

There are reasons to believe that the environment will become more inflationary. In some respects, a return to a high-inflation regime always threatened to be the endgame of the trajectory the global economy has followed for the past 40 years.¹⁵ Maybe the pandemic and the war – two exogenous shocks – have brought the endogenous endgame closer.

Why such an endgame?

Many of the secular economic tailwinds that helped keep inflation low could be turning into headwinds.¹⁶ Demographics? We know that this tailwind will become a headwind, as a scarcer labour force will see its bargaining power grow. Globalisation? There are some signs that it may be in retreat. Moreover, new headwinds are emerging. The transition to a greener economy will put strong pressure on many commodity prices – we have recently seen once more what the consequences might be. And in the background, there are also signs that the (geo)political

environment is becoming less supportive of global international cooperation and free market forces. Populism seems to be on the rise.

Last but not least, the legacy of the past 40 years is still with us in the shape of historically high debt levels. This could raise the temptation to accept inflation as a deceptively attractive way of reducing debt burdens.

It is not hard to see how this environment – closer to that of the 1970s – is structurally more inflationary. But the future is not preordained. The task of central banks is to prevent inflation from materialising. In such an environment, central banks will be tested to the full, not least institutionally. As the costs of higher interest rates to public finances became more starkly visible, central bank independence is likely to come under threat.¹⁷

Conclusion

Let me conclude.

Monetary policy has gone on an extraordinary journey over the past 40 years. At all points, the interaction between monetary policy regimes and the economic environment has played a key role in setting the stage for the next challenge. Now, central banks face the once-but-no-longer familiar challenge of preventing a transition from a low- to a high-inflation environment. Central banks have shown their mettle, as they have forcefully pivoted to prevent that transition. Yet, tougher tests may lie ahead.

Footnotes:

1 The views expressed are my own and not necessarily those of the BIS.

2 By “financial cycle” I mean the self-reinforcing interaction between credit, risk-taking and asset prices (especially property), which generates expansions (or booms) followed by contractions (or busts). See C Borio, *The financial cycle and macroeconomics: what have we learnt?*, *Journal of Banking and Finance*, vol 45, pp 182–98, August 2014, also published as BIS Working Papers, no 395, December 2012.

3 For an analysis of the change and the implications for leading indicators of recessions, see C Borio, M Drehmann and D Xia, “The financial cycle and recession risk”, *BIS Quarterly Review*, December 2018, pp 59–71. See also BIS Annual Economic Report, June 2021.

4 For a comparison of the two regimes from this perspective, see C Borio and P Lowe, “Asset prices, financial and monetary stability: exploring the nexus”, BIS Working Papers, no 114, July 2002 and for a broader analysis, see C Borio, “On money, debt, trust and central banking”, *Cato Journal*, Spring/Summer 2019, also published as BIS Working Papers, no 763, January 2019.

5 See C Borio, “Navigating by r^* : safe or hazardous?”, keynote lecture delivered at the SUERF, BAFFI Bocconi, OeNB workshop on “How to raise r^* ?” 15 September 2021, also published as BIS Working Papers, no 982, November 2021. See C Borio, “Revisiting three intellectual pillars of monetary policy”, *Cato Journal*, vol 36, no 2, pp 213–38, spring/summer 2016.

6 The corollary is that, by the time the global economy was re-emerging from the pandemic, the policy room for manoeuvre – both monetary and fiscal – had narrowed substantially. Hence the need to rebuild policy buffers, or safety margins, to deal with the inevitable future downturns as well as the unexpected. Since this was a joint task, it meant that, along the long normalisation path, the two policies would work at cross-purposes, complicating each other’s task. This is all the more so since central banks’ large scale asset purchases of government debt raise the sensitivity of fiscal positions to higher interest rates. What we have started to see, now that monetary policy is tightening, is just an illustration of this broader picture. For a more in-depth

discussion, see C Borio and P Disyatat, “Monetary and fiscal policies: in search of a corridor of stability”, VoxEU, November 2021 and BIS Annual Economic Report, June 2021.

7 See, C Borio and P Disyatat, “Low interest rates and secular stagnation: Is debt a missing link?”, VoxEU, June 2014.

8 This is, of course, a stylised picture: it is possible to find instances of this combination in some countries (eg, some EMEs), but globally what we are seeing is indeed unique.

9 The latest BIS Annual Economic Report, (June 2022) provides some simulations to shed light on the orders of magnitude involved.

10 See C Borio, M Farag and N Tarashev, “Post-crisis international financial regulatory reforms: a primer”, BIS Working Papers, no 859, April 2020. See also BIS Quarterly Review, December 2021 and therein A Carstens, “Non-bank financial sector: systemic regulation needed”.

11 See A Carstens, “The return of inflation”, speech delivered at the International Center for Monetary and Banking Studies, Geneva, 5 April 2022.

12 The Report characterises the inflation process as comprising two regimes – a low- and a high-inflation one – with self-reinforcing transitions from the low to the high one. The two regimes are very different. The low-inflation one has certain self-equilibrating properties: inflation largely reflects sector-specific (or relative) price changes rather than their co-movement: these sector-specific price changes tend to leave only a temporary imprint on inflation itself; and wages and prices are only loosely linked. The opposite is true in a high-inflation one. Moreover, the impact of monetary policy on inflation is much weaker, which may help explain the difficulties central banks have faced in raising inflation back to target post-GFC. For a full analysis, see Chapter 2, “Inflation: a look under the hood”; for a concise treatment, see the speech by C Borio, “Inflation: a look under the hood”, delivered at the Annual General Meeting, Basel, 26 June 2022, and for a more technical analysis, see C Borio, P Disyatat, D Xia and E Zakrajšek, “Monetary policy, relative prices and inflation control: flexibility born out of success”, BIS Quarterly Review, September 2021.

13 P Volcker, “We can survive prosperity”, speech to the Joint Meeting of the American Economic Association and American Finance Association, San Francisco, 28 December 1983, and A Greenspan, Meeting of the Federal Open Market Committee, 2–3 July 1996.

14 See A Carstens, “A story of tailwinds and headwinds: aggregate supply and macroeconomic stabilisation”, speech delivered at the Jackson Hole Symposium on Financial Stability and Macroeconomic Policy, sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, 26 August 2022.

15 See C Borio, “Secular stagnation or financial cycle drag?”, *Business Economics*, vol 52, no 2, pp 87–98, April 2017. See also C Borio, “Is inflation: dead or hibernating?”, SUERF Policy Brief, no 41, January 2021.

16 See A Carstens, *op cit*, see note 12.

17 See C Borio, “Central banking in challenging times”, SUERF Policy Note, no 114, November 2019, also published as BIS Working Papers, no 829, December 2019.

A New Era for Money^{*}

By ESWAR S. PRASAD ^{*}

“As bytes replace dollars, euros, and renminbi, some changes will be welcome; others may not.”

Money has transformed human society, enabling commerce and trade even between widely dispersed geographic locations. It allows the transfer of wealth and resources across space and over time. But for much of human history, it has also been the object of rapacity and depredation.

Money is now on the cusp of a transformation that could reshape banking, finance, and even the structure of society. Most notably, the era of physical currency, or cash, is drawing to an end, even in low- and middle-income countries; the age of digital currencies has begun. A new round of competition between official and private currencies is also looming in both the domestic and international arenas. The proliferation of digital technologies that is powering this transformation could foster useful innovations and broaden access to basic financial services. But there is a risk that the technologies could intensify the concentration of economic power and allow big corporations and governments to intrude even more into our financial and private lives.

Traditional financial institutions, especially commercial banks, face challenges to their business models as new technologies give rise to online banks that can reach more customers and to web-based platforms, such as Prosper, capable of directly connecting savers and borrowers. These new institutions and platforms are intensifying competition, promoting innovation, and reducing costs. Savers are gaining access to a broader array of saving, credit, and insurance products, while small-scale entrepreneurs are able to secure financing from sources other than banks, which tend to have stringent loan-underwriting and collateral requirements. Domestic and international payments are becoming cheaper and quicker, benefiting consumers and businesses.

Stability concerns

The emergence of cryptocurrencies such as Bitcoin initially seemed likely to revolutionize payments. Cryptocurrencies do not rely on central bank money or trusted intermediaries such as commercial banks and credit card companies to conduct transactions, which cuts out the inefficiencies and added costs of these intermediaries. However, their volatile prices, and constraints to transaction volumes and processing times, have rendered cryptocurrencies ineffective as mediums of exchange. New forms of cryptocurrencies called stablecoins, most of which ironically get their stable value by being backed by stores of central bank money and government securities, have gained more traction as means of payment. The blockchain technology underpinning them is catalyzing far-reaching changes to money and finance that will affect households, corporations, investors, central banks, and governments in profound ways. This technology, by allowing secure ownership of purely digital objects, is even fostering the rise of new digital assets, such as non-fungible tokens.

At the same time, central banks are concerned about the implications for both financial and economic stability if decentralized payment systems (offshoots of Bitcoin) or private stablecoins were to displace both cash and traditional payment systems managed by regulated financial institutions. A payment infrastructure that is entirely in the hands of the private sector might be efficient and cheap, but some parts of it could freeze up in the event of a loss of confidence during

^{*} This article was published on IMF website in September 2022.

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a period of financial turmoil. Without a functioning payment system, a modern economy would grind to a halt.

In response to such concerns, central banks are contemplating issuing digital forms of central bank money for retail payments—central bank digital currencies (CBDCs). The motives range from broadening financial inclusion (giving even those without a bank account easy access to a free digital payment system) to increasing the efficiency and stability of payment systems by creating a public payment option as a backstop (the role now played by cash).

A CBDC has other potential benefits. It would hinder illegal activities such as drug deals, money laundering, and terrorism financing that rely on anonymous cash transactions. It would bring more economic activity out of the shadows and into the formal economy, making it harder to evade taxes. Small businesses would benefit from lower transaction costs and avoid the hassles and risks of handling cash.

Risk of runs

But a CBDC also has disadvantages. For one, it poses risks to the banking system. Commercial banks are crucial to creating and distributing credit that keeps economies functioning smoothly. What if households moved their money out of regular bank accounts into central bank digital wallets, perceiving them as safer even if they pay no interest? If commercial banks were starved of deposits, a central bank could find itself in the undesirable position of having to take over the allocation of credit, deciding which sectors and firms deserve loans. In addition, a central bank retail payment system could even squelch private sector innovation aimed at making digital payments cheaper and quicker.

Of equal concern is the potential loss of privacy. Even with protections in place to ensure confidentiality, any central bank would want to keep a verifiable record of transactions to ensure that its digital currency is used only for legitimate purposes. A CBDC thus poses the risk of eventually destroying any vestige of anonymity and privacy in commercial transactions. A carefully designed CBDC, taking advantage of fast-developing technical innovations, can mitigate many of these risks. Still, for all its benefits, the prospect of eventually displacing cash with a CBDC ought not to be taken lightly.

The new technologies could make it harder for a central bank to carry out its key functions—namely, to keep unemployment and inflation low by manipulating interest rates. When a central bank such as the Federal Reserve changes its key interest rate, it affects interest rates on commercial bank deposits and loans in a way that is reasonably well understood. But if the proliferation of digital lending platforms diminishes the role of commercial banks in mediating between savers and borrowers, it's unclear how or whether this monetary policy transmission mechanism will continue to function.

Currency competition

The basic functions of central-bank-issued money are on the threshold of change. As recently as a century ago, private currencies competed with each other and with government-issued currencies, also known as fiat money. The emergence of central banks decisively shifted the balance in favor of fiat currency, which serves as a unit of account, medium of exchange, and store of value. The advent of various forms of digital currencies, and the technology behind them, has now made it possible to separate these functions of money and has created direct competition for fiat currencies in some dimensions.

Central bank currencies are likely to retain their importance as stores of value and, for countries that issue them in digital form, also as mediums of exchange. Still, privately intermediated payment systems are likely to gain in importance, intensifying competition between various forms of private money and central bank money in their roles as mediums of exchange. If market forces

are left to themselves, some issuers of money and providers of payment technologies could become dominant. Some of these changes could affect the very nature of money—how it is created, what forms it takes, and what roles it plays in the economy.

International money flows

Novel forms of money and new channels for moving funds within and between economies will reshape international capital flows, exchange rates, and the structure of the international monetary system. Some of these changes will have big benefits; others will pose new challenges.

International financial transactions will become faster, cheaper, and more transparent. These changes will be a boon for investors seeking to diversify their portfolios, firms looking to raise money in global capital markets, and economic migrants sending money back to their home countries. Faster and cheaper cross-border payments will also boost trade, which will be particularly beneficial for emerging market and developing economies that rely on export revenues for a significant portion of their GDP.

Yet the emergence of new conduits for cross-border flows will facilitate not just international commerce but also illicit financial flows, raising new challenges for regulators and governments. It will also make it harder for governments to control the flows of legitimate investment capital across borders. This poses particular challenges for emerging market economies, which have suffered periodic economic crises as a result of large, sudden outflows of foreign capital. These economies will be even more vulnerable to the monetary policy actions of the world's major central banks, which can trigger those capital outflows.

Neither the advent of CBDCs nor the lowering of barriers to international financial flows will alone do much to reorder the international monetary system or the balance of power among major currencies. The cost of direct transactions between pairs of emerging market currencies is falling, reducing the need for “vehicle currencies” such as the dollar and the euro. But the major reserve currencies, especially the dollar, are likely to retain their dominance as stores of value because that dominance rests not just on the issuing country's economic size and financial market depth but also on a strong institutional foundation that is essential for maintaining investors' trust. Technology cannot substitute for an independent central bank and the rule of law.

Similarly, CBDCs will not solve underlying weaknesses in central bank credibility or other issues, such as a government's undisciplined fiscal policies, that affect the value of a national currency. When a government runs large budget deficits, the presumption that the central bank might be directed to create more money to finance those deficits tends to raise inflation and reduce the purchasing power of central bank money, whether physical or digital. In other words, digital central bank money is only as strong and credible as the institution that issues it.

Government's role

Central banks and governments worldwide face important decisions in coming years about whether to resist new financial technologies, passively accept private-sector-led innovations, or embrace the potential efficiency gains the new technologies offer. The emergence of cryptocurrencies and the prospect of CBDCs raise important questions about the role the government ought to play in financial markets, whether it is impinging on areas that are preferably left to the private sector, and whether it can compensate for market failures, particularly the large number of unbanked and underbanked households in developing economies and even in advanced economies such as the United States.

As the recent cryptocurrency boom and bust have shown, regulation of this sector will be essential to maintain the integrity of payment systems and financial markets, ensure adequate investor protection, and promote financial stability. Still, given the extensive demand for more

efficient payment services at the retail, wholesale, and cross-border levels, private-sector-led financial innovations could generate significant benefits for households and corporations. In this respect, the key challenge for central banks and financial regulators lies in balancing financial innovation with the need to mitigate risks to uninformed investors and to overall financial stability.

New financial technologies hold the promise of making it easier even for indigent households to gain access to an array of financial products and services, and of thereby democratizing finance. However, technological innovations in finance, even those that might allow for more efficient financial intermediation, could have double-edged implications for income and wealth inequality.

The benefits of innovations in financial technologies could be captured largely by the wealthy, who could use them to increase financial returns and diversify risks, and existing financial institutions could co-opt these changes for their own benefit. Moreover, because those who are economically marginalized have limited digital access and lack financial literacy, some of the changes could draw them into investment opportunities whose risks they do not fully appreciate or have the ability to tolerate. Thus, the implications for income and wealth inequality—which has risen sharply in many countries and is fomenting political and social tensions—are far from obvious.

Another key change will be greater stratification at both the national and international levels. Smaller economies and those with weak institutions could see their central banks and currencies swept away, concentrating even more economic and financial power in the hands of the large economies. Meanwhile, major corporations such as Amazon and Meta could accrete more power by controlling both commerce and finance.

Even in a world with decentralized finance built around Bitcoin's innovative blockchain technology (which is likely to be its true legacy), governments have important roles to play in enforcing contractual and property rights, protecting investors, and ensuring financial stability. After all, it appears that cryptocurrencies and innovative financial products, too, work better when they are built on the foundation of trust that comes from government oversight and supervision. Governments have the responsibility to ensure that their laws and actions promote fair competition rather than favoring incumbents and allowing large players to stifle smaller rivals.

Central or fragmented

Financial innovations will generate new and as yet unknown risks, especially if market participants and regulators put undue faith in technology. Decentralization and its corollary, fragmentation, cut both ways. They can increase financial stability by reducing centralized points of failure and increasing resilience through greater redundancy. On the other hand, while fragmented systems can work well in good times, confidence in them could prove fragile in difficult circumstances. If the financial system is dominated by decentralized mechanisms that are not directly backed (as banks are) by a central bank or other government agency, confidence could easily evaporate. Thus, decentralization might yield efficiency in good times and rapid destabilization when economies struggle.

Potentially big changes to societal structures are also at hand. The displacement of cash by digital payment systems could eliminate any vestige of privacy in commercial transactions. Bitcoin and other cryptocurrencies were intended to secure anonymity and eliminate reliance on governments and major financial institutions in the conduct of commerce. Yet they are spurring changes that might end up compromising privacy. Societies will struggle to check the power of governments as individual liberties face even greater risk.

Adieu to Modern Monetary Theory

Ending Illusory Unlimited Government Q.E. Power Takes Skill and Luck

By HENRY CHAN*

The September financial market worldwide experienced one of the most volatile months since the Covid lockdown of March 2020. The U.S. dollar exchange rate surged more than 5% based on DXY, and the S&P index dropped more than 5% until September 27. The exchange rate & interest rate transmission mechanism from the global anchor currency, the USD, had caused spillover effects worldwide. The U.S. macroeconomic uncertainty today can be traced to the excesses caused by the unorthodox Modern Monetary Theory.

Modern Monetary Theory (MMT):

MMT is a heterodox macroeconomic proposition that says monetarily sovereign countries that do not need to borrow in foreign currencies to fund deficits are not constrained by revenues regarding government spending. Countries like the U.S., UK., and Japan do not need to follow the spending principle of funding government expenditure by either raising taxes or borrowing. They can create more money to pay off all their deficits without worrying about economic collapse; the only important thing is their central bank keeping interest rates low.

MMT proponents believed that government deficits and national debt don't matter as much as commonly believed. An interesting extension of the MMT is that free lunch is not impossible. It happens when the central bank keeps the real interest rate below the long-term economic growth rate, thus allowing the government to use higher growth-generated tax revenue to repay loans. This unorthodox view allows the government to pursue unfunded tax cuts and spending, disregarding spending constraints and discipline.

The belief in an almighty central bank is exemplified by former Federal Reserve Chairman Alan Greenspan in 2005 when he said, "There's nothing to prevent the federal government from creating as much money as it wants."

The quantitative easing (Q.E.) implemented in 2009-2014 helped to resolve the U.S. economy from the Great Recession of 2007-2009 after the bursting of the housing bubble and global financial crisis. The massive monetary easing and the fiscal injection to buy distressed assets and support federal activities during a recession had not caused inflation and gave the proponents of MMT the support for their beliefs.

However, most people overlook that while consumer price inflation in the 2010s was low, a lot of liquidity has gone into the asset market, as witnessed by the S&P index went from 800 in 2009 to more than 2500 at the end of 2019, a rise of more than 200% and one of the best decades for stock investment. In addition, the S&P Case-Schiller Home Price Index went up from 140 in 2010 to 220 in 2020.

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Using the MMT tools in the Covid-19 pandemic became fashionable and applauded worldwide. The U.S. alone ran a two-year budget deficit of almost US\$ 6 trillion, or more than 30% of GDP in 2020 and 2021.

MMT was a fashionable academic topic at that time. According to Nexis Uni, there were around 5,000 mentions of MMT in the news, academic articles et al. between 2019 and the end of 2021. However, this year, there have only been around 700 mentions. The surging inflation in 2022 turned the fashionable economic idea into the emperor's new clothes.

Inflation surge from MMT:

A good portion of the U.S. Covid deficit went into excess savings of the household and depressed the willingness to work. The term great resignation aptly describes what happened to the U.S. labour market, it is tight, and people easily get new jobs with higher pay. As a result, there are two job vacancies for every unemployed person. The labour force participation today is 1% below the pre-pandemic level of 63.2%, and The 3.7% unemployment rate in August is close to 50 years low.

The excess stimulus also heated the asset market. For example, the S&P Home Price Index went up from 220 before the pandemic to 320 in recent highs, the best in housing history. In addition, the S&P Index went up from the pandemic low of 2300 in March 2020 to more than 4700 at the end of Dec 2021.

Dissecting the August CPI shown that the key drivers behind the 8.3% inflation rate are not so much the result of supply chain disruption caused by lockdowns or energy inflation triggered by the Ukraine War. Instead, it resulted from higher service costs, higher wages, and higher rents from high housing prices. How long will it take the higher interest rate to cool the labour market and how high should it go to turn the situation around are twin questions hanging over the U.S. economy.

The close link between inflation rate and labour market condition is well-established, and the conventional wisdom that productivity provides the solution is proven right again today. Therefore, the promise of MMT that it can be an alternative to replace productivity is simply an illusion.

The reported stress on the central bank balance sheet further doubts MMT.

Record loss at Reserve Bank of Australia (RBA):

RBA announced on September 21 that it had taken a mark-to-market valuation loss on its bond holding of A\$44.9 billion (US\$30.02 billion) in 2021/2022. The bonds were accumulated under a A\$300 billion emergency stimulus programme from November 2020 to February 2022.

The losses eclipsed underlying earnings of A\$8.2 billion and left the central bank with an accounting loss of A\$36.7 billion. In addition, the RBA equity and reserve fund was wiped out and is in a negative equity position of A\$12.4 billion.

All central banks in the world have their liabilities guaranteed by the government, and its legal power to create money means RBA can stay in business. However, the accounting loss still constrains the ability of RBA to pay a dividend to the government in the immediate future.

With the rising interest rate, many central banks worldwide would face similar losses on their emergency stimulus programmes. In July, the Swiss National Bank reported a first-half loss of 95.2 billion Swiss francs, the biggest since the central bank was founded in 1907.

The inability of the central bank to conduct regular monetary operations is nowhere more glaring than the Bank of Japan when it faces depreciating pressure on the yen. The yen depreciated from 115 to a dollar at the start of the year to 145 on September 29 as the country became the only economy with a negative interest rate. Many pundits posited that the whooping 270% debt to GDP ratio left many Japanese banks holding a huge amount of Japanese Government Bond (JGB) on their books. Therefore, a rate increase will likely cause huge mark-to-market loss and technically

trigger bank solvency problems. That leaves market intervention as the choice to support the yen in the foreign exchange market. It is reported that BOJ and the Japanese government spent a record \$21bn in their first intervention in 24 years to prop up the yen last week.

Ending a conundrum takes skill and luck

The current problem arising from excesses of MMT takes time to unravel, and the immediate task is to stop the financial conditions from deteriorating and spiralling out of control. The unusual IMF warning on the U.K supplementary budget is a good case in point; hoping a tax cut can stimulate economic growth in the face of high debt, high inflation, and low growth has not proven workable in the case of supply-sider economies of the 1980s nor the MMT recently.

Expectation plays a particularly important role in economic adjustment today. It affects consumer spending behaviour and business willingness to invest. For the economy to move away from the prolonged almost zero interest rate environment to the new rate equilibrium that anchors spending and investment decisions is not easy. One should not rely on the market alone; any misstep can paralyze the system once confidence is shaken. Therefore, policymakers should focus on building public confidence in their ability to navigate out of the unsustainable high debt & high inflation dilemma.

A misguided understanding of important economic issues like MMT often causes many excesses that tip the macroeconomic balances. It takes time to rebalance the economy, and policymakers need luck and skill.

Policy Mix of the Future: the Role of Monetary, Fiscal and Macprudential Policies^{*}

By LUIS DE GUINDOS^{*}

I am very pleased to participate in this conference to mark the centenary of Lietuvos bankas. Building on the ECB's recent strategy review and our reflections on the policy mix, I will outline my views on the interplay between monetary, macroprudential and fiscal policy.

Academic research points to the need for monetary and fiscal policy to work together in times of crisis. This runs contrary to previous wisdom suggesting fiscal policy should mainly support economic outcomes by playing the role of an “automatic stabiliser.” For example, in recessions, government expenditure would automatically increase and tax revenue would automatically decrease. It has become evident that strong, discretionary countercyclical fiscal policy is needed in a crisis. Furthermore, research shows fiscal policy is particularly effective close to the lower bound of interest rates. In this way, fiscal policy not only effectively stabilises the economy, but also contributes to the ECB's objective of maintaining price stability. Structural fiscal policy[1] could also help raise the natural or equilibrium real rate of interest[2]. This rate of interest has been falling in recent decades and has made the pursuit of price stability much more challenging for central banks. Complementarity between monetary and fiscal policy was greatly effective following a long period of too low inflation. But how is this interaction in an inflationary environment? Or more generally, how does the level of inflation affect the fiscal-monetary policy mix?

Macroprudential policy addresses risks to financial stability. Our strategy review acknowledges that financial stability is a necessary condition for price stability. With an impaired transmission mechanism in times of financial turmoil, maintaining price stability is not possible. At the same time, monetary policy itself can have implications for financial stability. Accommodative monetary policy can reduce credit risk and prevent debt deflation. But it could also trigger excessive risk taking or encourage higher leverage in the financial system. In times of monetary policy tightening, the converse arguments apply.

We therefore decided to implement a new integrated analytical framework, which takes financial stability considerations explicitly into account in our monetary policy decisions. Our focus is threefold: detecting impairments to the transmission mechanism, such as fragmentation risk, monitoring a possible build-up of financial imbalances, and identifying how far macroprudential policy addresses financial imbalances.

Let me summarise how I see the complementarities between fiscal and macroprudential policies with monetary policy:

- Fiscal and macroprudential policy should be the first lines of defence for economic stabilisation and fostering financial stability, respectively. This leaves monetary policy to focus exclusively on price stability.
- The importance of both fiscal and macroprudential policy has recently increased. Fiscal policy became more important because of its role in times of crises, and its enhanced effectiveness

^{*}This article is the remarks at a panel at the conference “Future of Central Banking” organised by Lietuvos bankas and the Bank for International Settlements on 29 September 2022.

[†] Luis de Guindos is Vice-President of the ECB.

at the lower bound. Macroprudential policy became more relevant given its capacity to contain the potential side effects of monetary policy – both in the accommodative and tightening phases.

- Both fiscal and macroprudential policy need to be strongly countercyclical: this entails building up “buffers” during good times[3] for use in bad times.[4] While sovereign debt must be sustainable to be used countercyclically, macroprudential capital buffers need to first be built up so that they can be released when risks materialise.
- In the Economic and Monetary Union (EMU), both fiscal and macroprudential policy can be targeted at the country, sector or industry level. They can therefore account for heterogeneity within EMU by alleviating the occasional one-size-fits-all problem.

Thus, both fiscal and macroprudential policy can support monetary policy in its aim to achieve price stability. In the same way, successful monetary policy supports economic stabilisation and financial stability. All three policies have the potential to be mutually complementary in their respective fields of responsibility.

The recent pandemic crisis and the current challenges of soaring energy and commodity prices coupled with high overall inflation have underlined the case for these policy complementarities. The successful interplay between accommodative monetary policy, fiscal support measures and prudential relief safeguarded the real economy and the financial system across the euro area during the pandemic crisis. It succeeded in protecting nominal incomes, thereby supporting a fast recovery of demand when our economies reopened.

Subsequently, to combat steadily rising inflation, in December 2021 we started normalising our monetary policy by announcing the end of our asset purchases, in tandem with targeted fiscal measures aimed at mitigating the hardship of soaring prices for the most vulnerable households and firms. The scope and nature of fiscal measures needs to be different now than it was at the height of the pandemic, following a long period of too low inflation. Fiscal policy should not stoke inflation. It needs to be temporary and tailored to the most vulnerable households and businesses, who are being hardest hit by high inflation.

The Transmission Protection Instrument (TPI) was introduced in July 2022. It aims to ensure that the monetary policy stance is transmitted smoothly across all euro area countries. The TPI therefore supports price stability while safeguarding financial stability by addressing unwarranted, disorderly market dynamics. At the same time, certain euro area countries are applying macroprudential policy for a targeted build-up of resilience. This targeted build-up of capital buffers and the application of borrower-based measures takes into account heterogeneous cyclical developments across countries and sectors in the euro area. It fine-tunes the overall policy mix and complements the single monetary policy in support of overall financial stability across the euro area.

Despite the overall good resilience of the euro area banking sector, certain countries have in recent years seen a build-up of financial vulnerabilities, notably related to residential real estate prices and growing household and firm indebtedness. Some further careful and targeted tightening of macroprudential policy would be beneficial in selected countries at present. Given the deteriorated outlook for economic growth, some countries might benefit from further increasing the resilience of their financial sectors before credit risks start materialising. This includes for example taking measures to preserve capital in the banking sector which could then be used to absorb losses. Lithuania has been active in applying a comprehensive set of macroprudential policies to address current vulnerabilities. This year, authorities have activated a sectoral systemic risk buffer of 2% on residential real estate exposures and have tightened the loan-to-value limit for second and subsequent housing loans to 70%. Of course, the benefits of further policy action across countries, would need to be evaluated against the risk of procyclical effects, which is becoming more likely as the economic outlook worsens.

Let me conclude. Policy interaction has been a critical element for navigating the pandemic. Complementary actions of fiscal, macroprudential and monetary policy, in their respective fields of responsibility, continue to be essential in dealing with the current inflation shock and financial system imbalances.

In the current challenging macro-financial environment, macroprudential buffers contribute to preserving and strengthening banking sector resilience. Hence, I very much welcome that some national authorities – in close collaboration with the ECB – currently assess the extent to which there is merit in implementing additional macroprudential measures. The macroprudential policy response should consider the current near-term headwinds to economic growth since policy tightening should not result in an unintended tightening of credit conditions.

Interactions between monetary and macroprudential policy become even more pronounced in a monetary union where monetary policy, by definition, will be focusing on area-wide economic and financial conditions. In fact, macroprudential policy targeting imbalances building up at national level within the monetary union can help to achieve better policy outcomes in terms of price and financial stability.

Financial Regulation

Making the Financial System Safer and Fairer *

By MICHAEL S. BARR*

Thank you to the Brookings Institution for the invitation to speak to you today.¹ On July 19, I had the honor of being sworn in as the Vice Chair for Supervision of the Board of Governors of the Federal Reserve System. This job was created after the Global Financial Crisis to lead the Fed's work overseeing the safety and soundness of banks and in support of its financial stability mandate. In the 12 years since then, great progress has been made in strengthening the banking system, and in strengthening oversight. I look forward to building on that work by helping to make the financial system safer and fairer, in support of an economy that serves the needs of households and businesses.

On behalf of those who may wonder what "building on that work" means, I will speak about some of my near-term goals and how I will approach achieving them. Starting with that word "building," which to me means more than just "maintaining." Success in financial regulation and supervision does not mean standing still because finance does not stand still. The regulatory and supervisory framework adopted after the crisis recognizes that innovation and change are constant in finance, that our understanding of existing and emerging risks can and should deepen over time, and that regulation and supervision must evolve to be effective. Many issues at the forefront of banking regulation today were not prominent five years ago, and some of them scarcely even existed. "Building" means staying ahead of changes, evaluating how banks are managing risks, and making the financial system safer and fairer for households and businesses.

When I say that one of my top goals is to make the financial system safer, it is because keeping it safe involves an active and never-ending effort to analyze risks and make necessary adjustments. There is no responsible alternative to this approach because the stakes are far too high to do otherwise. The Global Financial Crisis caused a terrible recession and brought the United States to the brink of an economic collapse that could have been worse than the Great Depression of the 1930s. A significant cause was excessive risk-taking by banks and inadequate regulation and supervision by the Fed and other bank regulators. A hard-won lesson from the crisis is that the savings of every retiree, the job of every worker, the payroll of every business, and the well-being of every individual depend on a safe and stable financial system.

In addition to making the financial system safer, I am also committed to making it fairer. Fairness is fundamental to financial oversight, and I am committed to using the tools of regulation, supervision, and enforcement so that businesses and households have access to the services they need, the information necessary to make their financial decisions, and protection from unfair treatment. Safety and fairness may seem like distinct goals, but they are intertwined. Financial

* The article is a remark at the Brookings Institution, Washington, D.C on 7 September, 2022.

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instability unfairly harms those who are economically vulnerable, so making the financial system safer is making it fairer.

Capital

Nothing is more basic to the safety and soundness of banks and the stability of the financial system than capital. Capital enables firms to serve as a source of strength to the economy by continuing to lend through good times and bad. To continue to perform these functions, banks must have a sufficient level of capital to ensure that they can absorb losses and continue operations during times of stress in the financial system when losses may be significant.²

An important principle of the capital framework is that it must evolve through a continuous process of incorporating new risks that may emerge. While history is a guide to identifying the range of stresses that a bank may face, capital policy must also be forward-looking and responsive to changes in macroeconomic conditions, market structure, and financial activities.

A second principle is that the capital framework should be risk focused. Different activities pose different potential for loss, and the capital regime should calibrate requirements to account for the risks of specific activities. At the same time, simpler, non-risk-based approaches can serve as important backstops, given the complexity of risk-based approaches and evidence that these approaches can be gamed. As such, leverage ratios also serve an important role in this framework.

A third principle is that requirements should be tiered. As firms increase in systemic importance, the social cost of their failure grows. Regulations should be designed to require firms to internalize the costs that their potential failure would impose on the broader financial system and thus on businesses and households. This means that firms face higher costs through more stringent regulations as they grow in complexity, size, and interconnectedness. And rightly, that community banks face simpler regulations.

We are looking holistically at our capital tools to understand how they are supporting the resilience of the financial system, individually and in combination. When calibrating requirements, we will work to minimize unintended consequences, limit opportunities for gaming, and avoid excess compliance costs that do not result in risk reduction. Taking a holistic view will help us consider adjustments, if any, to the supplementary leverage ratio, countercyclical capital buffer, and stress testing. Within this context, I am also committed to implementing enhanced regulatory capital requirements that align with the final set of “Basel III” standards or the so-called the “Basel endgame.” This process will involve working with other federal banking agencies and soliciting public input, and I’ll have more to say about this later this fall.

Resolution

Sufficient capital in the financial system helps support the resiliency of individual banks, but it is still important to ensure that, if a large firm gets into trouble, it can be resolved without a costly bailout. The Dodd-Frank Act established the framework necessary to end bank bailouts. It provides the Federal Deposit Insurance Corporation (FDIC) with the authority to resolve any firm whose failure would pose substantial risks to our financial system, in a way that will protect the economy while ensuring that large financial firms—not taxpayers—bear any costs. In addition, the Fed and FDIC require large banks to develop living wills to demonstrate that they can be resolved in an orderly way.

Many gains have been made from this process. While recognizing these gains, we need to continue to analyze whether firms are taking all appropriate steps to limit the costs to society of their potential failure. As such, we will continue to work with the FDIC to rigorously review firms’ plans, making clear when firms do not meet our expectations and when remediation is necessary. In addition, beyond globally systemically important banks, or G-SIBs, we will be looking at the resolvability of some of the other largest banks as they grow and as their significance in the

financial system increases. As we consider future policy actions in this area, the Fed will work with our colleagues at other banking regulatory agencies and seek public comment.

Bank Merger Policy Review

Mergers are a feature of vibrant industries, but the advantages that firms seek to gain through mergers must be weighed against the risks that mergers can pose to competition, consumers, and financial stability. Another priority of mine is to evaluate our approach to reviewing banks' proposed acquisitions.³ The Board is required to consider a range of factors when reviewing proposed mergers. A merged institution may be able to provide more competitive products and services, but it could also have the potential to reduce competition and access to financial services in a geographic area by raising prices, narrowing the range of services offered, and reducing the supply of small business or community development loans that rely on local knowledge. Assessing these risks is a crucial component of reviewing proposed mergers. In addition, we review the potential effects on the convenience and needs of the communities to be served by the merged entity, particularly low-income communities.⁴ Under the Dodd-Frank Act, we are also required to consider financial stability risks. These risks may be difficult to assess, but this consideration is critical. I am working with Federal Reserve staff to assess how we are performing merger analysis and where we can do better.

Stablecoins as Private Money

Another priority for me as Vice Chair is the regulation and oversight of new forms of private money created through stablecoins. Stablecoins, like other unregulated private money, could pose financial stability risks.⁵ History shows that in the absence of appropriate regulation, private money is subject to destabilizing runs, financial instability, and the potential for widespread economic harm. In the nineteenth and early twentieth centuries, before the advent of prudential bank regulation and deposit insurance and before action was taken to ensure private money creation by banks was appropriately regulated, repeated crises did substantial damage to the U.S. economy. I believe Congress should work expeditiously to pass much-needed legislation to bring stablecoins, particularly those designed to serve as a means of payment, inside the prudential regulatory perimeter. I look forward to continued partnership with other regulatory agencies and Congress to address the risks of stablecoins.

Financial Risks from Climate Change

Before I move away from the discussion of making banks safer, let me say a few words about the potential risks to banks posed by climate change. As our nation, and the world, grapple with how to respond to climate change, banks are increasingly focused on the risks that climate change brings to their balance sheets. The Federal Reserve is working to understand how climate change may pose risks to individual banks and to the financial system. The Federal Reserve's mandate in this area is important, but narrow, focused on our supervisory responsibilities and our role in promoting a safe and stable financial system. In the near-term, we intend to work with the Office of the Comptroller of the Currency (OCC) and the FDIC to provide guidance to large banks on how we expect them to identify, measure, monitor, and manage the financial risks of climate change. In addition, we are considering how to develop and implement climate risk scenario analyses. In that regard, next year we plan to launch a pilot micro-prudential scenario analysis exercise to better assess the long-term, climate-related financial risks facing the largest institutions.

Innovation, Access, and Consumer Protection

These are a few of my near-term priorities to help make the financial system safer. I'll have more to say about these, and other priorities for safety and soundness, in the coming weeks and months. Let me turn now more directly to my other major objective as Vice Chair, which is to make the financial system fairer. In the past, I have described the three essential elements of fairness in the financial system as a three-legged stool because all three are necessary for any aspect of fairness to work. The three are (1) financial capability, (2) financial access, and (3) consumer protection. In terms of financial capability, an important component is transparency in the cost of services, which means making sure consumers have the information they need to make good decisions. Along with other bank regulatory agencies, the Federal Reserve has a role to play in ensuring banks disclose the costs and explain the conditions on the services they provide. More broadly, though, it means basing policy on a deeper understanding of human decision-making, and the contexts in which households and businesses make those choices.⁶ Under financial inclusion, one example would be promoting access to low-cost and safe banking services for low- and moderate-income (LMI) consumers, such as through local Bank On initiatives.⁷ And consumer protection involves using supervision and regulation to fully implement laws to promote fair lending, consumer protection, and transparency in the consumer financial services marketplace.

Let me say a bit about where innovation fits into this goal of making the financial system fairer. We should welcome financial innovation as a positive force that can increase access and lower costs for individuals and businesses. That said, innovation can also introduce new risks for consumers. We have already seen occasions when uses of new technologies and data can raise serious concerns about violations of fair lending laws.⁸

As innovative financial products develop and grow rapidly, excitement can outrun the proper assessment of risk. As we have seen with the growth of crypto assets, in a rapidly rising and volatile market, participants may come to believe that they understand new products only to learn that they don't, and then suffer significant losses. Crypto-asset related activity, both outside and inside supervised banks, requires oversight so that people are fully aware of the risks they face.

We plan to work with other bank regulatory agencies to ensure that crypto activity inside banks is well regulated, based on the principle of same risk, same activity, same regulation, regardless of the technology used for the activity. I plan to make sure that the crypto activity of banks that we supervise is subject to the necessary safeguards that protect the safety of the banking system as well as bank customers. Banks engaged in crypto-related activities need to have appropriate measures in place to manage novel risks associated with those activities and to ensure compliance with all relevant laws, including those related to money laundering.

At a more basic level, we need to focus on access to fast, efficient digital payments. This is a matter both of efficiency and of fairness. Low-income households can ill afford to wait days for their income checks to clear, nor can small businesses. A three-day payment delay is an annoyance to someone with savings and ample credit, but it is a costly burden, and sometimes a serious problem for others. And overdraft and insufficient funds fees hit LMI households hard. I have been working on issues of financial inclusion for a significant portion of my career as a public official and as an academic. I am so pleased with the progress made toward instant payments under the leadership of Vice Chair Brainard and Chair Powell, and I am looking forward to doing whatever I can to support this work, including the launch of the FedNow Service. The Federal Reserve has a responsibility to facilitate payments that work well for everyone, and we are committed to doing so.

Community Reinvestment

Rounding out my discussion of access to financial services, I will end my remarks today by touching on the importance of the Community Reinvestment Act (CRA). The CRA, first passed in 1977, encourages insured depository institutions to meet the credit needs of the communities in which they are chartered, including LMI neighborhoods, consistent with the safe and sound operation of such institutions.⁹ The CRA was designed to address past abuses of financial institutions, such as redlining. The CRA sends the unequivocal message that there is no place for discrimination in the financial system, and that every community and every borrower deserve to be treated fairly. Earlier this year the OCC, the Fed, and the FDIC jointly invited comment on a proposal designed to strengthen and modernize CRA regulations to achieve the objectives of the law. I strongly support the goals of the proposal and look forward to contributing to the important work underway, again led by Vice Chair Brainard.

So, to wrap up, I have tried to lay out my approach and a bit of my near-term agenda, as Vice Chair for Supervision, for making the financial system safer and fairer for households and businesses. As I said at the outset, I believe these goals are related and mutually reinforcing, so that progress in one area will advance efforts in the other. I have discussed a number of specific issues to illustrate these principles, but I'll have more to say about these ideas, and other important reforms, in the coming weeks and months. Thank you.

Footnotes:

1 I am grateful to Laura Lipscomb of the Federal Reserve Board for her assistance in preparing this text. The views expressed here are my own and do not necessarily reflect those of the Federal Reserve Board or the Federal Open Market Committee.

2 The financial crisis showed that pre-crisis bank capital requirements and levels were far short of this standard. Since then, capital requirements have increased substantially and banks have accordingly increased their capital and greatly improved their ability to understand their risks and plan for their capital needs, in concert with a greatly improved regulatory framework for capital that more accurately assesses risks to individual institutions in a complex, dynamic, and interconnected financial system.

3 The relevant statutes with respect to proposed acquisitions include the Bank Holding Company Act (BHCA), Bank Merger Act (BMA), Dodd-Frank Act, and the Home Owners' Loan Act.

4 The Board must take into consideration the convenience and needs of the community to be served by the resulting institution. See 12 U.S.C. § 1842(c)(2): <https://www.govinfo.gov/content/pkg/USCODE-2020-title12/pdf/USCODE-2020-title12-chap17-sec1842.pdf> 12 U.S.C. § 1828(c)(5)(B): <https://www.govinfo.gov/content/pkg/USCODE-2020-title12/pdf/USCODE-2020-title12-chap16-sec1828.pdf> 12 U.S.C. § 1467a(e)(2): <https://www.govinfo.gov/content/pkg/USCODE-2020-title12/pdf/USCODE-2020-title12-chap12-sec1467a.pdf> 12 U.S.C. § 2903(a): <https://www.govinfo.gov/content/pkg/USCODE-2020-title12/pdf/USCODE-2020-title12-chap30-sec2903.pdf>. In addition, the Community Reinvestment Act (CRA) requires the Board to assess a depository institution's record of helping to meet the credit needs of its entire community, including low- and moderate-income (LMI) neighborhoods, in evaluating proposals under the BMA or section 3 of the BHCA. See 12 U.S.C. § 2903(a).

5 See the President's Working Group on Financial Markets, Federal Deposit Insurance Corporation, and Office of the Comptroller of the Currency, Report on Stablecoins (Washington:

PWG, FDIC, and OCC, November 2021)

https://home.treasury.gov/system/files/136/StableCoinReport_Nov1_508.pdf.

6 See Michael S. Barr, *No Slack: The Financial Lives of Low-Income Americans* (Washington: Brookings Press, 2012).

7 Deposit products also play a critical role in providing an entry point to the banking system for low- and moderate-income individuals, including those who are considered unbanked. Having a bank account provides the means to receive, transact, and safely save funds. It is also a pathway for a bank customer to establish an ongoing relationship with a bank. Moreover, a bank account provides the cash flow data that some financial companies use to underwrite credit. One important way the Fed encourages greater access to deposit products is by giving banks credit under the Community Reinvestment Act (CRA) for offering low- cost deposit accounts to low- or moderate-income individuals. In addition, several Reserve Banks also participate in the Bank On initiative, a nationwide effort (with 90 local coalitions) to move the unbanked into the banking system by promoting access to safe, standardized low-cost transactional accounts.

8 *United States v. Meta Platforms, Inc.*, No. 1:22-cv-05187 (S.D. New York, June 21, 2022).

9 “What is the Community Reinvestment Act (CRA)?” Board of Governors, last modified August 24, 2022, https://www.federalreserve.gov/consumerscommunities/cra_about.htm.

Large Bank Supervision and Regulation*

By MICHELLE W BOWMAN*

I would like to talk about the future of supervision and regulation of the largest banks, which changed significantly after the financial crisis 14 years ago and has evolved more gradually over the past 5 years. As the backdrop for this look into the future, it is important to recognize that this recent past for supervision and regulation has been a success, resulting in a banking system that is safer, stronger, better capitalized, and more resilient. This is particularly true for oversight of the largest banks, including global systemically important banks (GSIBs), and their central role in the financial system. As supervision and regulation have been refined in recent years, the largest banks have maintained high levels of capital, and their resilience has been repeatedly confirmed by both supervisory and real-life stress tests. Most notably, the U.S. financial system faced the onset of the pandemic in the spring of 2020, which disrupted financial markets and raised fears of a severe crisis. During this time, banks performed very well, continuing to keep credit flowing throughout the financial system as governments and central banks responded to the crisis, setting the stage for a rapid recovery from the sharpest economic contraction that the U.S. economy has ever experienced.

This outcome is a recognition, in my view, of the gradual and experiential approach to changing large bank supervision and regulation over the past several years. After the rush of regulation and the supervisory overhaul of large banks in the wake of the financial crisis, the Board of Governors took time to observe how the changes were working, and how things might be improved. Input was solicited from the public, and the changes made were incremental and carefully calibrated. I think the evidence is very clear that these changes have preserved and, in many cases, strengthened supervision and regulation, and that our gradual and evolutionary approach was wise. As I look ahead, that record of success is a testament to the progress we have made to date and argues for the same incremental approach to ongoing refinements in supervision and regulation.

I am looking forward to working with Michael Barr, the Board's Vice Chair for Supervision, on the dual goals of making the financial system safer and fairer, two objectives that I strongly support. In doing so, I am not opposed to changes that make sense, based on the experience we have gained from applying existing rules and approaches, or prompted by new and emerging issues. As always, we should ensure that any further changes yield significant improvement to safety and soundness at reasonable cost and seek to avoid approaches that fail to consider the tradeoffs between cost and safety.

In forming my judgments about whether proposed changes in regulation meet the standard I have just laid out, I will be guided by the four principles I described in 2021, outlining my perspective on bank regulation and supervision. I would like to briefly discuss these four principles, and then talk about how they have guided and will guide my thinking on a number of issues important to large bank supervision and regulation.

The first principle is that bank regulation and supervision should be transparent, consistent, and fair. Combined, these three elements, which we can think of collectively as due process, build respect for supervisory practices, and in doing so, make supervision more effective and encourage open communication between banks and supervisors. This principle applies equally to regulation.

*This speech (virtual) was presented at the Institute of International Finance (IIF) event "In Conversation with Michelle Bowman", Washington DC, on 30 September 2022.

* Michelle W Bowman is Member of the Board of Governors of the Federal Reserve System.

Supervision cannot replace-and should never supersede-rulemaking. Published regulations that have gone through the rulemaking process, with solicitation of public comment and bona fide engagement with the issues raised, are the best and clearest way for banks to understand the rules of the road and for the bank regulatory agencies to ensure banks satisfy safety-and-soundness objectives.

This brings me to the second fundamental principle for regulation and supervision: striking the right balance between ensuring safety and soundness, on the one hand, and promoting acceptable and manageable risk-taking, including encouraging responsible innovation. To put it simply, this means matching regulatory and supervisory requirements to the risks presented. For the largest banks, this naturally includes an increased focus on financial stability risks.

There are obvious risks from under-regulation, and it is those risks that were addressed in the wake of the financial crisis 14 years ago. But we sometimes overlook the significant costs to our economy, and risks to safety and soundness, from over-regulation, where rules are not designed and calibrated to address the actual risks. In a time of rising interest rates that could constrain credit, it is especially important to ensure that regulation and supervision not add costs and burdens for banks with little or no benefits to safety and soundness.

My third principle is that effective regulation and supervision needs to be efficient. Efficiency is key to effective regulation. In the design of a regulatory framework, there is flexibility in how to achieve a desired outcome, and there are often multiple approaches that would be effective in doing so. Once a decision has been made to regulate an activity, the next objective should be to ensure that the regulation achieves its intended purpose and that there are not more efficient alternatives that can yield those benefits at a lower cost.

My fourth and final principle is that regulation and supervision should serve a legitimate prudential purpose, like promoting safety and soundness, or reducing financial stability risk. After the last financial crisis, there was strong public support for enhancing regulation and supervision over the banking system, with a particular focus on the largest banks. And many of the steps taken after the last financial crisis have improved the resiliency of the U.S. financial system. While the need for robust regulation and supervision remains as true today as it was after the last financial crisis, regulation and supervision must also allow banks to continue providing credit and other financial products and services.

Collectively, these principles guide my thinking about the future of supervision and regulation. With that framework in mind, I would like to turn to some critical issues that are relevant to large banks.

Stress Testing

As I just discussed, a critical element of due process is that rules and supervision should be consistent among firms, and over time. This can be a challenge because of the variability in the business models of banks, especially among the largest banks. Each bank is different in terms of its balance sheet, business lines, and risk profile, so regulators must be vigilant that both regulations and supervisory practices are being applied consistently.

One area where this need for consistency is clear is in the Board's stress testing framework. Since 2013, stress testing has been used to assess banks' capital positions and determine whether they have sufficient capital to both absorb losses and continue lending during stressed conditions. This process has evolved considerably since its inception, and that evolution is important to ensure that stress testing continues to be relevant and effective.

Much of the stress testing framework is designed to encourage consistency-we have a common scenario design for firms, and similarly situated firms are subject to stress testing on the same frequency. However, the stress tests produce results that vary considerably from year to year due to how a specific scenario interacts with a specific firm's business model, and this volatility flows

through to the stress capital buffers that apply to the largest firms. Although the stress scenarios are approved by the Board and change in some ways that are predictable over time or relate to changes in the underlying economy, how a scenario will affect a particular firm is not always predictable. These year-to-year variations are often not based in underlying changes to banks' business models and can create short-term challenges for capital management. There are likely many ways to limit this volatility while maintaining the value of the Board's stress tests, including by averaging results over multiple years.

As the stress testing framework continues to evolve over time, we should take into account what we learn from past tests, feedback from the public and the banks themselves, and ensure that the test evolves in a way that improves consistency and fairness over time.

Capital

Next, let's consider capital regulation. This is an area where requirements were quickly bolstered without extensive analysis in response to the 2008 financial crisis, resulting, in some cases, in redundant methods of calculating capital and demands that firms of all sizes and risk profiles comply with the highest requirements. The goal of efficiency dictates that over time this needs to be addressed. This is indeed what has happened over the past five years. In addition, the principle of balancing safety and soundness with the need for appropriate risk-taking is reflected in the extensive tailoring framework that the Board adopted over this time period, which carefully and deliberately matched regulation and supervision to the actual risks presented by different institutions. Often, the rules adopted immediately after the financial crisis applied a one-size-fits-all approach framed around the largest banks whose activities presented the most significant risks. This approach ignores the importance of bank size and business model. Obviously, expectations for the smallest banks with simple business models should not be equivalent to the expectations for large regional banks, or for large and complex bank holding companies engaged in significant securities or cross-border activities beyond taking deposits and retail lending.

As we look into the future to potential changes to the capital framework, including those expected under the Basel III endgame rulemaking, capital is a topic that is helpful to approach holistically. From my perspective, capital requirements should strike an appropriate balance for each relevant tier of firm, with requirements that appropriately address risks, including financial stability risks, while recognizing the costs of over-regulation. Calibrating capital requirements is not a zero-sum game, where more capital is necessarily always better. Regulation is not cost-free. Over-regulation can restrain bank lending, which becomes a burden for individual borrowers and a potential threat to economic growth.

Thinking about capital holistically also provides an opportunity to consider adjustments to the components of the capital requirements for the largest institutions, including the supplementary leverage ratio, the countercyclical capital buffer (CCyB), and, as I already discussed, the stress capital buffer, particularly where specific actions may have unintended consequences.

Since the onset of the pandemic, the banking system has seen a significant inflow of reserves due to the Federal Reserve's asset purchases in support of the economic recovery. For some firms, the influx of reserves resulted in leverage ratios becoming binding capital constraints, rather than serving as backstops to risk-based capital requirements. While these firms' leverage ratios may become less binding as the Federal Reserve reduces the size of its balance sheet and reserves are drained from the banking system, leverage ratios that discourage banks from intermediation in the Treasury market, or from holding ultra-safe assets such as Treasuries and reserves, can distort incentives and disrupt markets. Addressing these issues could improve market functioning and financial stability.

The CCyB is another component of the capital stack that deserves careful thought. In theory, the CCyB is a tool that could raise capital requirements in boom times to build resiliency and reduce capital requirements during times of stress to facilitate lending. In practice, the Board has not yet utilized the CCyB. While having releasable capital buffers shouldn't necessarily be ruled out, in my view, after a decade of stress testing and recent real-life stress experience, we have seen that the existing level of capital requirements has proven to be adequate for banks to deal with significant stress. Balancing safety and soundness with the need for appropriate risk-taking means that we should not simply assume that the further layering on of capital requirements, including through the application of the CCyB, would be beneficial.

The key is to strike an appropriate balance over time that addresses risks, including financial stability risks, without impeding the ability of the banking industry to extend credit and provide other financial services that are critical to our economy. The capital structure must also be predictable, to facilitate banks' longer-term capital planning, while preserving capital to allow firms to respond to unforeseen circumstances.

Bank Mergers and Acquisitions

I now want to turn to the review of bank mergers and acquisitions, specifically to discuss how the need for transparency, and to pursue legitimate prudential purposes, should guide our analysis of banking transactions under the established statutory framework.

The regulatory consideration of mergers is guided by the statutory factors prescribed by Congress—all of which are grounded in legitimate prudential purposes. The factors considered generally include the competitive effects of the proposed merger, financial and managerial resources, future prospects of the merged institutions, convenience and needs of the communities to be served, compliance with money laundering laws, and the effect of the transaction on the stability of the U.S. banking or financial system. This analytical merger framework works best when it is accompanied by transparency, both in timelines and expectations, that allows firms to know and understand what is expected of them, and what they can fairly expect during the merger application process. The rules of the road should not change during the application process.

We should be vigilant to be sure that other factors, like the idea that mergers are harmful or that increased bank size is inherently problematic, do not infiltrate that statutory analytical framework. The analysis and approval of mergers and acquisitions should be based on the reality of how customers and the financial system would be affected. For larger banks in particular, the evolution of the merger review framework should also factor in the evolution of markets, industry, and customer preferences.

A merger can have a significant impact on local communities, in terms of the quality and availability of products and services. The effects of a merger can be beneficial to communities, enhancing the safety and soundness of a firm, and leading to significant public benefits. The consequences of getting these policies wrong can significantly harm communities, in some instances creating banking "deserts," especially in rural and underserved markets.

Resolution

Next, I would like to discuss resolution planning, or so-called living wills. Each large banking organization is required to periodically submit a resolution plan to the Board of Governors and the FDIC, describing the organization's plan for an orderly resolution in the event of material financial distress or failure. The requirements for these plans are established by statute and regulation, with additional guidance published to give firms appropriate notice of regulatory expectations. For the U.S.-based GSIBs, resolution plans are also informed by other regulatory requirements, including the requirement that such firms issue a minimum amount of total loss-absorbing capacity, which

includes both equity and long-term debt. 5 The requirements that establish and support the orderly resolution of firms are important to supporting the financial stability of the United States.

Of course, these requirements have evolved over time, most recently with a proposal intended to increase the efficiency of living wills by alternating between data-intensive full plans and risk-focused targeted plans. I expect that further evolution will be considered in response to ongoing changes in the financial landscape and the risks facing the largest firms. In doing so, I believe that fairness dictates that broad supervisory powers should not displace rulemaking.

In my view, the need for fairness and due process in resolution planning is particularly critical when it comes to considering whether and how to address concerns about the resolvability of regional banks. This question of fairness and due process is important, and it involves, among other things, a debate about the merits of a single point of entry resolution strategy on the one hand (more common among the GSIBs), and on the other hand, established bankruptcy and FDIC bank resolution procedures. This issue transcends particular firms, and particular transactions. It is an issue that affects a broad range of institutions of similar size. And policy actions in this area will require working with colleagues at other bank regulatory agencies and seeking public comment. Fairness dictates that this debate occurs in the arena of regulation, with all the appropriate due process protections that this entails, and not on an ad hoc basis for a single firm that chooses to make an acquisition subject to regulatory approval. If the regulatory framework for resolution needs to be improved, we should look at the framework, and identify and remediate any areas of concern. It is hard to understand why banks that choose to grow through acquisition should be subject to different resolution expectations than banks that grow organically. This strikes me as a clear example where requirements and expectations should only evolve through appropriate rulemaking processes, consistent with underlying law, in order to promote a level playing field.

Other Areas

There are a number of other areas where I think these principles can help frame a productive conversation about the future of regulation and supervision, including around banks engaging in crypto-asset-related activities, and improving the transparency of supervisory standards.

Another area where regulation and supervision continues to evolve is around banks engaging in crypto-asset activities. These activities raise a number of significant issues. When I think about the evolution of supervision and regulation of these activities, I ask myself whether the rules are clear in the current rapidly evolving environment, and whether the rules as they evolve are serving a legitimate prudential purpose. Banks seek to understand and comply with rules because, above all, they value predictability and consistency. When a bank understands the legitimacy of a rule and establishes internal incentives to comply with it, the bank itself becomes the strongest supervisory tool that there is. But sometimes, rules are difficult to apply. This can be due to quickly evolving technologies, particularly when it comes to digital assets, but it can also be due to a lack of experience with new rules, or when the rules are not that clear in a particular context. Banks should be able to know what the supervisory expectations are with respect to these new technologies in order to responsibly take advantage of them. The adoption and use of new technologies may present novel supervisory concerns, but the best way to address these concerns and encourage innovation is dialogue between bankers and supervisors before and during the development and implementation of those technologies.

I believe the goal with digital assets should be to match oversight to risk, and to provide clarity in supervisory expectations for banks seeking to engage in the crypto-asset ecosystem. As fluctuations in crypto-asset prices have shown, there clearly are material risks associated with these assets. However, it is also an area where there has been and continues to be intense consumer

demand, and we should consider whether there is a stabilizing role for banks to play in intermediation, or ensure that the competitive landscape does not create a financial stability risk by pushing activities outside the banking system, as we have seen with the mortgage industry. To be effective in this space, any clarity regulators provide will need to recognize that this is not a risk-free activity, but I believe we should allow banks to participate as long as the risks can be identified and managed appropriately and responsibly.

Another way to promote consistency is to continue improving the disclosures around supervisory standards. While doing so improves transparency, it also improves fairness, another of my core principles. Like the due process protections enshrined in the U.S. Constitution and embedded in regulatory law, fairness is fundamental to the legitimacy and effectiveness of financial oversight, including supervision. In the context of bank regulation and supervision, fairness means being transparent about expectations, which should be clearly laid out in advance (and I want to emphasize that "in advance" part). Supervision should not be adjusted in specific situations to displace or alter regulations, or without appropriate notice and opportunity for public comment, and should be accompanied by clear communication with regulated firms. Where we have established precedents, we should respect them. Banks rely on our precedents in making their business decisions, so not respecting precedents can interfere with the ability of firms to plan and to fairly compete. If changes to precedents are appropriate, we should explain those intentions and employ a transparent and accountable administrative process to ensure fairness and appropriately implement the change.

Take, for example, the supervision criteria implemented by the Large Institution Supervision Coordinating Committee (the LISCC manual). Currently, these materials are not public. Making these materials public would not only improve transparency, doing so would also provide some assurance to the banks subject to them that they are being held to the same supervisory expectations as their peers over time. Without this clarity, it is far more challenging to build trust in this aspect of the supervisory process.

Improving transparency around supervisory standards promotes safety and soundness, both encouraging compliance, and limiting the role of formal and informal enforcement actions and penalties in addressing serious issues. In my view, success should not be measured by penalties or enforcement, but by how well banks are following the rules.

The principles I've articulated today reflect my approach to considering whether and how the regulation and supervision of the largest banks should evolve in response to changing economic and financial conditions. The regulation and supervision of financial institutions must be nimble to address new risks to safety and soundness and financial stability, but should always consider tradeoffs and potential unintended consequences, like increasing the cost of lending or pushing financial activities outside of the regulatory perimeter into the shadow banking system. I look forward to working with Vice Chair Barr, my fellow Board members, and colleagues at the other bank regulatory agencies, as we consider the evolution of supervision and regulation for the largest financial institutions.

Trust, Digitalisation and Banking: from My Word is My Bond to My Code is My Bond? *

By PABLO HERNÁNDEZ DE COS*

Introduction

Good morning, and thank you for inviting me to speak at Eurofi's 2022 Financial Forum, in association with the Czech Presidency of the Council of the European Union.

While the transition from pandemic to endemic remains challenging and uneven across countries, much has changed since the previous Eurofi High-Level Seminar in February. The dual shocks of the war in Ukraine and resurgent inflation have darkened the outlook. Growth is losing its momentum.

Against this backdrop, elevated financial vulnerabilities will continue to test the resilience of the global banking system – with the challenges coming most notably from increased debt levels, stretched real estate valuations and links with non-bank financial intermediation. In addition, the ongoing digitalisation of finance and climate-related financial risks loom increasingly large in the risk priorities of banks and supervisors over the medium term.

So there is no shortage of topics and work for the Basel Committee; each of them would deserve a speech on their own. I should reassure you though that, given our time constraints today, I will focus my remarks on a single theme, namely, the digitalisation of finance.

Digitalisation of finance

Interest in technology-driven innovation in financial services continues to grow at an almost exponential rate. I counted almost a dozen sessions related to digitalisation that are taking place at Eurofi's conference this week. Topics such as fintech, cryptoassets, big data and artificial intelligence (AI)/machine learning (ML) may have seemed arcane a decade ago, but are becoming increasingly mainstream nowadays. This interest has been backed by significant investment. Total global investment activity in financial technology between 2018 and 2021 totalled almost \$700 billion, with over 17,000 deals made during this period. And these figures are likely to be an underestimate, as they do not include in-house investments by established financial institutions and big techs.

The spurt in interest and activity in financial innovation needs to be put into context, however. Finance and technology have a long and symbiotic relationship. Technology has been used in finance for more than 150 years. The completion of the transatlantic telegraph cable in 1866 saw finance gradually shift from analogue to digital. This was followed by a second wave of technological innovations in financial services, starting with the advent of the automated teller machine in 1967. So today's wave of technological pervasiveness – including the emergence of new actors and channels for the provision of finance – is in many ways a continuation of this history.

I have previously discussed the Committee's work related to various aspects of financial innovation, including with regard to its impact on banks' business models and the prudential regulation of banks' exposures to cryptoassets. The Committee is also pursuing a wide range of analytical and supervisory initiatives related to AI/ML, data governance, distributed ledger

*This article is a keynote speech at the Eurofi 2022 Financial Forum, Prague, Czech Republic on 9 September 2022.

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technology and operational resilience, which I hope to be able to cover in future speeches. So I will today provide a few reflections on two related themes that span the panoply of topics related to the digitalisation of finance.

Trust and banking

The first relates to trust and banking. The banking system exists on a web of trust. Indeed, the etymology of the word "credit" stems from the Middle French term for belief or trust. Trust outranks virtually every other factor – including price and service quality – when it comes to consumers' choice of banks.

Trust also forms the bedrock of cross-border supervisory cooperation and fuels the "soft law" nature of the Basel Committee's decisions, where members are committed to implement globally agreed standards in their domestic jurisdictions. I would be remiss if I did not mention at this stage my trust in the European Union (EU) to implement the outstanding Basel III standards in a full and consistent manner, and as soon as possible. As a Governor of a EU central bank, I would add that further delays and deviations to implementing these standards would not only expose our banking system to additional risks and fragilities, but could also call into question the EU's commitment to global cooperation and, in the long run, weaken the trust that Committee member jurisdictions have in one another.

We also know that trust is fragile and can easily dissipate. The saga of bank misconduct practices following the Great Financial Crisis prompted a wide range of reviews and soul-searching about conduct and culture in banking, and highlighted the difficulty in restoring trust. We must never take it for granted.

The old adage of "my word is my bond" continues to be important today, but trust cannot and does not rely solely on words. Ethics and morals should be the primary foundation for instilling and preserving trust, but are (sadly) insufficient by themselves. A trustful and trusted banking system also depends on a scaffolding of regulatory safeguards, including with regard to conduct, safety and soundness, and market integrity. Incidentally, this applies as much to banking as to other critical industries, including aviation, food and pharmaceuticals, to name just a few.

While these safeguards may impose some costs, these are vastly outweighed by the benefits of trust at both a micro and macro level. For example, in 1866, the inflation-adjusted cost of a return delivery of financial assets with Wells Fargo's iconic stagecoaches was more than \$23,500. Fast forward to today, and money can be transferred at a fraction of this cost and in a sliver of the time, in part due to the trust that we place in technological advancements in today's banking system.

At a macro level, it has been estimated that a 10 percentage point increase in the share of trusting people within a jurisdiction raises annual GDP growth by about 0.5 percentage points. Moreover, in a globalised world, the benefits of trust spill over across borders: another study finds that an increase in trust by one standard deviation is positively associated with a 90 to 150% change in bilateral trade. And, in the case of banking, these benefits are in addition to the direct impact of regulations such as Basel III, where the net benefits are estimated to be overwhelmingly positive to society.

Why do I mention all of this? A narrative accompanying some of the emerging streams of financial innovation is centred around the concept of "trustlessness". This is often touted as a superior and more efficient model than today's system of banking, allowing individuals to transact in a quasi-pseudonymous manner, with trust being substituted by automated verification mechanisms. "Trust me, I'm a coder" is almost a mantra in this world.

While such a vision may be conceptually appealing to some, it falls short of providing the robustness, seriousness and societal benefits from regulations, supervision and the rule of law. A trust-free banking system would essentially require society to place its faith in a set of codes and complex models, which we know from history can be subject to errors and model risk. Moreover,

advances in financial technology bring with them greater risks to banks' operational and cyber resilience. Breaches in such areas could potentially weaken the fabric of trust in banking. The Committee's principles for operational resilience, finalised last year, aim to strengthen banks' ability to withstand operational risk-related events that could cause significant operational failures or wide-scale market disruptions. I strongly encourage banks and member jurisdictions to proceed with implementing these principles.

Just as few would be willing to board an airplane that does not meet regulatory standards and that has not been inspected by qualified supervisors, I suspect that not many individuals would want to deposit their money in a banking system void of any regulatory and supervisory safeguards.

You may have noticed that I have been referring to "banking" and not "banks". What matters when it comes to securing trust in banking is not so much the specific entities involved, but rather the extent to which entities that provide banking services are subject to relevant regulatory and supervisory requirements.

It is why I chair the Basel Committee on Banking Supervision, and not Bank Supervision. And it is why the Basel framework has been designed in a way to provide sufficient flexibility for authorities to determine the appropriate scope of application.

As we continue to see the emergence of new banking channels, services and entrants, it will be important for authorities to continue to review the appropriate scope of the regulatory perimeter and the type of regulations to apply. This task, which will need to be pursued at both a domestic and global level, should ensure that activities with the same risks are subject to the same regulations. Indeed, the Committee's Core principles for effective banking supervision embeds such a notion. And the Committee's recent high-level considerations on proportionality provide an additional lever for authorities that seek to implement the Basel framework for different types of institution in a proportionate manner and in a way that does not undermine financial stability or the safety of financial institutions.

AI, models and judgment

My second and related observation is about the role of human judgment in banking.

As AI technology continues to evolve, it is changing the banking industry in a number of ways. Digitalisation is posing a number of risks to banks, including:

- *Disintermediation: This is when customers bypass banks and go directly to other financial service providers, such as online lenders. This means that banks lose out on revenue and customers.*

- *Increased competition: There are new entrants to the market who are providing digital-only banking services. This increased competition puts pressure on banks to lower prices and offer more innovative products and services.*

- *Loss of customer trust: With the increase in data breaches and cyber attacks, customers are becoming more aware of the risks associated with digital banking. This loss of trust could lead to customers moving away from banks altogether.*

- *IT infrastructure: Banks need to have robust IT infrastructure in order to be able to provide digital banking services. This can be costly and there is always the risk that something could go wrong, leading to disruption for customers.*

- *Regulatory pressures: Banks are subject to strict regulation, which can make it difficult for them to keep up with the pace of change in the digital world.*

The text I just read (italicised above) was not written by me or any human being, but was instead entirely generated by an AI bot – Generative Pre-trained Transformer 3, or GPT-3, based on a few simple prompts. I will leave it to you to judge the quality of both the drafting and the content of the text (and, dare I ask, how it compares with the rest of my speech), but I think it nicely highlights the advancements and promises of AI/ML. It is therefore not surprising to see growing interest by

banks and supervisors in the use of AI/ML technology to increase operational efficiency and improve risk management.

But AI/ML also brings a range of risks and challenges, including the "explainability" of models. Understanding the outputs of models – including potential biases, limitations and robustness – is a key element of effective decision-making, risk management and supervisory oversight. Compared with traditional models, AI/ML models are more difficult to understand due to complex non-linear interactions among variables, making it more challenging to confirm their conceptual soundness. And the quality of modelled outputs are only as good as the inputs. Models can reflect biases and inaccuracies based on the data used, and potentially result in unethical outcomes if not properly managed. In a world with a seemingly ever-growing degree of uncertainty, the limitations of AI/ML models in anticipating and reacting to "unforeseen" and "unprecedented" events are likely to become of greater importance.

The risks to banks from AI/ML are further exacerbated when model development is outsourced. As AI/ML deployment often involves the use of large data sets, interconnectivity with third parties, and the use of cloud technologies, it can also create multiple possible points of cyber risk. In addition there may be greater data governance challenges for banks given the higher volume, velocity and variety of data commonly used to support AI/ML models. I should note here that banks maintain the responsibility and accountability for appropriate due diligence and oversight when relying on third-party service providers.

To offer a simplistic example of the limitations of such models, when prompted to describe Eurofi, the GPT-3 bot generated a paragraph about Eurofi being the "perfect choice" for a "top-quality, reliable and affordable car", thanks to its "over 30 years of experience in the automotive industry"! While the generated text is entirely legible, its content is clearly incorrect – unless David Wright and Didier Cahen know something that we do not about Eurofi's activities!

Given the challenges associated with AI/ML, both supervisors and banks are assessing existing risk management and governance practices to determine whether roles and responsibilities for identifying and managing risks remain sufficient. As with other complex operations and technologies, it is important that banks have appropriately skilled staff, which can include model developers, model validators, model users and independent auditors. This is why the Committee published a series of newsletters earlier this year covering its work to date on AI/ML and third- and fourth-party risk management and concentration risk.

Building on the discussions on the supervisory implications of the use of AI/ML so far, the Committee is working to develop further insights on this topic. Continuing discussions will focus on three areas:

- First, the extent and degree to which model outcomes can be understood and explained.
- Second, AI/ML model governance structures, including responsibilities and accountability for AI/ML-driven decisions including banks' third and fourth-party risk management and concentration risk-related arrangements.
- Third, the potential implications of broader usage of AI/ML models for the resilience of individual banks and more broadly, for financial stability.

Conclusion

Banking has always involved human relationships. The etymology of "bank" originates from the Late Latin for bench, referring to the place where money handlers sat in the market to transact in person. While advances in financial technology that seek to enhance the efficiency, inclusiveness and quality of services should be welcomed, they will not replace the critical role of human judgment in banking and supervision. And they cannot substitute for the importance of

ongoing cooperation among Basel Committee members with a view to safeguarding global financial stability.

Digital Economy

Crypto-Assets and Decentralized Finance through a Financial

Stability Lens ^{*}

By LAEL BRAINARD ^{*}

Recent volatility has exposed serious vulnerabilities in the crypto financial system. While touted as a fundamental break from traditional finance, the crypto financial system turns out to be susceptible to the same risks that are all too familiar from traditional finance, such as leverage, settlement, opacity, and maturity and liquidity transformation. As we work to future-proof our financial stability agenda, it is important to ensure the regulatory perimeter encompasses crypto finance.

Distinguishing Responsible Innovation from Regulatory Evasion

New technology often holds the promise of increasing competition in the financial system, reducing transaction costs and settlement times, and channeling investment to productive new uses. But early on, new products and platforms are often fraught with risks, including fraud and manipulation, and it is important and sometimes difficult to distinguish between hype and value. If past innovation cycles are any guide, in order for distributed ledgers, smart contracts, programmability, and digital assets to fulfill their potential to bring competition, efficiency, and speed, it will be essential to address the basic risks that beset all forms of finance. These risks include runs, fire sales, deleveraging, interconnectedness, and contagion, along with fraud, manipulation, and evasion. In addition, it is important to be on the lookout for the possibility of new forms of risks, since many of the technological innovations underpinning the crypto ecosystem are relatively novel.

Far from stifling innovation, strong regulatory guardrails will help enable investors and developers to build a resilient digital native financial infrastructure. Strong regulatory guardrails will help banks, payments providers, and financial technology companies (FinTechs) improve the customer experience, make settlement faster, reduce costs, and allow for rapid product improvement and customization.

We are closely monitoring recent events where risks in the system have crystallized and many crypto investors have suffered losses. Despite significant investor losses, the crypto financial system does not yet appear to be so large or so interconnected with the traditional financial system as to pose a systemic risk. So this is the right time to ensure that like risks are subject to like regulatory outcomes and like disclosure so as to help investors distinguish between genuine, responsible innovation and the false allure of seemingly easy returns that obscures significant risk.

^{*} The article is a remark at Bank of England Conference London, United Kingdom on 8 July, 2022.
^{*} Lael Brainard is Vice Chair Board of Governors of the Federal Reserve System.

This is the right time to establish which crypto activities are permissible for regulated entities and under what constraints so that spillovers to the core financial system remain well contained.

Insights from Recent Turbulence

Several important insights have emerged from the recent turbulence in the crypto-finance ecosystem. First, volatility in financial markets has provided important information about crypto's performance as an asset class. It was already clear that crypto-assets are volatile, and we continue to see wild swings in crypto-asset values. The price of Bitcoin has dropped by as much as 75 percent from its all-time high over the past seven months, and it has declined almost 60 percent in the three months from April through June. Most other prominent crypto-assets have experienced even steeper declines over the same period. Contrary to claims that crypto-assets are a hedge to inflation or an uncorrelated asset class, crypto-assets have plummeted in value and have proven to be highly correlated with riskier equities and with risk appetite more generally.

Second, the Terra crash reminds us how quickly an asset that purports to maintain a stable value relative to fiat currency can become subject to a run. The collapse of Terra and the previous failures of several other unbacked algorithmic stablecoins are reminiscent of classic runs throughout history. New technology and financial engineering cannot by themselves convert risky assets into safe ones.

Third, crypto platforms are highly vulnerable to deleveraging, fire sales, and contagion—risks that are well known from traditional finance—as illustrated by the freeze on withdrawals at some crypto lending platforms and exchanges and the bankruptcy of a prominent crypto hedge fund. Some retail investors have found their accounts frozen and suffered large losses. Large crypto players that used leverage to boost returns are scrambling to monetize their holdings, missing margin calls, and facing possible insolvency. As their distress intensifies, it has become clear that the crypto ecosystem is tightly interconnected, as many smaller traders, lenders, and DeFi (decentralized finance) protocols have concentrated exposures to these big players.

Finally, we have seen how decentralized lending, which relies on overcollateralization to substitute for intermediation, can serve as a stress amplifier by creating waves of liquidations as prices fall.

Same Risk, Same Regulatory Outcome

The recent turbulence and losses among retail investors in crypto highlight the urgent need to ensure compliance with existing regulations and to fill any gaps where regulations or enforcement may need to be tailored—for instance, for decentralized protocols and platforms. As we consider how to address the potential future financial stability risks of the evolving crypto financial system, it is important to start with strong basic regulatory foundations. A good macroprudential framework builds on a solid foundation of microprudential regulation. Future financial resilience will be greatly enhanced if we ensure the regulatory perimeter encompasses the crypto financial system and reflects the principle of same risk, same disclosure, same regulatory outcome. By extending the perimeter and applying like regulatory outcomes and like transparency to like risks, it will enable regulators to more effectively address risks within crypto markets and potential risks posed by crypto markets to the broader financial system. Strong guardrails for safety and soundness, market integrity, and investor and consumer protection will help ensure that new digital finance products, platforms, and activities are based on genuine economic value and not on regulatory evasion, which ultimately leaves investors more exposed than they may appreciate.

Due to the cross-sectoral and cross-border scope of crypto platforms, exchanges, and activities, it is important that regulators work together domestically and internationally to maintain a stable financial system and address regulatory evasion. The same-risk-same-regulatory-outcome

principle guides the Financial Stability Board's work on stablecoins, crypto-assets, and DeFi; the Basel consultation on the prudential treatment of crypto-assets; the work by the International Organization of Securities Commissions' FinTech network; the work by federal bank regulatory agencies on the appropriate treatment of crypto activities at U.S. banks; and a host of other international and domestic work.

In implementing a same-risk-same-regulatory-outcome principle, we should start by ensuring basic protections are in place for consumers and investors. Retail users should be protected against exploitation, undisclosed conflicts of interest, and market manipulation—risks to which they are particularly vulnerable, according to a host of research. If investors lack these basic protections, these markets will be vulnerable to runs.

Second, since trading platforms play a critical role in crypto-asset markets, it is important to address noncompliance and any gaps that may exist. We have seen crypto-trading platforms and crypto-lending firms not only engage in activities similar to those in traditional finance without comparable regulatory compliance, but also combine activities that are required to be separated in traditional financial markets. For example, some platforms combine market infrastructure and client facilitation with risk-taking businesses like asset creation, proprietary trading, venture capital, and lending.

Third, all financial institutions, whether in traditional finance or crypto finance, must comply with the rules designed to combat money laundering and financing of terrorism and to support economic sanctions. Platforms and exchanges should be designed in a manner that facilitates and supports compliance with these laws. The permissionless exchange of assets and tools that obscure the source of funds not only facilitate evasion, but also increase the risk of theft, hacks, and ransom attacks. These risks are particularly prominent in decentralized exchanges that are designed to avoid the use of intermediaries responsible for know-your-customer identification and that may require adaptations to ensure compliance at this most foundational layer.

Finally, it is important to address any regulatory gaps and to adapt existing approaches to novel technologies. While regulatory frameworks clearly apply to DeFi activities no less than to centralized crypto activities and traditional finance, DeFi protocols may present novel challenges that may require adapting existing approaches. The peer-to-peer nature of these activities, their automated nature, the immutability of code once deployed to the blockchain, the exercise of governance functions through tokens in decentralized autonomous organizations, the absence of validated identities, and the dispersion or obfuscation of control may make it challenging to hold intermediaries accountable. It is not yet clear that digital native approaches, such as building in automated incentives for undertaking governance responsibilities, are adequate alternatives.

Connections to the Core Financial Institutions

There are two specific areas that merit heightened attention because of heightened risks of spillovers to the core financial system: bank involvement in crypto activities and stablecoins. To date, crypto has not become sufficiently interconnected with the core financial system to pose broad systemic risk. But it is likely regulators will continue to face calls for supervised banking institutions to play a role in these markets.

Bank regulators will need to weigh competing considerations in assessing bank involvement in crypto activities ranging from custody to issuance to customer facilitation. Bank involvement provides an interface where regulators have strong sightlines and can help ensure strong protections. Similarly, regulators are drawn to approaches that effectively subject the crypto intermediaries that resemble complex bank organizations to bank-like regulation. But bringing risks from crypto into the heart of the financial system without the appropriate guardrails could increase the potential for spillovers and has uncertain implications for the stability of the system. It is important for banks to engage with beneficial innovation and upgrade capabilities in digital

finance, but until there is a strong regulatory framework for crypto finance, bank involvement might further entrench a riskier and less compliant ecosystem.

Private Digital Currencies and Central Bank Digital Currencies

Stablecoins represent a second area with a heightened risk of spillovers. Currently, stablecoins are positioned as the digital native asset that bridges from the crypto financial system to fiat. This role is important because fiat currency is referenced as the unit of account for the crypto financial system. Stablecoins are currently the settlement asset of choice on and across crypto platforms, often serving as collateral for lending and trading activity. As highlighted by large recent outflows from the largest stablecoin, stablecoins pegged to fiat currency are highly vulnerable to runs. For these reasons, it is vital that stablecoins that purport to be redeemable at par in fiat currency on demand are subject to the types of prudential regulation that limit the risk of runs and payment system vulnerabilities that such private monies have exhibited historically.

Well-regulated stablecoins might bring additional competition to payments, but they introduce other risks. There is a risk of fragmentation of stablecoin networks into walled gardens. Conversely, there is a risk that a single dominant stablecoin might emerge, given the winner-takes-all dynamics in such activities. Indeed, the market is currently highly concentrated among three dominant stablecoins, and it risks becoming even more concentrated in the future. The top three stablecoins account for almost 90 percent of transactions, and the top two of these account for 80 percent of market capitalization.

Given the foundational role of fiat currency, there may be an advantage for future financial stability to having a digital native form of safe central bank money—a central bank digital currency. A digital native form of safe central bank money could enhance stability by providing the neutral trusted settlement layer in the future crypto financial system. A settlement layer with a digital native central bank money could, for instance, facilitate interoperability among well-regulated stablecoins designed for a variety of use cases and enable private-sector provision of decentralized, customized, and automated financial products. This development would be a natural evolution of the complementarity between the public and private sectors in payments, ensuring strong public trust in the one-for-one redeemability of commercial bank money and stablecoins for safe central bank money.

Building in Risk Management and Compliance

Crypto and fintech have introduced competition and put the focus on how innovation can help increase inclusion and address other vexing problems in finance today. Slow and costly payments particularly affect lower-income households with precarious cash flows who rely on remittances or miss bills waiting on paychecks. Many hard-working individuals cannot obtain credit to start businesses or to respond to an emergency.

But while innovation and competition can reduce costs in finance, some costs are necessary to keep the system safe.¹² Intermediaries earn revenues in exchange for safely providing important services. Someone must bear the costs of evaluating risk, maintaining resources to support those risks through good times and bad, complying with laws that prevent crime and terrorism, and serving less sophisticated customers fairly and without exploitation. In the current crypto ecosystem, often no one is bearing these costs. So when a service appears cheaper or more efficient, it is important to understand whether this benefit is due to genuine innovation or regulatory noncompliance.

So as these activities evolve, it is worth considering whether there are new ways to achieve regulatory objectives in the context of new technology. Distributed ledgers, smart contracts, and digital identities may allow new forms of risk management that shift the distribution of costs.

Perhaps in a more decentralized financial system, new approaches can be designed to make protocol developers and transaction validators accountable for ensuring financial products are safe and compliant.

Conclusion

Innovation has the potential to make financial services faster, cheaper, and more inclusive and to do so in ways that are native to the digital ecosystem. Enabling responsible innovation to flourish will require that the regulatory perimeter encompass the crypto financial system according to the principle of like risk, like regulatory outcome, and that novel risks associated with the new technologies be appropriately addressed. It is important that the foundations for sound regulation of the crypto financial system be established now before the crypto ecosystem becomes so large or interconnected that it might pose risks to the stability of the broader financial system.

Green Finance

Remarks by World Bank Group President David Malpass at the Sina Finance 2022 ESG Global Leaders' Summit

By DAVID MALPASS*

Good morning to all of you in Asia and to those connecting from around the globe. I'm very pleased to participate in this Summit to discuss global challenges and opportunities in sustainable development.

The world is facing multiple, interlinked crises. In response to Russia's invasion of Ukraine, countries are shifting their energy policy priorities in ways that may slow down the energy transition and affect global climate goals and the achievement of electricity access.

The energy tradeoffs made in Europe will have major consequences for developing countries. The increased price of natural gas is already causing increased use of coal, diesel, and heavy fuel oil in the developing world. Meanwhile, additional fuel subsidies are being deployed to mitigate the impact of high prices. This worsens budget deficits and undercuts the longer-term objective of reducing greenhouse gas, or GHG, emissions. These broad-based subsidies distort price signals, reducing the incentives for energy efficiency and investments in cleaner energy.

These costs are coming at a time when there is considerable work yet to be done to support grid development and electricity access. There will need to be major investments in storage, new technologies and back-up capacity to integrate solar and wind into grids and compensate for intermittency.

Within this complex context, the world community is also focused on reducing GHG emissions. It will be important to identify, fund and implement the most impactful projects in terms of GHG emissions and resilience in adapting to major climate vulnerabilities. Incentive structures, tax regimes, and regulatory policies will be important components.

To help focus efforts in developing countries, the World Bank Group has launched a new core diagnostic called Country Climate and Development Reports, or CCDRs. These reports are part of our Climate Change Action Plan to integrate climate and development and help countries prioritize the most impactful actions. We published our first CCDR report, which was on Türkiye, this month. Over the next few months, we expect to publish as many as 20 more, including China. In addition to informing our own climate work, the reports aim to foster climate-oriented discussion and action in the countries and the global community.

A key challenge in sustainable development is addressing the large financing needs for the transition to lower-carbon energy. These include the large project preparation costs and financing and implementation risks that can extend for many years. To succeed, substantial funding will be

* David Malpass is World Bank Group President.

needed from the global community as well as early-stage technical assistance for project preparation.

Engagement and capital from the private sector will need to increase by an order of magnitude to address these immense costs. There is growing interest by investors in financial instruments that provide sustainability outcomes. Achieving the major increases needed in the amount of financing channeled through these instruments will require robust new frameworks for measurement, reporting and verification. Transparency will be a key challenge to avoid greenwashing.

Constant innovation will be needed as the private sector applies significant funding to global public goods. The World Bank Group has provided many such innovations, such as green bonds, and has proposed more as part of our Climate Change Action Plan. One recent example was the March 2022 launch of a Wildlife Conservation Bond, or Rhino bond, to support South Africa's conservation efforts. The bond is a first-of-its-kind financial instrument that channels investments to achieve conservation outcomes – measured in this case by a verifiable increase in black rhino populations. If targets are met, investors will receive, in addition to the redemption of their principal, a success payment at maturity, paid with funds provided by a performance-based grant from the Global Environment Facility. For a period of several years, the World Bank is bringing together investors, trust fund resources, a clear public purpose, and a significant government commitment. The approach can be adjusted and scaled to channel more private capital for other sustainable development objectives.

Looking broadly, strong Environmental, Social and Governance, or ESG, frameworks are critical to manage climate-related risks and opportunities in both development and corporate activities. There is currently significant variation globally in ESG reporting requirements, monitoring, and verification and little consensus on the priorities within ESG.

The World Bank Group is a long-standing supporter of global efforts to harmonize standards for sustainability reporting. We promote global transparency on climate metrics, targets, and outputs so that we can create opportunities, tackle challenges, and help countries maximize positive outcomes in their climate transition.

China's role as a major global creditor gives it additional responsibility to support the global shift toward investments with high ESG standards. As a major outward investor, particularly in infrastructure, China has considerable influence in promoting the adoption of international ESG standards in its lending and investing.

In October 2021, China announced that the country will no longer build coal-fired power plants abroad. In addition, the country has also announced that it will step up support for other developing countries in developing green and low-carbon energy. These are welcome steps, but there is more that can be done.

A key future step is the adoption of an ESG policy framework that applies to Chinese banks for their foreign investments. A commitment to high standards of transparency and environmental and social risk management, similar to the standards that the World Bank Group and other MDBs follow, would help recipient countries achieve sustainable development while also significantly lowering risks for Chinese investors themselves.

With these few thoughts, I wish you a successful event and fruitful discussions.

Doing What's Possible – How the Central Bank and Credit Institutions can Support the Necessary Transition towards a Carbon-neutral Economy *

By JOACHIM NAGEL *

1. Introductory remarks

It was a pleasure for me to come here today because my acquaintanceship with Karl-Peter Schackmann-Fallis goes back more than 30 years, spans a variety of professional positions, and became a friendship very early on.

Another point I'd like to make before I get on with my speech is that monetary policymakers are often compared with different types of birds. They are often dubbed hawks or doves in an effort to visualise their particular policy stance. I dare say everyone knows that monetary policy is far too complex a topic for all the possible points of view to be reduced to just two or three avian species. What I mainly like about this imagery is the perspective: the bird's eye view. Because with a little distance, you often see things better. And it's precisely that bird's eye view that I would now like to take in marking Karl-Peter Schackmann-Fallis's retirement. I will look first at his multi-faceted professional career and then turn my attention to the topics that occupied him and us in the past and will continue to do so in the future.

From an aerial perspective, one can make out two professional fields in which Karl-Peter Schackmann-Fallis has left his mark: politics and business. Karl-Peter, you started off studying politics, German studies, history and economics – that's quite a hefty workload, if you ask me. At the end of your university career, with a PhD to your name, you entered the world of business. Your professional journey followed a similar path. You started out in the political arena. It was from within the Social Democratic Party and the ministries that you played a role in shaping political life: at the Federal Ministry of Economics, and rising to the position of State Secretary in the Finance Ministries of both Saxony-Anhalt and Brandenburg. That was the time when our paths first crossed: we got to know each other in the late 1980s at the cross-party "monetary workshop", a meeting on the topic of monetary policy. Back then, I was there with the University of Karlsruhe's monetary affairs department – what a long time ago that was! You could say we later became colleagues there as honorary chairmen of the monetary workshop. After nearly two decades in politics, you switched back to the business world in 2004 to begin shaping the fortunes of the savings banks group as an Executive Board Member of the German Savings Banks Association. There you were in your element. German savings banks are governed by public law, operate under municipal trusteeship, are anchored in their home regions, and are committed to the common good, and that's what makes their business model such a perfect fit for you, Karl-Peter. And it's why it came so naturally for you to wholeheartedly champion the savings banks group for no less than 18 years, right up to the present day, shortly before your well-earned retirement. Up till then, settling down hadn't really been in your nature, so your long stint with the savings banks group speaks volumes about your strong commitment to performing this important task for the

*This article is a speech marking the retirement of Dr Karl-Peter Schackmann-Fallis, Executive Board Member of the German Savings Banks Association, Berlin on 26 September 2022.

† Joachim Nagel is President of the Deutsche Bundesbank.

entire savings banks family. What were the big issues during this period – again from a bird's eye perspective?

2. A look at the savings banks group

The year 2008 was when the financial crisis started raging. Every one of you, ladies and gentlemen, had to do your bit to make sure your own ship made it through this storm without running aground. Up and down the country, "ordinary" savings banks, with their regional focus, were mostly seen more as part of the solution than as part of the problem. They supported the economy by continuing, even in times of crisis, to provide loans to their counterparties, whom they mostly knew well. But there were also some savings banks that did not emerge unscathed, such as the ones that were shareholders in Landesbanken. Landesbanken needed large-scale bailouts with taxpayers' money. Since then, an important cleansing process has taken place here, and further consolidation steps are still pending.

The financial crisis then gave way to the European sovereign debt crisis and the low interest rate period. As of 2015, banks in Germany saw a steady decline in their net interest income. This process began five years earlier at the savings banks. Savings banks and cooperative banks faced a particularly stiff challenge – after all, their profitability has always hinged on net interest income. The Savings Banks Finance Group has, however, succeeded in boosting the amount of net commission income of late, which means that savings banks have been able to offset the declines in net interest income to a degree. Profitability can also be improved by embracing innovation – nowadays these are often advances in the digital realm. After all, more and more customers want to handle their financial affairs digitally. The coronavirus pandemic intensified this trend. Agile rivals have been setting new standards in this area for some time now. The savings banks group has also embarked on a mission to make its business more digital.

It is a journey where everyone needs to be on board. The same can be said for the plan to strengthen the Savings Banks Finance Group as a whole, with its common institutional protection scheme, so that the savings banks can give each other the backing they need should the worst come to the worst. The current plan is for more than €5 billion to be raised from the affiliated institutions between 2025 and 2032 for an additional IPS fund, as it is known – that equates to 0.5% of joint risk-weighted assets (RWAs). These projects, and many others, saw Karl-Peter Schackmann-Fallis draw on his wealth of experience in politics: whenever interests started to diverge, he had the stamina and patience needed to put them back on track. This strengthened not just the group's competitiveness but also the trust it engendered, and this ultimately also made Germany's banking sector a better-performing and more stable place overall. Karl-Peter, it is to your credit that the public banks – with the savings banks and Landesbanken – also became better known and respected outside the country as the third pillar of Germany's banking system. That was, and still is, an important condition for ensuring that the idiosyncrasies of the German banking system are adequately taken into account in European regulation.

3. Transition to a climate-neutral economy

For the Savings Bank Finance Group, as well as for all those in positions of responsibility in this country, there is one topic that is becoming more and more important: the transition to a climate-neutral economy. The urgency and significance of this issue is now clear, especially after this past summer, which saw the most sunshine since records began [in 1881], with temperatures well above average and considerable drought. "Heißzeit", or "hot age", playing on the German for "ice age", was the German Word of the Year in 2018 – and, unfortunately, it has not lost any of its relevance in 2022. The transition to a climate-neutral economy is urgently needed. Furthermore, this would help to free Germany from its crippling dependence on Russian gas – another reason to press ahead with full force. Savings banks are helping to fund this transition. After all, it is not

least bank loans that allow the many small and medium-sized enterprises in Germany to be part of the green transition. However, the savings banks group has also identified a number of other ways in which it can play a part. These are set out in its "Commitment by German Savings Banks to climate-friendly and sustainable business practices". By early August, more than 230 savings banks and 14 affiliated institutions had signed up to this commitment. I hope that many more institutions will add their signatures, too. The German Savings Banks Association should support its members in upholding this commitment as well as systematically and successfully managing the associated risks.

However, not only savings banks, but also other banks as well as central banks have been paying greater attention to climate and sustainability risks for some time now. With regard to the climate, there are two very different types of risk involved here. First, there are the risks arising from the direct, physical repercussions of climate change – from the banks' perspective, these could be risks associated with real estate financing in areas facing a greater threat from flooding. However, there are also risks resulting from urgently needed climate policies and structural change towards climate neutrality. At its core, it is about ensuring that the costs of greenhouse gas emissions are no longer borne by society as a whole, but by the emitters themselves. This may make certain business models unprofitable and sooner or later lower the value of those enterprises' shares or bonds. This means that climate risks are financial risks, too. They need to be made transparent on financial institutions' balance sheets, and this is what we as supervisors are calling for. This would help to stabilise the banking sector – and, at the same time, would support the transition.

However, this will only work if enterprises are transparent about their carbon footprints and climate vulnerabilities across the board. Only then will markets be in a position to appropriately price in their climate-related financial risks. The ECB recently released the results of its climate risk stress test for major European banks. This included some German Landesbanken. The good news is that the significant institutions likely do not need to expect any material losses overall based on the scenarios used in the stress test. That said, the test also found that there is room for improvement when taking account of climate risks in risk management. Also recently, the Bundesbank once again conducted the LSI stress test for the smaller German banks under our supervision. Institutions were surveyed on how they assess the medium-term impact of climate risks on their business and to what extent these are already factored into their risk management. The results will be published by the Bundesbank and BaFin on Wednesday. It would be surprising if smaller institutions were not also able to improve the way in which they depict climate risks in their risk management.

In the European Union, the Corporate Sustainability Reporting Directive (CSRD) is helping to provide the necessary basis of information. Previously, only enterprises with 500 employees or more were subject to reporting requirements in this regard. With the CSRD, more and more enterprises will gradually be required to submit reports from 2024 onwards. Forward-looking enterprises are already making preparations to regularly disclose certain climate-related information. Savings banks, in particular, with their many small and medium-sized corporate customers, will thus have a significantly better pool of data. This will enable them to develop their risk management systems in an adequate and proportionate manner – in line with supervisory expectations.

As supervisors, we central banks are also supporting the transition to a climate-neutral economy. In this context, we must adhere to the same standards as banks. We, too, must make sure that climate risks are appropriately accounted for on our balance sheet and in our risk management, especially as we would not be able to safeguard price stability without a sound balance sheet. Moreover, we, as the central bank, are also becoming more transparent. In July, for example, we reported on the climate impact of our own euro-denominated non-monetary policy portfolio. This

includes funds that we invest as a counterpart to the Bank's capital, statutory reserves, and long-term provisions for civil servant pensions and healthcare assistance. At the same time, we are committed to improving the available data at both the national and international levels.

And the Eurosystem is now also accounting for climate aspects in its monetary policy operations. As of October, climate-based "tilting" will be applied to purchases of corporate bonds. If bond issuers perform comparatively poorly in terms of greenhouse gas emissions, decarbonisation targets and climate-related reporting, their bonds will be purchased in smaller volumes. However, there is no doubt that the volume of corporate bonds purchased will be determined by monetary policy considerations. After all, our primary objective is price stability in the euro area. Furthermore, in the long term, and in line with the aforementioned EU Corporate Sustainability Reporting Directive, only bonds issued by enterprises that disclose climate-related information will be allowed into the collateral pool.

Transparency standards will also have important effects for markets. For example, they will allow financial markets to more easily price in climate issues, long-term financing risks, and potential returns. It will then be possible for prices and asset returns to better reflect climate effects. And this promotes the efficient allocation of capital. There is no question that both financial institutions and central banks must take action to tackle climate-related financial risks as well as be more transparent about them. I am absolutely certain of this.

4. Financial institutions and their profitability

Meanwhile, savings banks and banks also face other challenges. At present, they must be vigilant in various areas. I would like to briefly discuss three of the challenges that they face. First, the interest rate reversal. In the medium term, higher interest rates are likely to buoy institutions' earnings. In the short term, however, the interest rate reversal is also hurting some institutions. Second, Russia's war of aggression against Ukraine and all its consequences. The war has severely dampened the outlook for the economy and considerably increased uncertainty. For financial institutions, this means that credit risk could materialise. And this would result in corresponding write-downs and weigh on profitability. Third, from March to June of this year, we have seen a sharp decline in inflows of deposits from households and non-financial corporations to accounts with financial institutions. This is probably related to rising prices and the resultant falling real incomes. With prices higher, it is increasingly difficult to form new savings. This development is likely to be particularly relevant for savings banks.

Institutions would therefore be well advised to act very prudently now, not to neglect adverse scenarios and to conduct sound risk management. If credit quality deteriorates, this should be reflected on balance sheets very quickly. At present, however, the German banking system is on a fairly sound footing, with a good buffer of surplus capital. The same is also true of the savings bank sector. Savings banks have a clear buffer over and above supervisory requirements. They are therefore well equipped to weather bad times.

5. Inflation and monetary policy

Developments in inflation over the past year have demonstrated just how quickly times can change. After decades in which inflation rates were quite predominantly low, even too low for a time, the inflation curve picked up significantly in the summer of 2021. This increase was initially thought to be temporary, but has continued month after month and has become increasingly broad based. In both the euro area and Germany, the inflation rate has now exceeded 8% since May; in other words, it is more than four times higher than the target of 2%. In August, the Harmonised Index of Consumer Prices for the euro area stood at 9.1%, with inflationary pressures broadly based. Core inflation, which excludes energy and food, came to 4.3% in the euro area in August.

The inflation forecasts for the next two years have likewise been raised to an average of 5.5% for 2023 and a still considerable 2.3% for 2024.

The economic costs of such high inflation are severe – and they hit the most disadvantaged the hardest. The Governing Council of the ECB is determined to restore price stability. That is our remit, our mandate.

We on the Governing Council of the ECB have therefore taken action. As at 1 July, net purchases under the long-running asset purchase programme (APP) were discontinued. In July, we raised key interest rates by 50 basis points, thereby closing the negative interest rate chapter. Three weeks ago, we followed up with an even larger interest rate hike of 75 basis points. Further interest rate increases are expected to follow over the next few monetary policy meetings as the risks to the inflation outlook are still tilted to the upside. The danger of a de-anchoring of long-term inflation expectations remains high.

Against this backdrop, it is clear that further decisive measures are needed to bring the inflation rate to 2% in the medium term. Further interest rate steps will therefore need to be taken for us to fulfil our mandate. How large these steps will be depends on economic developments and the requirements at the respective time.

We must ensure that the high inflation ends. For there can be no doubt that the longer inflation remains high, the greater the risk of longer-term inflation expectations rising significantly. If this happens, the high inflation rate would become entrenched. The Governing Council must prevent this from happening. The Eurosystem and its monetary policy are on course for 2% inflation. I will do my utmost and use all the Bundesbank's expertise to ensure that we maintain this course until we reach our goal.

6. Conclusion

And that brings me to the conclusion. We have taken a look, from a bird's eye perspective, at the various positions Karl-Peter Schackmann-Fallis has held over the course of his career and at the issues that have occupied you, Karl-Peter, and indeed all of us over the past 18 years. Now that you are retiring, some of these issues may no longer keep you awake at night quite as much. Some things become less significant when seen from afar, details become blurred. The big picture, meanwhile, stands out in greater clarity.

I plainly see two big challenges facing our society as a whole. First, climate change. Every one of us will have to do what we can, individually and together, at work and at home, to overcome this major challenge. Second, inflation. Here, the Governing Council of the ECB must act. And I will do my utmost to bring inflation back to the desired level.

What does It Take to Get to Net Zero^{*}

By RAVI MENON^{*}

There are many pressing issues I could talk about today. The world is just emerging from the most devastating pandemic in over a century, with far-reaching changes whose effects will be felt for years to come. A major war has broken out between the two largest countries in Europe, heightening geopolitical risks and setting off a food and energy crisis across the world. The global economy is facing the sharpest surge in inflation and fastest pace of monetary policy tightening in 40 years, with highly uncertain consequences.

Instead, I want to talk about what I think is the mother of all challenges facing the world today, and for the next few decades – climate change. Long after our conjunctural challenges of war, disease, and inflation are behind us, the climate crisis will still be with us, only more intense, more urgent, more disruptive.

CLIMATE CHANGE

Climate change is already happening. Over the last three decades, the number of registered severe weather events has tripled. Over the last two decades, the rate of increase in sea levels has doubled. Over the last decade, the pace of ice loss in the Arctic and Antarctic has tripled. This year, wildfires and heatwaves of unprecedented ferocity have swept across Europe, North America, and Australia, while record rainfall in countries ranging from India to America have caused devastating floods. Climate change is happening at a faster pace than predicted by early climate models.

It is critical that we stop putting more carbon into the atmosphere by 2050. According to climate scientists, to avoid catastrophic and irreversible climate change, global warming needs to be kept within 1.5 degrees Celsius above pre-industrial levels. This in turn requires that global greenhouse gas emissions must reach net zero around 2050, meaning we remove whatever greenhouse gases we put into the atmosphere every year. This is what more than 190 countries resolved as part of the Paris Agreement in 2015.

The world is currently far from a net-zero emissions trajectory. To limit global warming to 1.5 degrees Celsius, global greenhouse gas emissions must peak by 2025 and come down about 45% by 2030 relative to 2019 levels. We are currently not on track to achieve this. Even if all countries follow through on commitments made in the Paris accords, carbon emissions will come down by just 7.5% by 2030.

This means 1.5 degrees Celsius is almost out of reach. According to the latest report by the United Nations Intergovernmental Panel on Climate Change (IPCC), global warming has already reached 1.1 degrees Celsius above pre-industrial levels, the warmest in 125,000 years. Based on current policies, global temperatures are expected to rise by 2.7 degrees Celsius above pre-industrial levels by 2100. Even according to the most optimistic estimates of emission cut pledges made at COP-26, the world is on course to heat up by 1.8 degrees Celsius. According to the IPCC, to fall back below the 1.5 degrees Celsius target, it would be necessary to remove from the atmosphere a decade or two of carbon emissions.

If the current emissions trajectory continues, the world will likely experience climate catastrophe. In his book, Hothouse Earth, Bill McGuire, emeritus professor of geophysical and climate hazards at University College London, argues that there is now no chance of the world

^{*}This keynote speech was given at the Economic Society of Singapore Annual Dinner 2022, Singapore on 17 August 2022.

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avoiding a pervasive climate breakdown. When temperatures rise beyond 1.5 degrees Celsius within the next 10 years, we can expect a world plagued by intense summer heat, extreme drought, devastating floods, reduced crop yields and food supplies, higher incidence of vector-borne diseases, rapidly melting ice sheets, and surging sea levels. Many parts of the world will become less hospitable for human habitation. By some estimates, climate change may force more than one billion people to migrate by 2050.

THE CHALLENGE OF DECARBONISATION

2020 to 2030 is the critical decade for climate action. Net zero commitments for 2050 are fine and good but a credible trajectory towards that goal will be substantially determined by 2030. While a growing number of countries and companies have set net-zero targets, very few have credible plans to meet them. The problem is that countries and companies alike are pledging to hit targets in almost three decades' time without committing to action for which they can be held accountable in the short term. To achieve net-zero by 2050, the necessary policies and the associated investments must be made between now and 2030.

Singapore is firmly committed to doing its part in the global effort to reduce greenhouse gas emissions. Last year, the government launched the Singapore Green Plan, which sets out a road map towards sustainable development, a green economy, and net zero emissions. Singapore aims to peak carbon emissions around 2030 and to achieve net zero by or around mid-century. If anything, the direction of travel in the coming years can only be towards greater climate ambition, not less.

The world should be upfront about the cost of decarbonisation and have concrete plans to support those adversely affected. There will no doubt be opportunities in green technologies and industries, and the long-term cost of doing nothing will be much more than the cost of mitigation measures. But decarbonisation will impose substantial short-term economic costs and have profound distributional implications. Like all economic transformations, the green transition will involve winners and losers, and unless this is recognised and dealt with, the sustainability agenda will lose social legitimacy. If we do not support the losers, there will be a strong backlash against the shift to a greener, cleaner future, much like the backlash we have seen against globalisation by those who were adversely affected by it.

The transition to net zero will likely entail the biggest economic and societal transformation since the Industrial Revolution. As the environmental scientist Vaclav Smil, in his book *How the World Really Works*, declares rather ominously, "We are a fossil-fuelled civilization whose technical and scientific advances, quality of life, and prosperity rest on the combustion of huge quantities of fossil carbon." To transit from such a fossil fuel civilisation to a net zero world will require considerable economic restructuring, significant technological breakthroughs, and substantial financial investments.

Getting to net zero will not be easy and will require five transformative changes:

- ***a price on carbon;***
- ***a shift to cleaner energy;***
- ***a greening of the economy;***
- ***a pivot to transition finance;***
- ***a sustainable lifestyle.***

CARBON PRICING

A meaningful price for carbon is the single most important measure to help decarbonise the economy. A carbon price can be achieved in three ways: a tax on carbon emissions; or a system

for trading emissions permits; or regulatory limits on emissions that could be translated into an implicit carbon price.

Without getting the price of carbon right, most sustainability efforts will not make economic sense and not gain traction. The right price on carbon sends a powerful signal across the entire economy: it induces consumers to reduce demand for carbon-intensive goods and services; firms to move to low carbon technologies; innovators to invent and develop new low carbon products and processes; and investors to fund and commercialise them. The invisible hand of the carbon price incentivises and coordinates emissions-reduction efforts in ways that regulation cannot achieve.

While carbon pricing has gained traction globally, it needs to be higher and applied more broadly. The right price of carbon is the social cost it imposes on the environment. According to the World Bank, less than 5% of the emissions covered by a carbon pricing initiative are priced at a level consistent with achieving the goals of the Paris Agreement, namely US\$40-80 per tonne of carbon dioxide by 2020 and US\$50-90 per tonne by 2030. The idea of a federal carbon tax remains political anathema in the United States. Even the European Emissions Trading System currently covers only about 50% of the EU's greenhouse gas emissions and gives many allowances for free.

Singapore will progressively raise its carbon taxes from 2024. The current level of S\$5 per tonne of CO₂ equivalent will be raised to S\$25 per tonne in 2024 and 2025, and S\$45 in 2026 and 2027, with a view to reaching S\$50-80 by 2030. This translates to a carbon price of roughly US\$36-58 per tonne of CO₂ equivalent in 2030. It is somewhat below the US\$50-90 estimated by the World Bank of what a net-zero consistent price of carbon should be in 2030 but Singapore's carbon tax covers about 80% of our national greenhouse gas emissions, much broader than in most countries. Singapore is also progressive in having a long tradition of high petrol taxes and no subsidies for fuel or electricity. Together, these policies will help to sharpen the substitution effects necessary for shifting to cleaner transportation modes and improving energy efficiency as carbon taxes rise.

Let me make three observations about carbon pricing.

First, carbon taxes should be implemented equitably so that they do not overly burden low-income households and SMEs. Singapore does not intend to derive extra net revenue collected from the carbon tax. The carbon tax revenue will be used to cushion the impact on lower-income households through U-Save rebates and incentives to switch to energy efficient appliances. Carbon tax revenues will also be directed to SMEs to help boost their energy efficiency and decarbonisation efforts. This is an economically sound approach: it retains the desired allocative effects of higher carbon taxes while dampening its distributional consequences.

Second, green subsidies are useful complements to carbon pricing but they are not substitutes. Subsidies for clean technology and energy efficiency can help to speed up the transition towards sustainability. But they often make economic sense only if combined with some form of carbon pricing. Take for instance subsidies for electric vehicle purchases and infrastructure. Without a price on carbon that is in turn reflected in electricity prices, subsidies for electric vehicles will likely lead to more such cars on the road with little reduction in the number of petrol-powered cars or shift towards cleaner sources of electricity generation. Indeed, it has been observed in California that electric vehicles are bought mostly by households with multiple cars, as a supplement to petrol-powered cars.

Third, a global minimum carbon price makes economic sense but needs to be carefully designed. As emphasised by economist William Nordhaus, there should be a common,

harmonised price of carbon, across sectors and across countries, that is equal to the global social cost of carbon. Every molecule of carbon dioxide that is emitted imposes the same social cost, regardless of where it is emitted from. It is unlikely that there will be an international agreement on a single global carbon price. But there are two ways in which global convergence in carbon pricing can come about.

- The first is through carbon credits and markets. If a sufficient number of countries have carbon taxes, it would facilitate cross-border trading of carbon credits which will help to drive carbon prices closer.

- The second is through the carbon border adjustment mechanism, or CBAM, which is a tariff that prices the carbon content of imported goods the same as the carbon emitted in domestic production. Advocates of the CBAM see it as a way to ensure that internalising a global externality in some economies does not lead to expansion of more polluting firms elsewhere. But opponents view CBAMs as being potentially protectionist and disproportionately hurting developing countries who lack the capabilities and support to decarbonise.

Singapore will do well to prepare for a future where CBAMs cover a significant part of world trade. CBAMs are likely to be a reality, especially if several major economies agree on a global minimum carbon price. The EU has already proposed a CBAM. A well-designed CBAM that does not raise barriers to trade, is compliant with WTO rules, and gives some relief to the poorest countries who are also small emitters, is not a bad outcome.

CLEANER ENERGY

The second imperative for the net zero transition is a decisive shift towards cleaner energy. According to the IPCC, to have a good chance of limiting global warming to 1.5 degrees Celsius, global consumption of coal, oil, and gas must start declining immediately and steeply. This is unlikely to happen.

The growth in renewable energy has been spectacular but not sufficient to meet growing energy demand. Despite a 50-fold increase in the supply of new renewable energy in the last two decades, fossil fuels continue to account for more than 80% of global primary energy consumption. One of the reasons is that about 750 million people in the world still lack access to electricity. For them, the priority is having the lights on at an affordable price, not how much carbon dioxide is emitted in its production. Most of the people living in sub-Saharan Africa in 2020 consume no more energy per capita than the people of France and Germany did in 1860. Providing these poor people a dignified standard of living would require doubling their rate of energy consumption.

According to the International Energy Agency (IEA), the energy transition to achieve net-zero is doable but difficult.

First, even when the world achieves net-zero emissions, fossil fuels will be with us. Energy demand in Asia is expected to double by 2030 on the back of strong economic growth, rising affluence, and urbanisation. Even if overall global energy use falls in the net zero scenario, it will increase in many of the poorest countries. Fossil fuels will continue to play an important role in meeting the energy demands of Asia and Africa. Coal is unlikely to have a role in a net zero world but oil and gas will. The IEA has projected that if the world reached net zero by 2050, it would still be using nearly half as much natural gas as today and about one-quarter as much oil.

Second, solar and wind power will need to be the largest energy source. The cost of solar and wind energy has fallen dramatically over the past decade and the amount of power generated through these renewables is rapidly catching up to that generated by coal. The IEA has projected photovoltaic capacity jumping twenty-fold between now and mid-century. This is no mean task – it implies by 2030 installing every day the generation capacity of what is currently the world's biggest solar farm.

Third, hydrogen will be an important new hope for decarbonisation. This involves using renewable energy to split water molecules to produce both hydrogen and oxygen. The hydrogen can be burnt as a fuel emitting only water vapour or be put into a fuel cell to make electricity on demand. It can also be used as a feedstock to make more energy-dense compounds such as ammonia, which can serve as a fuel itself. Hydrogen and ammonia can be critical to the transition to a net-zero world given their potential role in decarbonising hard-to-electrify sectors, such as steel production; fuelling trucks, ships, and other heavy vehicles. All of this is technologically possible but making it economically efficient will require further innovation.

In Singapore, our aim is to progressively decarbonise the power sector. We do not have the land for large solar or wind farms or fast flowing rivers for hydro-electric power. But it helps that Singapore is already less carbon-intensive in power generation than many other countries that still use coal.

- We are working to increase the carbon efficiency of natural gas which today accounts for 95% of electricity generation and is likely to remain the dominant energy source for some time.
- We are accelerating solar deployment across the island and building viable energy storage systems. Using our reservoirs, we are opening one of the world's largest floating solar energy systems.
- We are using transmission lines linked to neighbouring countries to import the renewable energy they produce. Singapore has already started importing from Laos energy from hydroelectric power.
- We are exploring geothermal and biomethane technologies as well as small modular reactors using nuclear fission.

GREEN ECONOMY

The third imperative for the net zero transition is to green the economy.

Greening the existing economy is more important than growing new green sectors. Investing in green technologies and renewable energy is important. But such pure green activities are estimated to make up less than 8% of the global economy. Non-green activities – in manufacturing, building and construction, aviation, maritime, agriculture and fisheries - make up the bulk of any economy. To move the needle on emissions reduction, we need transition strategies that progressively reduce the carbon footprint across all sectors.

Let me highlight six challenges associated with greening the global economy.

First, a green economy will rely much more on electricity. The cheapest and easiest way to decarbonise several sectors of the economy, such as cars that run on petrol or heat generated by burning natural gas, is to electrify them and ensure that the electricity is generated from zero or low carbon sources. According to the Princeton researchers, total electricity usage in the United States will likely be two to four times as great in a fully decarbonised economy compared with today. In the IEA's net zero world, electric vehicle sales would vault from 5% of the car market today to 60% in 2030. This would require building the equivalent of 20 of Tesla's massive "gigafactories" every year this decade.

Second, a green economy will need to be much more energy efficient. Energy intensity - the energy needed to produce a dollar of GDP - will have to improve substantially. The IEA has estimated that, to reach net zero, the rate of improvement in energy intensity would have to go up to more than 4% a year, which is more than double the average rate of the previous decade. Current plans and commitments made by countries will yield an improvement of only 2.8% a year.

Third, a green economy will need to find ways to decarbonise so-called 'hard-to-abate' sectors and activities. There are currently not very good transition pathways for aviation and maritime. There are also some critical materials whose production is hard to decarbonise. Some 17% of the

world's primary energy supply is used just to make four materials – steel, cement, plastic, and ammonia (which is used in fertilisers). These four materials have been described as "pillars of modern civilization". Not only are there no readily available substitutes for these materials, but also no practical low-carbon ways to produce enough to meet current demand. And the world must actually expand their production as Africa and Asia modernise.

Fourth, the sectoral composition of economies will change. The sectors with the highest greenhouse gas emissions – such as coal, oil and gas power and petroleum products – will be most impacted. They account for about 20% of global GDP. McKinsey estimates that US\$2.1 trillion worth of assets in the power sector could be retired or underutilised between now and 2050. Activities supporting lower-emissions products are likely to grow in importance, ranging from mining lithium for batteries to manufacturing solar panels and charging stations for electric vehicles. Demand will also grow for green services, such as forest management, sustainable engineering and design, green finance, and emissions measurement and tracking solutions.

Fifth, inflation is likely to be higher during the long transition to net zero. Higher energy prices will feed through into the production of many goods, and prices overall will rise. The Bank of England estimates inflation will increase by nearly 0.6 percentage by the early 2020s if there is an orderly transition to net zero and 2 percentage points by the early 2030s if the transition is disorderly. We are probably seeing a preview of that scenario currently. But it's not just energy prices. Demand will surge for minerals such as copper, aluminium, cobalt, lithium, nickel, and rare earths, which are critical to various clean energy technologies, including wind turbines and electric vehicles. For example, solar or wind power plants use up to six times more copper than conventional power generation. According to the IEA, a world on track for net-zero in 2050 will need six times as much of these materials in 2040 as it does today. The result is greenflation, or rising prices for these metals and minerals that are essential to renewable energy and technologies.

Sixth, the labour market will undergo a major adjustment. Jobs will be lost in traditional carbon-intensive sectors but new jobs will be created in carbon-neutral industries. It is estimated that about 200 million jobs would be created and 185 million lost globally by 2050 from a net-zero transition. There will be a period of net job losses during the transition: foundry workers will not instantaneously be transformed into building-insulation experts. Worker reskilling and redeployment will thus be crucial. Identifying skills adjacencies will be a key part of worker retraining programmes.

In Singapore, a comprehensive strategy to green the economy is taking shape, with a focus on boosting energy and resource efficiency and creating good jobs.

- In the petrochemical industry, all the major players have committed to reach net zero by 2050 and government agencies, industry players, and research institutes are developing capabilities in carbon capture and storage technologies.

- In the maritime industry, investments are being made to help our port terminals become net zero by 2050 and support the provision of low and zero carbon marine fuels such as ammonia, hydrogen, and biofuels.

- In road transport, Singapore aims to do away with the internal combustion engine and switch to electric vehicles by 2040.

- Singapore enjoys a trust premium; many emerging green services, like the trading of carbon credits and monitoring, reporting, and verifying carbon emissions, are built on trust.

TRANSITION FINANCE

The fourth enabler for the path to net zero is transition finance. A McKinsey report estimates that getting to net zero in 2050 would require about US\$9.2 trillion of investment per year. That is US\$3.5 trillion per year more than is currently being invested today. As incomes grow and

transition policies are legislated, expected spending will increase and narrow the gap. But there will still be a gap in annual spending of about US\$1 trillion.

Two areas in finance need urgent action.

First, green finance needs to be complemented by transition finance. The global financial industry has made good progress in harnessing green finance, namely finance to support green projects such as renewable energy or clean technologies. Last year, green and sustainable bond issuance reached US\$800 billion, a ten-fold increase from 2015. Where the industry needs to do better is in transition finance – to provide the funding support for companies that are not so green, to become greener. This includes financing, for instance, early retirement of coal-powered plants and decarbonising hard-to-abate activities.

Second, we need to synergise public and private capital through blended finance for green and transition projects. Many sustainability projects in emerging markets pose financial and political risks that are not commensurate with their expected returns. Catalytic or concessionary capital from multilateral development banks, national authorities, and philanthropic organisations can help to share the risk and improve project bankability, thereby attracting private sector capital. There is also scope to recycle capital by taking loans off the balance sheets of commercial banks and multilateral development banks and structuring them in a form that could be subscribed by institutional investors, insurance companies, and sovereign wealth funds. Several blended finance models have been piloted. But they need to be substantially scaled up to channel the extra US\$1 trillion in financing needed for the net zero transition.

Singapore is building a comprehensive ecosystem for green and transition finance to facilitate Asia's net zero journey.

- We are building capabilities in environmental risk management in the financial sector through climate stress tests.
- We are providing grants to defray the costs of issuing green and sustainability-linked loans and bonds.
- We are supporting industry efforts to build the infrastructure for a liquid and transparent voluntary carbon credit market in Asia.
- We are deploying technology to address data challenges, such as through an ESG registry to maintain provenance of green certifications and an ESG disclosure platform to allow listed companies to upload corporate sustainability data in a structured and efficient manner.

SUSTAINABLE LIFESTYLE

The fifth and last key to achieving net zero: a sustainable lifestyle. While many of the changes necessary to mitigate climate change are in the realm of public policies, business practices, financial decisions, and technological advances, people will also need to make lifestyle adjustments. According to an IPCC study, everyday behavioural changes by people which reduce demand for energy – such as adjusting temperature settings in buildings and reducing air travel – can cumulatively lead to substantial reductions in carbon emissions. People across the world are increasingly concerned about climate change and want to do something about it. Climate change is inspiring people to step up to a higher cause, to take collective action for the common good of our planet.

Singaporeans too are becoming more environmentally conscious. According to a 2020 study by the Institute of Policy Studies, 61% of Singaporeans surveyed felt that protecting the environment should be prioritised even if it results in slower economic growth and some loss of jobs. More individuals are taking climate-friendly actions, motivated by a desire to preserve a liveable world for future generations.

There are many things we can do as individuals to minimise our impact on the climate.

- We can do energy audits of our homes to identify ways to be more energy efficient.
- We can reduce food and plastic waste. We can become a zero-waste nation and a circular economy, where we use less resources and re-cycle resources.
- We can eat lower in the food chain and shift towards more plant-based protein. University of Oxford researchers have found that reducing meat and dairy products from our diet can help to shrink our carbon footprint from food by up to 73%.
- We can drive less and take public transport more. According to a 2021 study of seven European cities, individuals who switched one trip per day from driving to cycling reduced their carbon footprint by about 0.5 tonnes over a year.

CONCLUSION

Let me conclude. This is a gathering in the name of the dismal science. I hope I did not give too dismal a speech. But it is important that as economists and as Singaporeans, we appreciate the gravity of the net zero challenge.

The climate crisis demands collective action: nothing short of a whole-of-society effort across countries will suffice. And the time for action is now, not tomorrow. Yes, we wish we can postpone carbon taxes, costly investments in energy efficiency, restructuring of business processes, mandatory reporting of climate risks, until economic conditions are better. But the planet cannot wait, it is continuing to warm up. The cost of delay is having to make sharper and more painful adjustments later amid a worsening climate.

The road to net zero is not easy. But we have seen time and again that when confronted with grave challenges, humankind has risen to the challenge. The recent COVID-19 pandemic is a good example. Yes, the world's response was not optimal, and not everyone played their part. But by and large, governments put in place the necessary measures to save both lives and livelihoods; scientists and industry came together to produce vaccines in record time; businesses adapted and changed to continue providing goods and services; and people around the world took the necessary precautions, adjusted to new ways of living and working, made sacrifices, and helped one another out.

With that same spirit, difficult as it may be, the world will get to net zero and avert climate disaster. It will be a better world, and a better Singapore.

Working Paper

Does Lending Relationship Help or Alleviate the Transmission of Liquidity Shocks? Evidence from a Liquidity Crunch in China^{*}

By BAI YIYI, TRI VI DANG, HE QING AND LU LIPING ^{*}

Abstract: *We examine China's June 2013 liquidity crunch as a negative shock to banks and analyze the wealth effects on exchange-listed firms. Our findings suggest that liquidity shocks to financial institutions negatively impact borrower performance, particularly borrowers reporting outstanding loans at the end of 2012. Stock valuations of firms with long-term bank relationships, however, outperform the market and experience smaller subsequent declines in investment than peers lacking solid banking relationships. This effect is (strongest for firms that enjoy good relations with China's large state-owned banks or foreign banks, and weakest for firms whose connections are solely with local banks. We document a positive correlation between the stock performances of firms and the stock performances of lender banks and the likelihood of lender banks operating as net lenders in the interbank market. These results suggest that banks transmit liquidity shocks to their borrowing firms and that a long-term bank-firm relationship may mitigate the negative effects of a liquidity shock.*

JEL Classification: G30, G140, G210

Keywords: Lending Relationship; Interbank Liquidity Crunch; Local Banks

1. Introduction

The global financial crisis of 2008 highlighted the role of the interbank market in liquidity management of financial institutions. The drying up of liquidity in the interbank market, which initially spread to credit markets, eventually led to a collapse of the real economy that required massive intervention by financial authorities (Bui et al, 2020). Given the social and economic costs of financial crises (Ongena et al., 2003; Gan, 2007; Iyer and Peydro, 2011), it is hard to deny the importance of understanding the channels through which interbank market liquidity shocks affect the real economy. The following discussion addresses the role of financial institution lending as a transmission channel linking credit markets to stock markets.

A failure of the interbank lending market makes it difficult for financial institutions to cover liquidity shortfalls. Affected banks can transmit the shock to their borrowing firms (Schnabl, 2012), but may attempt to cushion liquidity-shock effects for their most trusted clientele. This is because

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banks benefit from long-term relationships that reduce information asymmetry (Petersen and Rajan, 1994; Berger and Udell, 1995; He et al., 2017). Long-term relationships put them in a better position to monitor borrowers and avoid risk-shifting during a liquidity shortfall. Such favorable treatment is rarely granted to arm’s-length borrowers. Thus, the transmission of bank liquidity shocks to a borrowing firm depends to some extent on the closeness and longevity of the bank-firm relationship.

The literature has not properly addressed this nexus of bank-firm lending relationships and liquidity shock transmission. Liquidity shocks typically affect both financial institutions and borrowing firms, making it difficult to disentangle liquidity effects (Chava and Purnanandam, 2011; Schnabl, 2012). We address this challenge with an examination of China’s June 2013 interbank liquidity crunch. This well-contoured negative liquidity shock allows us to tease out the role of lending relationships in liquidity shock transmission.

China offers excellent conditions for conducting a natural experiment on liquidity shock transmission. First, the June 2013 interbank liquidity shock occurred after China’s new leadership had been installed the previous March. To drive home the point that a new era had arrived, the shock was used to put interbank participants on notice that they needed to recalibrate their expectations regarding interventions from the People’s Bank of China (PBOC) and improve their liquidity management. Second, the liquidity crunch was a well-defined exogenous event lasting only a few days. It started with the PBOC showing reluctance to provide liquidity to financial institutions, and ended with the PBOC offering funds to the interbank market. Third, the annual reports of listed firms allow us to compile a novel dataset that covers both borrower and lender information on the five largest long-term loans held by listed firms in 2012. Relationship lending alleviates information asymmetry and facilitates long-term contracting (Boot, 2000). We therefore use long-term loans to identify a relationship between the lending financial institution and the borrowing firm. Fourth, the liquidity crunch achieved its policy purpose. Banks subsequently tightened their lending standards. This behavior shift suggests that banks became worried about future access to the interbank market and thus allows us to estimate the impact of the bank-firm relationship on the real economy through lending channels.

Our analysis of the role of institution lending in the transmission of interbank liquidity crunch starts with an examination of stock market reactions to this shock. We find that all firms experienced sharp drops in their share prices during this period. The declines are more pronounced for firms with outstanding loans at the end of 2012, allowing us to infer that the liquidity shock was transmitted from institutional lenders to their borrowers. Among firms that have access to institutional credit, we distinguish between firms with a “relationship bank” (i.e. a bank providing the bulk of their long-term credit) and firms without that. We find that firms with a relationship bank experienced a lower valuation loss than other firms during the liquidity crunch. This suggests that a bank-firm relationship can mitigate the negative effect transmitted from an interbank liquidity shock.

We next conduct several tests on firms with access to institutional credit to clarify the role of relationship banking. We find that firms with relationship banks experience a lower valuation loss than peers borrowing from non-bank institutions. The effect is the strongest for state-owned banks and foreign banks, and the weakest for local banks.¹ This finding reflects financial deregulation in China over the past two decades. Foreign banks have *gradually* come to play significant roles in the credit market. We also document a positive correlation between the stock performances of firms and

¹ Although local governments are main owners of local banks in some cases, only state-owned banks are fully controlled by the central government. State-owned banks are very different from local banks in many aspects such as size and market share, so it makes sense to separate them into two groups. The China Banking Regulatory Commission (CBRC) categorizes banks into 11 groups: policy banks, state-owned banks, joint-stock banks, foreign banks, city commercial banks, rural commercial banks, rural cooperative banks, rural credit unions, village banks, private banks and postal saving bank (see <http://www.cbrc.gov.cn/chinese/jrjg/index.html>). Following the CBRC, we simplify it into four groups: state-owned banks (including also policy banks), joint-stock banks (including postal saving bank), local banks (including city commercial banks, rural commercial banks, rural cooperative banks, rural credit unions and village banks), and foreign banks.

the stock performances of their lender banks, as well as the lender banks' positions in the interbank market.

The study concludes with an investigation of the long-run impact of the liquidity crunch on firm investment in subsequent years. The June 2013 liquidity crunch acted as a signal to banks about appropriate lending strategies. Aware that the PBOC might withhold short-term liquidity in the future, banks responded by adjusting their loan terms (e.g. amount, interest rate, maturity). Modified lending conditions, in turn, may have influenced corporate investment strategies. Consistent with other studies, we find that firms with outstanding loans reduced their investment ratios over the two-year post-event period. Firms that had long-running and close relationships with banks were less shy about investing than their peers in the post-event period. This evidence supports our view of how the lending channel works.

This paper makes three contributions to the literature. First, our study is related to recent literature emphasizing the impact of the shocks to liquidity providers on their borrowers (Chava and Purnanandam, 2011; Schnabl, 2012). This literature tends to focus on whether financial institutions transmit liquidity shocks to their borrowers and subsequent impacts on firm investment opportunities and performances. However, the economic factors that trigger the liquidity shocks may directly affect firm profitability and growth opportunities, which are key challenges for empirical identification (Michaud and Upper, 2008; Cocco et al., 2009). One contribution of our study is to isolate a well-defined exogenous shock in liquidity providers and provide reliable evidence of its impacts on borrowers' performance.

Second, our study is closely related to the role of the bank-firm relationship in mitigating value-relevant friction and the effect of a bank's health on a borrower's performance. For instance, James (1987) and Lummer and McConnell (1989) find positive market reactions of bank loan announcements from the borrowing-firm perspective. Slovin et al. (1992) find that small, less prestigious firms benefit more than their larger counterparts from screening and monitoring services associated with bank loans. Moreover, the quality, organizational structure, and origin of the lender also matter for market reactions (Slovin et al., 1988; Billett et al., 1995; Ongena and Roscovan, 2013). Using the exogenous shock in supply side and detailed loan level data, i.e. loan size, maturity and main bank, we find that the impact of liquidity shock is weaker for firms with a bank-firm relationship. Hence, we provide new results on the value implications of a bank-firm relationship at the time of liquidity shortage.

Finally, this paper also relates to studies on the effect of central bank interventions in financial markets. A number of studies have examined the effectiveness of central bank interventions in foreign exchange markets (Sarno and Taylor, 2001; Chen et al., 2012; Watanabe and Yabu, 2013), bond markets (De Pooter et al., 2018; De Santis and Holm-Hadulla, 2017), loan market (Lewis and Roth, 2019), and interbank markets (Brunetti et al., 2011; Giannone et al., 2012). Our study adds to this literature by showing that the unexpectedly drastic action of the central bank in the interbank market as a signal of policy change works effectively in curbing subsequent excessive bank lending. We provide novel evidence that a liquidity shortage can propagate from the interbank market to the real economy through lending linkages of banking sectors. This finding has a valuable policy implication for the central bank interventions on the real economy through financial markets.

The remainder of the paper is organized as follows. Section 2 describes the institutional background and the testable hypothesis. Section 3 discusses the research design and the summary statistics. Section 4 provides empirical results. Section 5 concludes with a summary of the findings and policy suggestions.

2. Institutional background and testable hypotheses

2.1 Institutional background

China's bank-centered financial system and relatively small capital markets make it challenging for firms to raise external financing from bond or equity markets (Allen et al., 2005; He et al., 2015). According to China's National Bureau of Statistics, the bank-credit-to-GDP ratio in China was about 112% in 2013, with banks providing about half of total financing for Chinese firms. The Chinese banking system has been dominated by the "Big Four" state-owned banks and three major policy banks.² There are twelve joint-stock banks, hundreds of local banks,³ as well as hundreds of branches and representative offices of foreign banks that conduct limited business activities in China (He et al., 2017).

The Chinese banking sector operated in an uncompetitive environment before the early 1990s (He et al., 2017). Commercial banks, especially the Big Four state-owned banks, accounted for a substantial proportion of credit granted for political reasons rather than profit maximization (Bailey et al., 2011). The government maintained strict control of the allocation of bank credit. The PBOC set the base interest rate along with upper and lower bounds for both the deposit and the lending market.⁴ As a result, banks had no incentive to monitor borrowers actively or curtail default risk. Most of the bank credit extended by state-owned banks to state-owned enterprises (SOEs) suffered from poor lending practices (Berger et al., 2009). This inefficient lending led to a huge amount of non-performing loans in the banking sector that increased the fragility of the country's financial system. Since the late 1990s, the Chinese government has adopted a series of reforms to enhance bank efficiency and lower the non-performing loan ratio. Clean-up measures have ranged from straight-out bailouts to injecting funds into financial institutions.

Following China's entry into the World Trade Organization in 2001, the government has sought to deregulate the financial system in anticipation of intensive competition from foreign financial institutions. Most Chinese banks nowadays have been restructured from wholly state-owned banks. Foreign investors are now permitted to take minority ownership in these banks. Western-style corporate governance mechanisms such as shareholder meetings, boards of directors and auditing systems were adopted to monitor daily bank operations. Many commercial banks, including the Big Four, have become publicly listed firms with strategic foreign institutional investors.

Despite substantial improvement of operational efficiency (Jia, 2009), many problems with the Chinese banking sector remain. Banks are subject to many prudential requirements imposed by the regulators. For example, during our sample period, banks were still facing a variety of restrictions on lending practices, including capital ratio requirements and the deposit rate ceiling. Bankruptcy law is poorly enforced; government agencies often try to prevent defaults and bankruptcies for the sake of social stability and employment. Thus, with an expectation of government bailout *ex ante*, banks often adopt an aggressive strategy in making lending decisions.

Both the number and volume of bank loans have soared since 2009. In a response to the global financial crisis, the Chinese government launched an RMB 4 trillion (around USD 650 billion) stimulus plan on November 9, 2008. With abundant liquidity and a gloomy economy, banks that were mostly engaged in short-term funding activities (e.g. short-term credit) channeled their new funds to long-term projects with potentially higher returns. Even worse, many loans were extended through shadow banking activities with limited regulatory scrutiny (Acharya et al., 2016). To attract

² China's "Big Four" state-owned banks are Agricultural Bank of China, Bank of China, China Construction Bank, and Industrial and Commercial Bank of China. The three policy banks are China Development Bank, Agricultural Development Bank of China, and Export-Import Bank of China. The Big Four were formed to replace the mono-bank system and separate commercial lending from central banking functions. Joint-equity banks were incorporated as limited companies and typically featured a state-dominated shareholding structure (Bailey et al., 2011).

³ Local banks include city and rural commercial banks, urban and rural credit cooperatives, rural cooperative banks, and village and town banks.

⁴ This policy has been lifted gradually since 2013, leaving only a small part of it, such as credit card interest rates, which are still under regulation.

more savings, many banks issued wealth management products (WMP) to circumvent the ceiling and offer significantly higher yields.⁵ WMPs financed a lot of risk projects that pay off in a longer period, such as real-estate investments and infrastructure projects. At the same time, many large companies had diverted funds in WMPs, or invested heavily in more profitable real estate due to soaring labor costs as well as declining business opportunities.

The rise of shadow banking activities has significantly contributed to the fragility of the Chinese banking system. When redemptions on their short-term funding came due, banks turned to the interbank market and borrowed at higher interest rates to cover their cash needs. Many commercial banks have used interbank transactions with banks and non-bank financial institutions aggressively to fund their lending or offload their loans, thus making the interbank market a critical part of their liquidity management (Acharya et al., 2016). The average interbank deposit ratio (interbank deposits/total assets) for China in the period from 1995 to 2015 is 10.74% (Allen et al., 2019). In addition, the PBOC intensively intervened in the interbank market, i.e., adjusting interbank liquidity, so as to influence bank credit in China (Fungáčová et al., 2016).

2.2 Liquidity crunch

The drying up of interbank market liquidity became a seasonal phenomenon in China after 2010. Cash demand peaks in late June as banks turn to the interbank market to meet their semi-annual regulatory requirements (e.g. loan-to-deposit ratios, reserve requirement ratios, and other repayment obligations). The PBOC typically injects funding into the interbank market during this period of liquidity tightness to smooth market function.

At the beginning of June 2013, banks followed the established pattern of extending credit aggressively to meet their semi-annual performance goals. The stock of new lending increased to RMB 863 billion in June 2013, a 28.89% increase from May 2013. Banks assumed the PBOC, as usual, would accommodate their liquidity needs by injecting extra funding into the interbank market. This time around, however, the PBOC altered its policy stance and provided no additional liquidity to the market.

In the weeks leading up to the June 20 panic, the interbank market witnessed several adverse news events (see Appendix 1 for a timeline of major events). A bond offering from the Agriculture Development Bank of China on June 5, 2013 was undersubscribed, raising the prospect of an impending liquidity squeeze in the interbank market. The overnight interbank interest rate was 4.62% that day. During June 6-8, a rumor flew that China Everbright Bank (a joint-stock bank) had defaulted on a repayment obligation of RMB 100 billion in interbank loans to Industrial and Commercial Bank of China. While both banks claimed the rumor was groundless, interbank market participants were shaken. The interbank market delayed its closing time due to potential defaults on interbank loans, and the interbank rate spiked to 9.58% on June 8. After falling back to normal levels on subsequent days, the unexpected June 14 non-issuance of treasury bonds again stoked fears in the interbank market. The market continued to believe that the PBOC would step in with extra funding to alleviate the heightened systemic risk caused by low liquidity conditions.

The climax of the episode began with a June 19 statement from the State Council by Premier Li Keqiang on economic and financial reform. He stated that China would maintain a prudent monetary policy stance and a reasonable level of money supply. The interbank rate rose to 7.66% that day. Closing of the interbank market was again delayed by 30 minutes. Panic was rife by the opening of the interbank market the next day, yet the PBOC insisted on issuing treasury bills, further siphoning liquidity from the interbank market. A new rumor flew that Bank of China had defaulted in the interbank market. The overnight interest rate, already over 10% at the opening of the interbank market, reached a historic high of 13.44% at the end of the day.

⁵ The upper bounds of deposit rates were up to 1.5 times the base rates until 2015. The regulated deposit rate is much lower than the market rate.

A statement from the PBOC on June 23, 2013 reiterated the State Council’s stance on “prudent monetary policy.” The PBOC would fine-tune its monetary policy and rein in monetary aggregates. “Black Monday” hit the stock markets on June 24, with the Shanghai Stock Exchange Composite Index falling by about 5%. Stock prices decreased by about 10% for most commercial banks. Throughout the meltdown, the PBOC stayed neutral and announced that market liquidity was sufficient. Some financial institutions were forced to sell assets to meet their liquidity needs.

Concerned by a potential contagion, the PBOC issued a statement on June 25 declaring its commitment to ensuring sufficient market liquidity and providing temporary funding to accommodate banks’ liquidity needs. There was great relief in the markets as the PBOC suspended treasury-bill issues and granted liquidity support to some financial institutions. On June 26, the overnight interbank interest rate returned to 5.55% and the panic abated.

China’s June 2013 liquidity crunch is considered an attempt by the government to rebalance economic growth while avoiding a debt-induced financial crisis. Regulators were concerned that the escalated shadow banking and China’s local government debts in the economic boom induced by China’s 2008 monetary stimulus package could endanger China’s financial stability.⁶ To push banks to curtail risky lending and shadow banking activities, the PBOC withheld its usual injection of extra liquidity. When this seemed to overshoot the desired response, it abandoned the experiment and began to provide extra liquidity to avoid a larger crisis. It is worth noting here that when we analyze the long-term interbank interest rate (one-year interest, see Figure 1), a proxy for financing activity in the real economy, we find no significant changes during the liquidity crunch period.

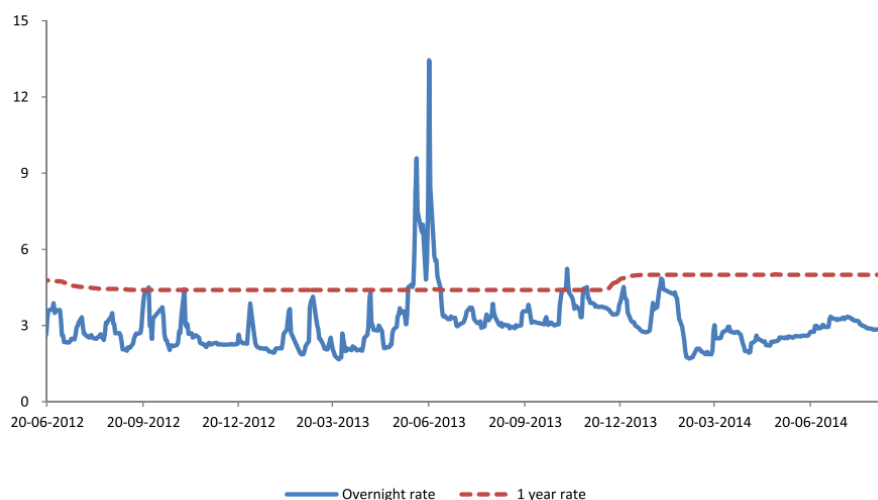


Figure 1. Interbank interest rate from one year before to one year after June 20, 2013 liquidity crunch.

This figure plots the interbank interest rates from one year before to one year after the 2013 liquidity crunch in China. The sample is daily over the period June 2012 to June 2014. The solid line depicts the Shanghai interbank overnight rate (SHIBOR) while the dashed line depicts the 1 year rate.

The main feature of the liquidity crunch in June 2013, therefore, is the power of PBOC’s messaging on excessive risk-taking to banks. The financial institutions that relied heavily on the

⁶ Jia, Li (December 2011), “The Chinese Credit Crunch”, News China, archived from [the original](#) on 9 August 2014, retrieved 8 August 2014
 Wildau, Gabriel; Jianxin, Lu (24 June 2013). “China cash squeeze eases, but bank shares take big hit”. Shanghai. Reuters. Retrieved 8 August 2014
 “Crunch Escalates as Money Funds Rival Shadow Banks: China Credit”, Bloomberg News, 19 January 2014

interbank market for short-term credit were exposed to severe liquidity constraints with a sudden tightening of the monetary stance.

The liquidity crunch substantially altered lending practices of Chinese banks. By keeping money tight, and thereby pushing interbank borrowing rates up, PBOC is forcing banks to curb risky loans and adjust to a more market-oriented environment.⁷ Banks are more cautious about their new loans to risky sectors, and are clearing out non-performing loans. Consequently, the market witnessed a decline in new bank loans following the event.⁸

Figure 2 plots the growth rate of loan supply before and after the liquidity crunch. We obtain data for all newly issued loans disclosed by listed firms during the six months before and after the liquidity crunch, and estimate the growth rate in the number and amount of loans in the two periods. As shown in Figure 2, the amount of loans falls by 27% and the number of loans decreases by 17% after the liquidity crunch. In contrast, the amount of loans increases by 38% and the number of loans rises by 12% in the pre-crisis period.



Figure 2. Growth of newly issued bank loans (quarterly, Jan. 2013 – Dec. 2013).

This figure plots the growth rate of all loans obtained by Chinese listed firms six months before (represented by the blue bars) and after the liquidity crunch (represented by the red bars). The growth rates are calculated based on the amount of loans in the left panel, and the number of loans in the right panel.

We also obtain data on the total volume of long-term loans⁹ newly issued by Chinese financial institutions six months before and after the liquidity crunch. From this, we calculate the monthly percentage of long-term loans over total loans in 2013. We then plot the term structure of newly issued loans between January 2012 and October 2014 in Figure 3, and find a descending trend in the year-on-year growth in the percentage of long-term loans over all loans.

⁷ It is also a way to flush out reckless shadow banking in China.

⁸ Bloomberg News, 12 May 2014, "[China's New Credit Declines](#)".

⁹ Long-term loans are typically loans that have a maturity longer than a year.

This result indicates that banks moved to a more cautious lending strategy and changed their liquidity management approach after the liquidity crunch.¹⁰ It is broadly in line with the significant drop in the growth of loans shown in Figure 2. We notice that this effect doesn't appear in 2012 and 2014, suggesting that this is not a seasonal phenomenon happening in June every year. Thus, the June 2013 liquidity crunch event presents a unique setting in which financial institutions face an induced temporary liquidity shortage and respond by adopting conservative lending strategies that substantially reduce their liquidity supply over the long run. We exploit this unique event to investigate whether these changes in bank behavior caused by the liquidity shock are transmitted to borrowers.

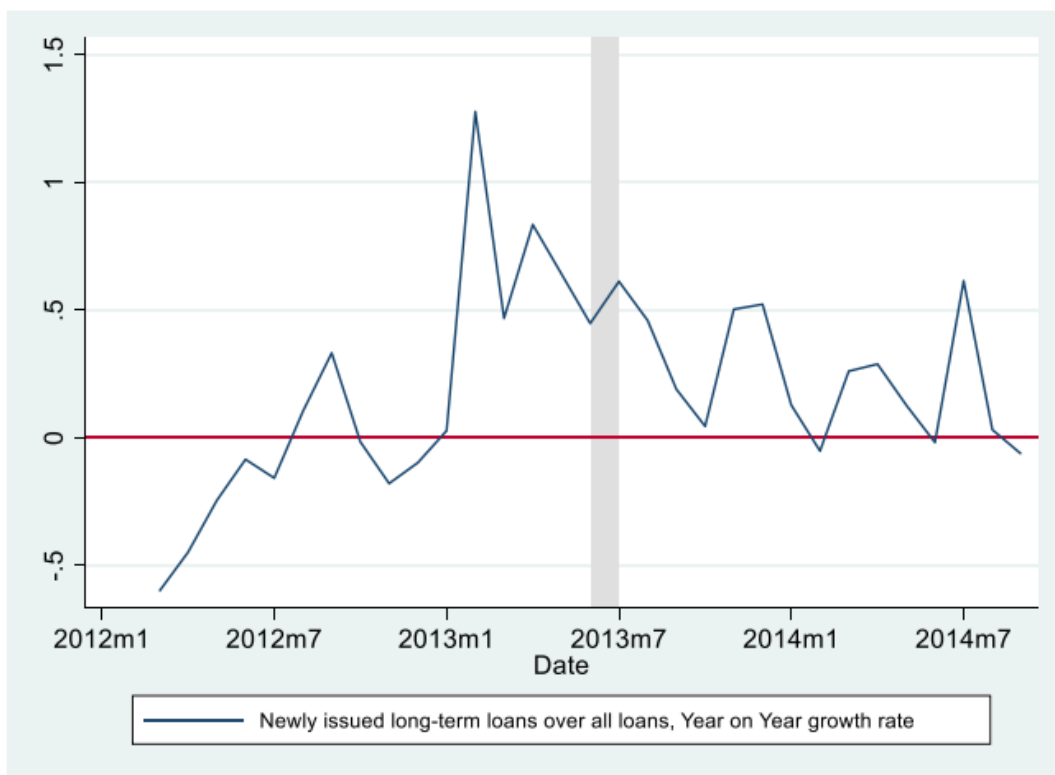


Figure 3. Term structure of loans newly issued by financial institutions (monthly, Jan. 2012 – Oct. 2014).

This figure presents the year on year growth rate of the percentage of long-term loans over all loans that are newly issued by Chinese financial institutions. The sample is monthly over the period of January 2012 to October 2014. The event period (i.e. June 2013) is represented in the shaded area.

2.3 Testable hypotheses

In a frictionless financial market, shocks to financial institutions should not affect firm borrowing as firms can easily access alternative external financing sources. However, market frictions (e.g. moral hazard and information asymmetry) can undermine the ability of a firm to access alternative financing channels (Holmstrom and Tirole, 1997).

¹⁰ Besides, banks choose to be more cautious as they expect PBOC will be stricter in providing liquidity.

In an economy where market frictions are present, shocks that affect the lending abilities of financial institutions can also impact their borrowers (Chava and Purnanamdam, 2011). Banks may reduce the amount of funds available to borrowers or reallocate their asset portfolios in favor of safer assets (Stein, 1988). China is no exception. In its bank-centered financial system, financial institutions mainly obtain short-term funding from the interbank market. This exposes them to severe constraints during a liquidity crunch. It adversely affects their lending abilities, which then leads to a loss of value in firms borrowing from banks. Thus, we propose our first hypothesis:

Hypothesis 1: *A firm that borrows from financial institutions experiences a larger value loss during a liquidity crunch than a firm that has no institutional borrowing.*

The literature suggests that market frictions such as information asymmetry and agency costs may affect the flow of funds to firms with profitable investment opportunities (e.g. Stiglitz and Weiss, 1981). Lenders are uncertain about the creditworthiness of managers and investment opportunities. Financial institutions, and banks in particular, overcome these frictions by producing and analyzing information on their clients before making loan decisions (Petersen and Rajan, 1994).

One feature of the bank business is relationship lending. Banks benefit from reduced costs of information collection about borrowers and may gain access to otherwise useful proprietary information. Boot and Thakor (1994) show that the duration of bank-firm relationships is associated with loan contract terms. Firms with long-term banking relationships pay lower interest rates and are not required to pledge as much collateral. Empirical studies are generally consistent with the benefits of banking relationships. Hoshi et al. (1990, 1991) find that banks help their clients with long-term relationships alleviate credit constraints and survive liquidity shocks during the crisis. James (1987), Billett et al. (1995), Maskara and Mullineaux (2011) and Ongena and Roscovan (2013) document positive market reactions of bank loan announcements, suggesting that bank relationships are valuable from the perspective of outside investors.

We expect that banks can obtain sufficient information to monitor their borrowers through close and repeated interactions, and thus prevent risk-shifting in a liquidity shortfall. For firms borrowing from financial institutions, the transmission of liquidity shocks via relationship banks is weaker than via other non-bank financial institutions. Thus, we propose our second hypothesis:

Hypothesis 2: *For firms borrowing from financial institutions, a firm with banking relationships is likely to experience less value loss during a liquidity crunch than a firm lacking banking relationships.*

A feature of the Chinese financial system is the dominance in credit allocation of state-owned banks, whose funding is implicitly guaranteed by the government. Relative to local banks and joint-equity banks, state-owned banks typically have more financing flexibility due to broader geographical presence and greater diversification of deposits and other funding sources. Their close ties with the government earn them frequent support from the regulatory authority, especially during crisis periods.

At the other end of the government-involvement spectrum, we find foreign banks to be largely immune to an induced liquidity crunch used by political leaders as a tool to promote prudential behavior. The information generated from lending relationships with foreign banks and state-owned banks has a larger valuation effect than those with joint-stock and local banks. Thus, the transmission of liquidity shocks by joint-stock banks and local banks is stronger than that of foreign and state-owned banks. We propose our third hypothesis:

Hypothesis 3: *The value loss is lowest if a firm's relationship banks are state-owned or foreign banks, and highest if the relationship banks are local or joint-stock banks.*

The June 2013 liquidity crunch provided notice to banks on appropriate lending strategies and motivated banks to adjust their lending practices to cope with potential interbank liquidity shortfalls. After the liquidity crunch, we see that it took seven months for the volume of new loan issues to recover to a level comparable to that of June 2013. Therefore, the event provides an opportunity to investigate how bank lending behavior affects firm investment. When banks play a special role in mitigating frictions in an economy, it may be that long-term bank relationships help firms alleviate credit constraints. With a decreasing loan growth rate, we expect that firms with established banking relationships will see smaller reductions in their investments. We propose our fourth hypothesis:

***Hypothesis 4:** Firms with bank relationships have smaller reductions in investments than other firms after a liquidity crunch.*

3. Research design, data and descriptive statistics

3.1 Research design

A standard market model (James, 1987) is used to estimate the benchmark returns and calculate abnormal returns (ARs). We run a daily market model over the estimation window of [-120, -21] to calculate abnormal returns and cumulative abnormal returns (CARs), with day 0 as the liquidity crunch date. We use an equal-weighted universal market index¹¹ for all listed firms from both the Shanghai and the Shenzhen stock exchanges. We calculate the CARs over the event windows of [-1, +1] as our main dependent variable. We link the CARs to bank-firm relationship, firm and bank level characteristics in the regression equation:

$$CAR_i = \alpha + \beta Bank_firm_i + \sum_{m=1}^M \gamma_m FIRM_{(m),i} + \sum_{n=1}^N \delta_n BANK_{(n),i} + Industry\ FE + \epsilon_i \quad (1)$$

where $Bank_firm_i$ equals 1 if the firm's largest lender of long-term loans is a bank, and 0 otherwise. We further categorize banks into state-owned banks (i.e. including the Big Four commercial banks and three main policy banks),¹² joint-stock banks, local banks, and foreign banks. Bank balance sheet data is retrieved from BankFocus. State-owned banks have dominated the Chinese banking sector since the 1980s. They are often considered the safest banks as they enjoy implicit government guarantees. Therefore, we propose that firms having relationships with state-owned banks may perform better in the stock market during an interbank liquidity crunch. We define local banks as urban or rural commercial banks, urban or rural credit cooperatives, rural cooperative banks, and village-town banks (i.e. small and medium-sized banks). Local banks may be quite different from national and regional banks in terms of geographical presence, organizational structure and business orientation. Local banks also enjoy a lower legal reserve requirement ratio, which is intended to incentivize them to finance small and medium-sized enterprises (SMEs). Since May 2012, the legal reserve requirement ratio has been 20% for national and regional banks and 16.5% for local banks.

$FIRM_{(m),i}$ denotes a set of firm characteristics, such as firm size, leverage, profitability, ownership, Tobin's Q, growth prospects, and stock market liquidity. We add firm ownership information from CSMAR, a widely-used database for the Chinese stock market, and create an SOE dummy variable that equals 1 if the firm's ultimate controller is a state-owned entity. We supplement the CSMAR

¹¹ One potential concern is that using an equal-weighted market index might have potentially twisted the results since in China small stocks are more volatile particularly during a sharp market crash. We use a value-weighted market index as the alternative measure to address this point. It turns out that our primary results remain qualitatively unchanged. These results are consistent with the notion that the estimation results of event study are not sensitive to such choice as the use of equal-weighted versus value-weighted market indices (Peterson, 1989). For the sake of brevity, the results are not reported, but are available upon request.

¹²As only a small number of listed firms borrow from policy banks, our results remain qualitatively unchanged by excluding the three banks.

stock data with firm balance sheet data at the end of 2012 from the Wind database. Detailed variable definitions are provided in Appendix 2.

3.2 Summary statistics

Our sample consists of all firms traded on the Shanghai and Shenzhen stock exchanges in 2013. We retrieve stock return data from CSMAR. We include all firms with information on stock returns within the [-5, 5] window around June 20, 2013. This leaves us with a sample of 42 financial firms and 2,335 non-financial firms.

We first search for the 2012 corporate annual reports on websites of record with the China Securities Regulatory Commission (CSRC). Disclosure rules at the time of the crisis required all listed firms to report information on their top five largest outstanding loans at the end of 2012 in their annual reports.¹³ Thus, the firm's relationship bank can be identified by the major lender from long-term loans disclosed in the firm's 2012 annual report. As the same lender may provide loans from more than one branch, we aggregate loan amounts at the headquarter level of the lender.

We also include the following bank balance sheet data from BankFocus: bank total assets, bank liquidity ratio, and bank equity ratio. BankFocus balance sheet information is available for 46 of the 78 banks that serve as the listed firms' providers of long-term loans. This covers about 95% of firms with long-term bank loans in our sample.

For the 2,335 non-financial firms with stock price information available in the event window, 1,830 firms had outstanding loans at the end of 2012 (including 767 firms whose largest lenders of long-term loans were non-bank institutions, and 1,063 firms that had banks as their largest lenders of long-term loans), and 505 firms did not report any loans.

Of the 1,063 firms whose largest lenders of long-term loans were banks in 2012,¹⁴ 31 firms reported most of their loans came from foreign banks, 85 firms had loans from 38 local banks, and 240 firms had loans from 12 joint-stock banks. The remaining 649 firms borrowed mainly from China's Big Four state-owned banks or three main policy banks.

4. Empirical results

4.1 Abnormal returns around the time of the liquidity crunch

Table 1 reports some descriptive statistics of CARs in eight event windows for 2,377 Chinese listed firms. For all reported windows, CARs are significantly negative at the 1% level. For example, $CAR[-1, 1]$ equals -0.022 and is significant at the 1% level. This means that the stock prices on average decreased abnormally by 2.2% for Chinese listed firms within the three trading days around the event day (i.e. the preceding Wednesday, the event day Thursday, and the following Friday). The result is economically significant as the average CARs of bank loan announcements before 2007 is around 0.5% (Li and Ongena, 2015). The negative market reactions to the liquidity crunches in China confirm that the liquidity shortage witnessed by financial institutions in the interbank market may have negatively impacted the borrowing firms' performance as well.

¹³ The China Securities Regulatory Commission (CSRC) requires all listed firms to disclose relevant information on their five largest outstanding loans in the annual reports, e.g. lender name, loan outstanding, maturity, etc.

¹⁴ This includes 58 firms that did not disclose details of their five largest long-term loans in their 2012 annual reports, i.e. they simply reported that they had some long-term bank loans outstanding.

Table 1. Descriptive statistics of CARs

	Mean	Std. Err.	Obs.	Min.	Max.
CAR[-1, 1]	-0.022***	0.001	2377	-0.28	0.218
CAR[0, 1]	-0.023***	0.001	2377	-0.148	0.171
CAR[-1, 0]	-0.017***	0.001	2377	-0.262	0.22
CAR[-2, 2]	-0.047***	0.001	2377	-0.318	0.289
CAR[-3, 3]	-0.044***	0.002	2377	-0.291	0.367
CAR[-5, 5]	-0.046***	0.002	2377	-0.397	0.497
CAR[-1, 2]	-0.050***	0.001	2377	-0.303	0.287
CAR[-1, 4]	-0.041***	0.001	2377	-0.286	0.367

The table reports descriptive statistics of the dependent variable cumulative abnormal return (CAR). The equal-weighted universal market index and daily stock returns at each trading day are used to calculate the CARs for eight event windows. Data source: *CSMAR*.

We categorize the listed firms by type of relationship bank to examine the role of lending relationships during the interbank liquidity crunch. Table 2 provides summary statistics on the CARs in five different event windows sorted by bank type.

Following previous studies, we choose the standard event window and focus on the CAR over a three-day window [-1, 1]. We obtain similar results when checking other windows such as [0, 1], [-1, 0], [-3, 3] and [-5, 5] as a robustness test.

Firms reporting outstanding loans at the end of 2012 underperformed their peers. The differences are negative and significant in all five event windows. It suggests that the negative liquidity shock for the interbank market had downstream impacts on firms seeking to meet their financing needs. Among all firms with financing needs, firms that borrowed from non-bank institutions had distinctly lower CARs than firms borrowing from banks. This finding indicates that investors perceive that banks are willing to keep supporting borrowers with established lending relationships during a liquidity crunch in the interbank market to such an extent that it confers a valuation premium on such firms.

Table 2. Firm CARs sorted by firm type

	# of firms		CAR [-1, 1]	CAR [0, 1]	CAR [-1, 0]	CAR [-3, 3]	CAR [-5, 5]
Non-financial firms							
Overall	2335	Mean	-0.023***	-0.023***	-0.017***	-0.044***	-0.045***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
No loans	505	Mean	-0.019***	-0.020***	-0.015***	-0.029***	-0.012***
		Std. Err.	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)
Loans	1830	Mean	-0.024***	-0.024***	-0.017***	-0.049***	-0.054***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
		Dif No loans	-0.004**	-0.003**	-0.002*	-0.020***	-0.043***
No relationship	767	Mean	-0.025***	-0.026***	-0.019***	-0.047***	-0.051***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Bank relationship	1063	Mean	-0.022***	-0.022***	-0.017***	-0.050***	-0.056***
		Std. Err.	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
		Dif No bank relationship	0.003**	0.004***	0.002*	-0.004	-0.005
Type of bank							
State-owned bank	649	Mean	-0.021***	-0.021***	-0.016***	-0.050***	-0.059***
		Std. Err.	(0.002)	(0.001)	(0.001)	(0.003)	(0.004)
		Dif No bank relationship	0.004**	0.005***	0.003**	0.003	0.007*
Local	85	Mean	-0.026***	-0.024***	-0.020***	-0.056***	-0.067***
		Std. Err.	(0.004)	(0.003)	(0.004)	(0.008)	(0.010)
		Dif No bank relationship	-0.0001	0.003	-0.001	-0.010	-0.016*
Joint	240	Mean	-0.025***	-0.024***	-0.018***	-0.051***	-0.046***
		Std. Err.	(0.003)	(0.002)	(0.002)	(0.004)	(0.006)
		Dif No bank relationship	0.0005	0.002	0.001	-0.005	0.006
Foreign	31	Mean	-0.011	-0.020**	-0.009	-0.031	-0.040**
		Std. Err.	(0.010)	(0.009)	(0.006)	(0.016)	(0.019)
		Dif No bank relationship	0.015**	0.006	0.010**	0.015	0.011

This table reports the mean and standard error for CARs in five event windows sorted by firm type. CARs are calculated from returns for daily stock price and an equal-weighted market index. Of the 2,335 non-financial firms with stock price information available in the event window, 1,830 firms had outstanding loans at the end of 2012 (including 1,063 firms whose largest long-term loan lenders were banks, and 767 firms whose largest long-term loan lenders were non-bank institutions), while 505 firms had no reported outstanding loans. In the 1,063 firms whose largest long-term loan lenders were banks, 649 had borrowed from state-owned banks, 85 firms from local banks, 240 firms borrow from joint-stock banks, 31 firms borrow from foreign banks, and 58 firms borrow from banks without disclosing information sufficient to determine bank type. Definitions of bank-type variables (State-owned bank, Local bank, Joint stock bank, and Foreign bank), are listed in Appendix 2. Differences of the means between firm types are reported with significance indicated at the 1 %, 5 %, and 10 % levels, and indicated with ***, **, and *, respectively.

The second panel of Table 2 shows CARs in five event windows across four groups of firms that are associated with four types of banks. The small number of firms borrowing from foreign banks have the highest CARs in all five windows. Firms borrowing from local banks have the lowest CARs among all four groups. For the other two groups, firms borrowing from state-owned banks almost consistently outperform firms borrowing from joint-stock banks.

The differences in the CARs between firms borrowing from foreign banks and firms in the other three groups are always positive. This evidence suggests that firms having relationships with foreign banks are practically immune to policy-induced liquidity shocks. State-owned banks seem to offer a slight advantage over the remaining types of banks, because their borrowers seem to be better insulated from the impact of the interbank liquidity crunch. Investors ascribe least value to the fact that a firm has local banking relationships. In the view of investors, local banks are believed to suffer the most from an interbank liquidity crunch, so firms that have lending relationships with local banks experience the most negative market reactions from a liquidity crunch event.

4.2 Cross-sectional regressions

In Tables 3 and 4, we include loans and bank-firm relationship variables in the regression to distinguish between firms reporting and not reporting outstanding loans at the end of 2012, and between firms with and without bank relationships (i.e. firms relying mainly on bank lending).

Table 3 reports the regression results with an OLS model using a sample of 2,335 Chinese firms listed on the Shanghai and Shenzhen stock exchanges. The dependent variables are $CAR[-1, 1]$, calculated using the daily stock return and an equal-weighted universal market index. In the first two columns, the main independent variable is *Loans*, which equals 1 if the firm had outstanding loans at the end of 2012, and 0 otherwise.

In addition, we include a set of firm balance sheet variables in the previous year 2012: *firm size* (total assets), *leverage*, *profitability* (EBIT), *Tobin's Q*, *state-owned* dummy, *special treatment*¹⁵(ST) dummy, *sales growth* (growth in sales revenue), and *stock liquidity*. We also include the industry fixed effects in some regressions, and the standard errors are clustered at the industry level.

The coefficients of *Loans* are always negative and statistically significant at the 1% level in all four columns. For example, the coefficient is -0.004 in column (1), i.e. firms with outstanding loans at the end of 2012 have 0.4% lower CARs than otherwise. This makes sense as firms that reported no loans are considered as having no financing needs and no relationships with lenders in the interbank market. A negative liquidity shock in the interbank market is less likely to be transmitted to these firms as they face no exposure to the lending channel. Adding industry fixed effects and

¹⁵ A firm is designated as a special treatment (ST) firm by the Chinese Securities Regulatory Commission (CSRC) if it incurs losses for two continuous years.

firm balance sheet controls does not change the results much. These results are robust to other event windows as well.¹⁶

Table 3. Borrowing and information disclosure of firms

	(1)	(2)	(3)	(4)
Loans	-0.004*** (0.001)	-0.004*** (0.001)	-0.008*** (0.001)	-0.007*** (0.001)
Total asset			-0.001 (0.001)	-0.001 (0.002)
Leverage			0.007 (0.005)	0.005 (0.004)
EBIT			-0.013 (0.016)	-0.013 (0.016)
Tobin's Q			-0.002 (0.002)	-0.002 (0.002)
SOE			-0.002 (0.002)	-0.003 (0.002)
ST			0.011*** (0.002)	0.010*** (0.002)
Sales growth			-0.001 (0.002)	-0.001 (0.002)
Stock liquidity			-0.002*** (0.001)	-0.003*** (0.000)
Constant	-0.019*** (0.001)	-0.014*** (0.001)	0.014 (0.033)	0.031 (0.037)
Observations	2335	2335	2207	2207
R-squared	0.002	0.016	0.024	0.039
Industry FE	no	yes	no	yes

This table reports regression results with an OLS model using a sample of 2,335 Chinese firms listed on the Shanghai and Shenzhen exchanges. The dependent variables are CAR[-1, 1]. *Loans* equals 1 if a firm has outstanding loans in the end of 2012, 0 otherwise. Firm balance sheet controls include the following variables: *Log total assets* is the logarithm of total assets at the end of 2012 in 1,000 RMB; *Leverage* is total liabilities over total assets at the end of 2012; *EBIT* is the industry-adjusted EBIT at the end of 2012; *Tobin's Q* is the book value of total liabilities plus the market value of total equity over the book value of total assets at the end of 2012; *SOE* equals 1 if the firm was directly or indirectly controlled by the state the end of 2012, 0 otherwise; *ST* equals 1 if the firm is under special treatment, 0 otherwise. Other firm-level controls include the following variables: *Sales growth* is the rate of growth in sales revenue in 2012; *Stock liquidity* equals the average ratio of trading volume divided by tradable shares market value in 30 days before the event. Standard errors are clustered at industry level in all four columns and reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

Having seen that firms with outstanding loans at the end of 2012 underperformed in the stock market during the interbank liquidity crunch, we now go a step further in exploring the variations in stock market performances of firms with outstanding loans. That is, did having a banking relationship play a role or not? Table 4 reports the regression results with an OLS model using a sample of 1,234 Chinese firms that disclosed their five largest long-term loans in their 2012 annual reports. Our aim here is to test whether having a bank as the largest provider of long-term loans

¹⁶ Results are available upon request.

affected the stock performance of a firm during the interbank liquidity crunch. In columns (3) and (4), the sample is enlarged to 1,830 firms that had institutional loans outstanding at the end of 2012 (i.e. including another 596 firms whose detailed long-term loan information is missing). In columns (5) and (6), the sample is enlarged to all 2,335 Chinese firms listed on the Shanghai and Shenzhen stock exchanges (i.e. including another 505 firms that did not report any outstanding institutional loans). The dependent variable is $CAR[-1,1]$. $Bank_firm$ equals 1 if a firm's largest provider of long-term loans is a bank, and 0 otherwise.

The coefficients of $Bank_firm$ are positive and statistically significant at the 1% level in all six columns. For example, the coefficient is 0.007 in column (1). Firms with a bank as the largest provider of long-term loans tend to have 0.7% higher CARs than otherwise. Adding firm balance sheet variables to control for other potential impacts from the firm side does not substantially change the results. The results are also robust in columns (5) and (6), where we enlarge the sample to include all 2,335 non-financial listed firms in China.

The results remain robust when other firm characteristics are added as control variables. The ST dummy has positive and significant coefficients in all three columns, and the coefficients of EBIT and stock liquidity are largely negative and significant, suggesting that SOE firms having a higher profitability and liquidity in the stock market tend to have lower CARs. The remaining firm-level control variables are largely insignificant, indicating that none affected the market reactions during the interbank liquidity crunch.

Table 4. Firms whose largest provider of long-term loans is a bank

	(1)	(2)	(3)	(4)	(5)	(6)
	Firms disclosing five largest long-term loans		All firms with loans		All firms	
Bank_firm	0.007*** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.007*** (0.001)	0.007*** (0.002)	0.007*** (0.002)
Information Disclosure			-0.005** (0.002)	-0.007** (0.003)	-0.007* (0.002)	-0.010*** (0.003)
Total asset		-0.001 (0.002)		-0.002 (0.001)		-0.001 (0.002)
Leverage		-0.001 (0.005)		0.004 (0.004)		0.003 (0.005)
EBIT		-0.035 (0.023)		-0.035* (0.018)		-0.016 (0.016)
Tobin's Q		0.000 (0.003)		0.000 (0.002)		-0.002 (0.002)
SOE		-0.004 (0.003)		-0.002 (0.003)		-0.003 (0.002)
ST		0.015*** (0.004)		0.011*** (0.003)		0.011*** (0.003)
Sales growth		-0.003 (0.002)		-0.001 (0.002)		-0.001 (0.002)
Stock liquidity		-0.005*** (0.001)		-0.004*** (0.000)		-0.002*** (0.000)
Constant	-0.032*** (0.001)	-0.003 (0.038)	-0.018*** (0.001)	0.027 (0.036)	-0.017*** (0.001)	0.018 (0.037)
Observations	1234	1200	1830	1742	2335	2207
R-squared	0.028	0.073	0.018	0.054	0.016	0.039
Industry FE	yes	yes	yes	yes	yes	yes

This table reports regression results with an OLS model using a sample of the 1,234 Chinese firms that disclosed their five largest long-term loans in their 2012 annual reports. In columns (3) and (4), the sample was enlarged to 1,830 firms that had outstanding loans at the end of 2012 (includes another 596 firms whose detailed long-term loan information is absent). In columns (5) and (6), the sample was enlarged to encompass all 2,335 Chinese firms listed on the Shanghai and Shenzhen exchanges (includes another 505 firms that did not report any outstanding loans). The dependent variables are $CAR[-1,1]$. $Bank_firm$ equals 1 if the firm's largest lender of long-term loans is a bank, 0 otherwise. Information disclosure equals 1 if a firm discloses its five largest long-term loans in its 2012 annual report, 0 otherwise. Firm balance sheet controls are the same as in Table 3. Standard errors are clustered at industry level in all four columns and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Before turning to heterogeneity across bank and firm ownership in the transmission of interbank liquidity crunch, we perform a variety of robustness checks on our main results. First, to show that what we observe here is not just a seasonal phenomenon, we do a placebo test with baseline regressions by setting the event date as June 20, 2012, exactly a year before the event. The empirical results are reported in Panel A of Table 5. The coefficients of *Loans* and *Bank_firm* are both insignificant in all four columns, indicating that there is no such effect in 2012. Second, there are concerns that bank-firm relationships are not randomly established. Firms with stronger balance sheets may be more likely to build relationships with banks, and at the same time experience smaller decreases in stock prices because they are more resilient to adverse shocks. To address the selection bias, we therefore run propensity score matching between firms with and without outstanding loans, as well as firms with and without bank-firm relationships at the end of 2012, which are otherwise identical. The results remain robust as shown in Panel B of Table 5. It indicates that firms with outstanding loans have lower probability of experiencing a high CAR. The average difference in probability is -0.009 in column (1) and decreases to -0.005 in column (2) with industry fixed effects. Similarly, firms with a bank as the largest provider of long-term loans tend to have a higher CAR than otherwise.

Third, we use external financial dependence as an alternative proxy for firms' exposure to liquidity shock. Apart from partitioning firms by existing bank loans, we split the sample by dependence on external finance to see whether it has any impact on the results. Following Rajan and Zingales (1998), we calculate a firm's dependence on external finance as capital expenditures minus cash flow from operations divided by capital expenditures between 2010 and 2012 (i.e. three years before the event), and use the industry median to smooth temporal fluctuations and reduce effects of outliers. We then rerun Tables 3 and 4 with the two subsamples. As shown in Panel C of Table 5, the coefficients of *Loans* are always negative and statistically significant in both columns. Meanwhile, we do not observe a significant difference between the two groups of firms whose dependence on external finance is above and below median. We find our results remain robust after splitting the sample by firms' dependence on external finance. The reason that the coefficient *Loans* remains significant and similar between the two subsamples could be that *dependence on External Finance* is constructed at the industry level and therefore has less variation than *Loans*, which is constructed at the firm level. In the last six columns of the table, our results also hold as the coefficient of *Bank_firm* remains positive and significant in all but one column. Moreover, we find that the coefficient of *Bank_firm* has slightly higher statistical and economic significance in the subsample of firms with below median dependence on external finance. This indicates that among all firms with bank relationships, those firms having lower external financial dependence slightly outperform in the stock market during the liquidity crunch.

Noting that the impact of the event may have gone beyond the presumed event window of [-1, +1], we also calculate CARs over longer event windows as dependent variables. Specifically, we re-estimate the regressions in Tables 3 and 4 using CAR[-3, 3] and CAR[-5, 5] as dependent variables to check the robustness of our results. As shown in Panel D of Table 5, our primary results remain qualitatively unchanged. The coefficients of *Loans* in columns (1) - (2) are negative and statistically significant at the 1% confidence level, and the coefficients of *Bank_firm* remain positive and significant in columns (3) - (8). These results again provide supporting evidence for our first and second hypotheses.

Table 5. Robustness

Panel A Placebo test								
	(1)	(2)	(3)	(4)				
	All firms		Firms with loans					
Loans	-0.001 (0.001)	0.001 (0.001)						
Bank_firm					0.001 (0.002)		0.001 (0.001)	
Firm balance sheet controls	yes	yes			yes		yes	
Observations	2067	2067			1619		1619	
R-squared	0.09	0.119			0.084		0.111	
Industry FE	yes	yes			yes		yes	
Panel B Propensity score matching								
	(1)	(2)	(3)	(4)				
Loans	-0.009*** (0.003)	-0.005** (0.002)						
Bank_firm					0.006* (0.003)		0.006* (0.003)	
Firm balance sheet controls	yes	yes			yes		yes	
Observations	2207	2207			1200		1189	
Industry FE	no	yes			no		yes	
Panel C. Splitting samples by firms' dependence on external finance								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				Firms disclosing five largest long-term loans		All firms with loans	
	Dep Ext Fin > median	Dep Ext Fin < median	Dep Ext Fin > median	Dep Ext Fin < median	Dep Ext Fin > median	Dep Ext Fin < median	Dep Ext Fin > median	Dep Ext Fin < median
Loans	-0.009*** (0.001)	-0.010*** (0.003)						
Bank_firm			0.004 (0.002)	0.010*** (0.003)	0.006** (0.003)	0.010*** (0.003)	0.005* (0.002)	0.010*** (0.002)
Firm balance sheet controls	yes	yes	yes	yes	yes	yes	yes	yes
Information disclosure control	no	no	yes	yes	no	no	yes	yes
Observations	940	687	940	687	465	385	727	547
R-squared	0.068	0.059	0.067	0.056	0.086	0.074	0.071	0.068
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Panel D. Robustness test with extended event windows								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full sample				Firms disclosing five largest long-term loans		All firms with loans	
	CAR(-3,3)	CAR(-5,5)	CAR(-3,3)	CAR(-5,5)	CAR(-3,3)	CAR(-5,5)	CAR(-3,3)	CAR(-5,5)
Loans	-0.013*** (0.002)	-0.018*** (0.003)						
Bank_firm			0.008*** (0.003)	0.015** (0.007)	0.010*** (0.002)	0.016*** (0.007)	0.009*** (0.003)	0.016** (0.007)
Firm balance sheet controls	yes	yes	yes	yes	yes	yes	yes	yes
Information Disclosure control	no	no	yes	yes	no	no	yes	yes
Observations	2207	2207	2207	2207	1200	1200	1742	1742
R-squared	0.074	0.155	0.073	0.153	0.045	0.088	0.044	0.100
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes

Panel A reports results of the placebo test on previous dates. The dependent variables are CAR[-1, 1]. We define 20th June 2012, exactly a year before the event, as the new event day, and rerun the baseline regressions as we did in Tables 3 and 4. Panel B reports regression results of propensity score matching between firms with and without outstanding loans, as well as firms with and without bank-firm relationships at the end of 2012, that are otherwise identical. Panel C reports regression results with splitting samples by firms' dependence on external finance. Panel D reports results of robustness test using extended event windows. Similarly, the independent variables and control variables in columns 3-8, are the same as in Table 4. *Loans* equals 1 if a firm has outstanding loans in the end of 2012, 0 otherwise. *Bank_firm* equals 1 if the firm's largest lender of long-term loans is a bank, 0 otherwise. Standard errors are clustered at industry level in regressions, and are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

4.3 Results by bank type and firm ownership

Table 6 reports the regression results with an OLS model using a sample of 1,830 Chinese firms that had outstanding loans by the end of 2012. The dependent variable is $CAR[-1,1]$. *State-owned banks* equals 1 if a firm's largest lender of long-term loans is one of the Big Four state-owned banks or three main policy banks; *local banks*, *joint-stock banks*, and *foreign banks* equal 1 if a firm's largest lender of long-term loans is a local bank, a joint-stock bank and a foreign bank, respectively, and 0 otherwise. All four columns use 767 firms borrowing from non-bank institutions as the benchmark group.

Panel A in Table 6 considers whether the ownership structure of relationship banks impacted the stock performance of firms. In column (1) of Panel A, with the full sample of 1,830 firms, the coefficient of *state-owned banks* is 0.006 and significant at the 1% level. The coefficient remains the same when we include industry fixed effects and several firm balance sheet control variables in column (4). The results are qualitatively similar for all columns. The positive coefficients of *state-owned banks* are always statistically significant at the 1% level in all four columns, suggesting that firms whose largest lenders of long-term loans are state-owned banks tended to outperform in the stock market during the interbank liquidity crunch compared to firms borrowing from other domestic banks. *Foreign banks* also have significantly positive coefficients that have even larger economic significance than the coefficients of *state-owned banks*. This result comports with our third hypothesis.

Interestingly, compared to the coefficients of the other three bank types, we observe a consistent pattern whereby the coefficients of *state-owned banks* always have the second-highest economic significance, the coefficients of *local banks* always have the lowest economic significance, and the coefficients for *joint-stock banks* have a slightly larger economic significance than for *local banks*. This pattern persists after adding industry fixed effects and firm balance sheet variables as controls.

As an explanation, it seems that local banks are often more fragile in an interbank market due to their small size and limited funding, which exposes them more in an interbank liquidity crunch. Firms with lending relationships with local banks seem more prone to suffering from an interbank liquidity crunch than firms with regional and national bank lending relationships.

Next, we estimate the regression separately by firm ownership. Brandt and Li (2003) note that state-owned enterprises (SOEs) in China are treated favorably by commercial banks, especially state-owned commercial banks. Non-SOEs, in contrast, face obstacles in obtaining external finance from state-owned banks due to their short borrowing histories or simple discrimination (He et al., 2017). In general, we expect stronger effects for non-SOEs that borrow mainly from foreign banks because foreign banks are more likely to allocate credit based on commercial judgments. We define a firm as an SOE if its ultimate largest shareholder is the government or a government-related entity. We add controls for industrial fixed effects and a set of firm characteristic variables.

Panel B reports the results for non-SOEs and SOEs. We find that the coefficients of *state-owned banks* are around 0.012 and significant at the 1% level for SOEs. In contrast, the coefficients of *state-owned banks* are negative and significant at the 5% level for non-SOEs. Long-term lending relationships with local banks have a positive effect in SOEs, while they have a negative effect in non-SOEs. A possible explanation is that state-owned banks and local banks are less efficient in accessing information of non-SOEs than of SOEs. To ensure sufficient credit supply to SOEs, state-owned banks and local banks are more likely to cut their credits to non-SOEs when faced with liquidity shock. In other words, the non-SOEs may be crowded out during the tightening of credit supply. These findings are in line with Ru (2018), who shows that government credits to SOEs crowd out private firms in the same industry, especially during macroeconomic downturns. In addition, the results also show that the coefficients of *foreign banks* are around 0.013 for non-SOEs

and 0.011 for SOEs. Consistent with our hypothesis, foreign banks allocate credit by commercial judgments, especially for extending credits to non-SOEs.

Table 6. Results by bank type and firm ownership

Panel A. Whole sample				
	(1)	(2)	(3)	(4)
<i>State-owned banks</i>	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)
<i>Local banks</i>	0.002 (0.003)	0.001 (0.004)	0.004 (0.003)	0.002 (0.004)
<i>Joint-stock banks</i>	0.002 (0.002)	0.003 (0.002)	0.004 (0.002)	0.003 (0.002)
<i>Foreign banks</i>	0.017*** (0.004)	0.017*** (0.003)	0.018*** (0.005)	0.018*** (0.005)
Firm balance sheet controls	no	no	yes	yes
Observations	1830	1830	1742	1742
R-squared	0.005	0.020	0.037	0.056
Industry FE	no	yes	no	yes
Panel B. Non-SOEs vs SOEs				
	(1)	(2)	(3)	(4)
	Non-SOE		SOE	
<i>State-owned banks</i>	-0.005** (0.002)	-0.004** (0.002)	0.012*** (0.002)	0.012*** (0.002)
<i>Local banks</i>	-0.009** (0.004)	-0.011* (0.006)	0.015** (0.006)	0.012* (0.006)
<i>Joint-stock banks</i>	-0.004 (0.003)	-0.003 (0.003)	0.005 (0.003)	0.005 (0.003)
<i>Foreign banks</i>	0.012** (0.004)	0.013*** (0.003)	0.011*** (0.003)	0.011*** (0.003)
Firm balance sheet controls	yes	yes	yes	yes
Observations	927	927	815	815
R-squared	0.037	0.061	0.094	0.134
Industry FE	no	yes	no	yes

This table reports regression results by bank type and firm ownership. Panel A shows results from an OLS model using a sample of 1,830 Chinese firms that showed outstanding loans in 2012 annual reports. The dependent variables are CAR[-1,1]. *State-owned banks* equals 1 if the firm's largest lender of long-term loans is one of the four large state-owned banks or three major policy banks. *Local banks*, *joint stock banks*, and *foreign banks* equal 1 if the firm's largest lender of long-term loans is a local bank or a joint-stock bank or a foreign bank, and 0 otherwise. All four columns use 171 firms that borrowed from non-bank institutions as the underlying comparison group. Firm balance sheet controls are the same as in Table 3. In Panel B, we split the sample into Non-SOEs and SOEs. The dependent variables and independent variables are the same as in Panel A. Standard errors are clustered at industry level in all four columns, and are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

4.4 Bank strength and market reaction

Table 7 examines whether firms' performances in the stock market are associated with their banks' stock price change and interbank position. The first two columns in Table 7 are OLS regression results using a subsample of Chinese firms whose largest long-term loan lenders are one of the 16 listed banks in China. *Bank CAR* is the CAR of the bank which is the largest lender of long-term loans of a firm, also calculated in the event window of [-1,1]. Given that all 16 Chinese listed banks are domestic, Dummies of *state-owned banks* and *local banks* are added as control variables in column (2). After controlling for bank characteristics and industry fixed effects (and firm balance sheet in some specifications), we find our results still robust.¹⁷

In column (1) of Table 7, we find that the coefficient of *Bank CAR* is 0.018, indicating that a 1% increase in *Bank CAR* corresponds to a roughly 1.8% increase in the CARs of firms borrowing from banks. This result suggests a positive relationship between firm CAR and bank CAR, which makes sense as the flagging financial health of a lending bank could bleed over and distress borrower firms. It is understandable that the coefficient is insignificant given that our group of 16 listed banks represents but a small fraction of the full sample of 78 banks. The relationship becomes more pronounced in column (2), where the coefficient of *Bank CAR* rises to 0.188, and becomes significant at the 10% level when we add firm balance sheet variables to control for any potential effect from the firm side. Investors seem to believe that firms are likely to suffer less during an interbank liquidity crunch if their relationship banks also suffer less from the liquidity shock.

Table 7. Heterogeneity across bank CARs and bank interbank positions

	(1)	(2)	(3)	(4)
<i>Bank CAR</i>	0.018 (0.066)	0.188* (0.101)		
<i>Bank Interbank Position</i>			0.011** (0.005)	0.013 (0.008)
Firm balance sheet controls	no	yes	no	yes
Bank balance sheet	yes	yes	yes	yes
Observations	472	329	472	329
R-squared	0.061	0.162	0.062	0.120
Industry FE	yes	yes	yes	yes

This table reports regression results with an OLS model that explores the heterogeneity across bank CARs and bank interbank positions. The dependent variables are CAR[-1,1]. *Bank CAR* is the CAR of the bank which is the largest lender of long-term loans of a firm, also calculated in the window of [-1,1]. The main independent variable is *Bank Interbank Position*, which equals the average ratio of interbank assets over interbank liability in 2012. Industry fixed effects, and bank balance sheet controls, including bank total assets, equity ratio and revenue growth rates, are added in all four columns. Given that all 16 Chinese listed banks are domestic, *state-owned banks* and *local banks* are also added in as control variables for bank ownerships in all columns. Firm balance sheet controls are the same as in Table 3. Standard errors are clustered at industry level in all four columns. Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

¹⁷ Note that we do not include bank-level fixed effects in our regressions, because cross-sectional regressions have no variation in time dimension.

The last two columns in Table 7 report the regression results with an OLS model using a subsample of Chinese firms whose largest long-term loan lenders are among the 50 banks with 2012 interbank market information available. The main independent variable is *Bank Interbank Position*, which equals the average ratio of interbank assets over interbank liability in 2012. A value above 100% indicates that the bank has high liquidity in the interbank market. We propose that the higher the liquidity of a bank in the interbank market the lower the shock to the stock price of its borrower firms (i.e. those firms with which it has lending relationships). Standard errors are clustered at the industry level in all four columns. Column (4), which includes firm balance sheet variables as controls, shows qualitatively similar results.

In column (3) of Table 7, we find that the coefficient of *Bank Interbank Position* is 0.011 and significant at the 5% level, indicating a positive relationship between firm CAR and a bank's position in the interbank market. This makes sense as net lenders in the interbank market (*Bank Interbank Position* greater than 1) are less likely to be negatively affected by a liquidity crunch – and may even benefit from it. In contrast, net borrowers suffer more than others as the liquidity crunch dries up alternative funding sources in the interbank market. Such relationships remain positive, but insignificant when we add firm balance sheets as control variables.

4.5 Impacts on investment

As this liquidity crunch had a temporary and exogenous impact on liquidity supply, analysis of stock returns allows us to investigate the effects of liquidity shortage and bank-firm relationship on firm value. Nevertheless, the liquidity crunch substantially altered lending practices of Chinese banks. By keeping money tight, and thereby pushing interbank borrowing rates up, PBOC is forcing banks to curb risky loans and adjust to a more market-oriented environment. Figures 2 and 3 both show that banks significantly reduced their lending after the crunch, so we flesh out our study on the relationship between the liquidity crunch and firms' investment behaviors.

Figure 4 shows the average ratio of investment over total assets for firms with and without outstanding loans before and after the liquidity crunch. There is no substantial difference in year-to-year investment ratio between the two groups of firms before the liquidity crunch. In 2013, investment ratios for firms without loans increase almost 2%, while that of firms with loans remain relatively flat. For both groups of firms, investment ratio declines about 0.5% in the two years subsequent to the liquidity crunch, a bit more so for the first year than for the second. This graph provides strong visual evidence of common trend for both types of firms, and a treatment effect (liquidity crunch) that shows a significant deviation from this trend.

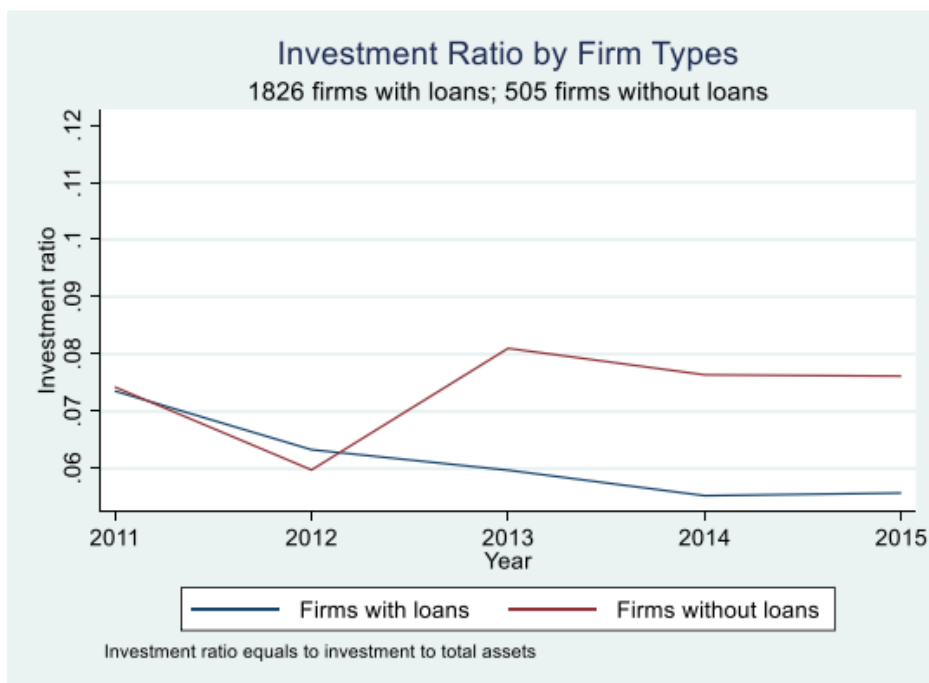


Figure 4. Investment ratios for firms with and without outstanding loans around the liquidity crunch

Figure 4 shows the average ratio of investment over total assets for firms with loans and firms without loans before and after the liquidity crunch.

For the firms with outstanding loans, Figure 5 distinguishes between firms with and without long-term bank relationships and plots their average year-to-year investment ratios. Investment ratios for both types of firms were reasonably flat with a downward trend before the liquidity crunch. For firms without long-term bank relationships, the investment ratio declines about 1% in the two years subsequent to the liquidity crunch. In contrast, the investment ratio for firms with long-term bank relationships experiences a slight decline in the first year after the liquidity crunch, and rises back to the baseline level. It shows both types of firms have a relatively common underlying trend, and a treatment effect (liquidity crunch) that introduces a sharp deviation from this trend.

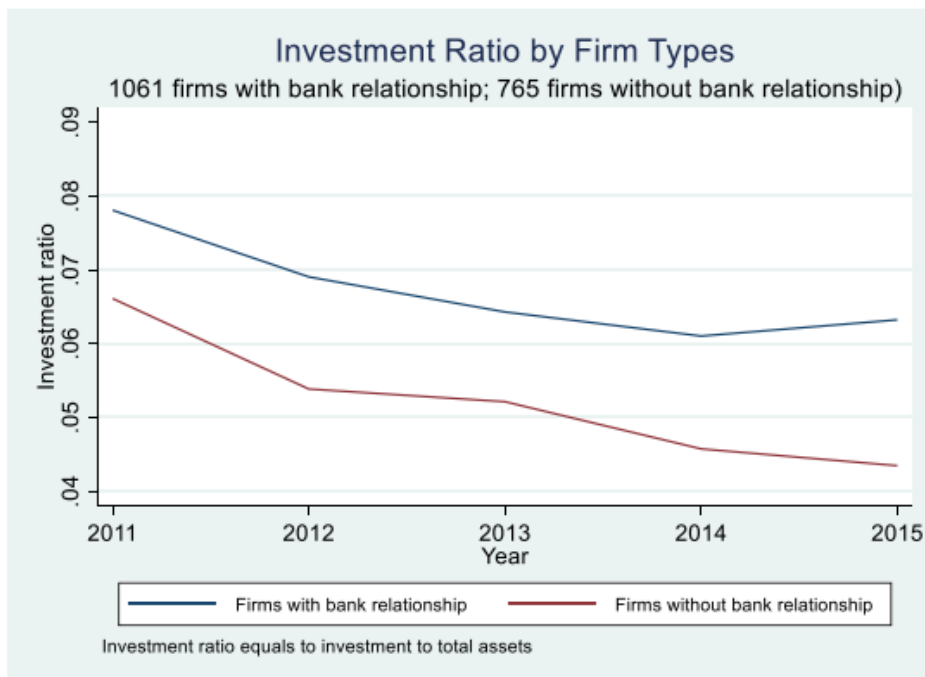


Figure 5. Investment ratios for firms with and without long-term bank relationships around the liquidity crunch

Figure 5 shows the average ratio of investment over total assets for firms with long-term bank relationship and firms without long-term bank relationships before and after the liquidity crunch.

Next, we estimate the following difference-in-difference regression model:

$$Y_{it} = \alpha + \beta Bank_firm_i + \gamma After_t + \delta Bank_firm_i * After_t + \sum_{n=1}^N \varphi_n FIRM_{(n),it} + \sum_{m=1}^M \omega_m BANK_{(m),it} + Industry FE + \epsilon_i \quad (2)$$

The dependent variable Y_{it} is investment ratio, which is the ratio of investment over total assets for firm i in year t . $Bank_firm_i$ is a dummy variable that equals 1 if a firm's largest provider of long-term loans is a bank (i.e. a firm borrows from financial institutions), and 0 otherwise. $After$ is a dummy that equals 1 for observations in 2013 or after (i.e. post-crisis). The coefficients of interaction term identify the effects of the liquidity crunch on a firm's investment activities.

$Bank_firm_i * After_t$ measures changes in investment behavior of firms with long-term bank relationships (i.e. firms with access to institutional lenders) to investment changes of their counterparts in the post-crisis period. We estimate the model using data from two years before and after the liquidity crunch year of 2013, the period from 2011 to 2015, aiming to test for a long-run effect of the liquidity crunch on the operations of borrower firms.

Columns (1) and (2), which involve a sample containing all 2,355 non-financial listed firms, presents the results of whether the liquidity shock influenced operations of borrower firms through lending channels. The results in columns (3) and (4) are based on a sample of 1,830 firms with outstanding loans. Here, the purpose is to examine whether bank-firm relationships impact the transmission channel.

Table 8. Long-term effect

	(1)	(2)	(3)	(4)
	All firms		Firms with loans	
After * Loans	-0.049*** (0.001)	-0.049*** (0.001)		
Loans	0.014* (0.072)	0.015* (0.060)		
After * Bank_firm			0.013** (0.013)	0.013** (0.017)
Bank_firm			0.014*** (0.004)	0.015*** (0.002)
After	0.051*** (0.001)	0.050*** (0.001)	-0.010*** (0.047)	-0.011*** (0.046)
Firm Balance sheet controls	yes	yes	yes	yes
Observations	8247	8247	6719	6719
R-squared	0.026	0.036	0.060	0.094
Year FE	yes	yes	yes	yes
Industry FE	no	yes	no	yes

This table reports OLS regression results using a panel data of 2,335 Chinese listed firms during 2011 and 2015, two years before and after the liquidity crunch. The dependent variable is investment ratio, i.e. the ratio of investment over total assets. *Bank_firm* equals 1 if the firm’s largest lender of long-term loans is a bank, 0 otherwise. *After* is a dummy that equals 1 for observations in 2013 and onwards. The sample contains all 2,355 non-financial listed firms in columns (1) and (2), and only 1,830 firms with loans in columns (3) and (4). Firm balance sheet controls are the same as in Table 3. Standard errors are clustered at industry level in all four columns and reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels.

Column (1) of Table 8 shows that the interaction terms between *Loan* and *After* are always negative and statistically significant at the 1% level. This suggests that firms with financing needs (i.e. those having outstanding loans at the end of 2012) tended to invest less after the liquidity crunch than their peers due to the negative shock to bank funding. On the other hand, we find positive and significant coefficients for the interaction term between *Bank_firm* and *After* in the last two columns. Here, firms that have lending relationships with banks maintain their levels of investment better than firms that only have lending relationships with non-bank financial institutions. This evidence bolsters our fourth hypothesis. The result is robust to include year and industry fixed effects, as well as certain firm balance sheet variables. We also investigate whether the ownership structure of relationship banks is related to the levels of investment. It shows that firms with lending relationships with foreign banks or state-owned banks have a significantly higher level of investments than firms without long-term bank relationships.¹⁸

In summary, we find that financial institution lending was a transmission channel for the June 2013 liquidity shock. On the one hand, firms that had outstanding loans performed worse during the liquidity crunch than firms without long-term loans, indicating that their lending relationships with banks induced a transmission of the liquidity shocks to them. On the other hand, such relationships also proved to help firms alleviate the liquidity shock impacts during and after the crisis relative to firms that borrowed mainly from non-bank institutions.¹⁹

¹⁸ These empirical results are not reported here, but are available upon request.

¹⁹ We also implement a dynamic treatment effects test through leads and lags of treatment as regressors. We plot the coefficients, as well as the confidence intervals, of the interaction terms between year and various firm type dummies. All coefficients are insignificant before the event year 2013 and statistically significantly different from zero after 2013. For the sake of brevity, we do not report these figures.

5. Conclusions

We use China's June 2013 liquidity crunch in the interbank market to study, in a natural setting, the negative shock to banks and the wealth effects on borrower firms. While institutional lending was shown to provide a channel for transmission of liquidity shocks, we find that firms with long-term banking relationships experienced smaller valuation losses than firms that borrowed from non-bank institutions. Firms that had no long-term loans (i.e. reported no outstanding loans at the end of 2012) were unscathed by the liquidity crunch. The effect was strongest for state-owned banks and foreign banks, and weakest for local banks. We further document a positive relationship between the stock performances of borrower firms and the stock performances of their lender banks and the liquidity positions of such banks in the interbank market. We also find evidence of a long-term impact of relationship lending on firm investment in the aftermath of the liquidity crunch.

Policymakers may find it worthwhile to consider both the short-term reactions of the stock market to an interbank liquidity crunch and the long-term impacts on firm investment. The PBOC is now well aware of the advantages and drawbacks of this policy tool in motivating prudent behavior and reducing moral hazard. Beyond this, we identify specific features of institutional lending and the bank-firm lending relationship in transmission of shocks in the interbank market to the stock market and the real economy that should be helpful to PBOC policymakers in optimizing future policies.

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Appendix 1.

Major financial events around or during the June 20, 2013 interbank liquidity crunch

Date	Event
2013/6/5	Agriculture Development Bank of China bond issue fails to attract subscribers.
2013/6/14	Treasury bond issue fails to attract subscribers.
2013/6/19	Premier Li Keqiang expresses government support for financial reforms. The overnight rate increases by about 200 basis points to 7.66%. The PBOC holds private talks with several big banks, prompting the banks to inject RMB 400 billion in liquidity into the system. The interbank market delays its closing by 30 min.
2013/6/20	The overnight rate is hiked by 578 basis points to 13.44%. The PBOC begins to issue central bank bills to reduce liquidity in the interbank market. A rumor flies that the Bank of China has defaulted in the interbank market.
2013/6/21	PBOC supplies RMB 50 billion RMB to Industrial and Commercial Bank of China. The overnight interbank interest rate drops about 500 basis points from the previous day to 8.49%.
2013/6/23	Several branches of the Industrial and Commercial Bank of China in Beijing and Shanghai are closed unexpectedly.
2013/6/24	Bank stocks crash. Shanghai Stock Exchange Composite Index decreases by about 5%, while stock prices of Ping An Bank, China Minsheng Bank, and China Industrial Bank each fall about 10%.
2013/6/25	PBOC suspends bill issue and declines to supply liquidity support to certain financial institutions.
2013/6/26	Overnight interbank interest rate cut to 5.55%.

Appendix 2.

This table reports definition and descriptive statistics for the bank-firm relationship, as well as firm and bank characteristics. The data are sourced from *CSMAR*, *BankFocus*, and *Wind*.

Variable	Definition	Mean	Median	Std. Dev.	Obs.
Loans	Equals 1 if a firm has outstanding loans in the end of 2012, 0 otherwise.	0.774	1	0.418	2377
Information disclosure	Equals 1 if a firm discloses long-term loan information in its 2012 annual report.	0.522	1	0.500	2377
Bank_firm	Equals 1 if firm has relationship bank, 0 otherwise.	0.581	1	0.494	1830
State-owned banks	Equals 1 if a firm's relationship bank is with one of the four large state-owned banks or three main policy banks.	0.646	1	0.498	1005
Local banks	Equals 1 if firm's relationship bank is with a local bank	0.085	0	0.259	1005
Joint-stock banks	Equals 1 if firm's relationship bank is with a joint-stock commercial bank.	0.239	0	0.169	1005
Foreign banks	Equals 1 if firm's relationship bank is with a foreign bank.	0.308	0	0.146	1005
Bank Interbank Position	Interbank Asset / Interbank Liability of bank that was the firm's biggest lender in 2012.	0.75	0.732	0.384	949
Bank CAR	CAR[-1, 1] of bank with which a firm had a relationship in 2012.	-0.046	-0.030	0.036	702
Total asset	Total assets (in RMB 1000) in 2012	5.04E+07	2.64E+06	6.31E+08	2377
Leverage	Total liabilities to total assets in 2012	0.435	0.434	0.232	2377
EBIT	Industry-adjusted EBIT in 2012	0.057	0.053	0.052	2377
Tobin's Q	Book value of total liabilities plus market value of total equity over book value of total assets in 2012.	1.893	1.583	1.087	2377
SOE	Equals 1 if firm was ultimately controlled by the government in 2012, 0 otherwise.	0.402	0	0.49	2377
ST	Equals 1 if firm received special treatment in 2012, 0 otherwise.	0.018	0	0.133	2377
Sales growth	Rate of sales growth in 2012.	0.156	0.066	0.543	2250
Stock liquidity	30-day average ratio of trading volume divided by tradable shares market value prior to event.	2.453	1.717	2.377	2375
Investment ratio	Investment over total assets.	0.116	0.053	2.138	11982

Risk Sharing and Industrial Specialization in China^{*}

By DU JULAN, HE QING, ZHANG CE^{*}

Abstract: *We investigate how risk sharing shapes industrial specialization across prefecture-level cities in China. By unbundling the mechanisms of risk sharing, we find that ex ante risk sharing generates a first-order stimulant effect on the geographical concentration of manufacturing industries, particularly for non-state-owned enterprises and cyclical industries. Ex post risk sharing matters only for state-owned enterprises. This result remains robust to instrument variable estimation and controlling for other determinants of industrial specialization. Finally, we show that interregional labor migration (special fiscal transfers) plays an important role in promoting interregional ex ante (ex post) risk sharing. The study implies that much more risk sharing and efficiency gains from industrial specialization would be achieved if capital markets and credit markets are better developed.*

Keywords: Risk sharing; Industrial specialization; State-owned enterprises; Cyclical industry; Cultural boundary

1. Introduction

The importance of production risk insurance in gaining benefits from industrial specialization is widely recognized (Brainard and Cooper, 1968; Ruffin 1974; Helpman and Razin, 1978). Specialization helps achieve higher economic growth but incur a greater variance of output (Saint-Paul, 1992). In the absence of insurance of production risks, the welfare losses due to the latter would outweigh the benefits brought by industrial specialization. If regions and countries can insure their idiosyncratic production risks, they are able to better explore comparative advantage by specializing in their productions (Greenwood and Jovanovic, 1990; Saint-Paul, 1992; Obstfeld, 1994; Acemoglu and Zilibotti, 1997). Consistently, Kalemli-Ozcan et al. (2003) provide evidence that more insurance is associated with higher specialization. Yet, the economic mechanism is yet to be well understood.

Theoretically, there are two ways to smooth regional output fluctuations in a market economy (Kalemli-Ozcan et al., 2003). First, residents in a region can geographically diversify their revenue sources among regions, primarily through capital markets, thereby insuring their income and smoothing their consumption (*ex ante*). Second, in response to income fluctuations (temporary shocks), residents in a region can mainly borrow or lend through credit markets to smooth their consumption (*ex post*) (Asdrubali et al., 1996). No effort has been made to unbundle these two mechanisms of risk sharing. Our main task is to demonstrate empirically the relative importance of *ex ante* vs *ex post* risk sharing in promoting industrial specialization.

This issue is particularly relevant for emerging market economies and developing countries. In advanced economies, the well-developed capital markets and credit markets serve as the primary instruments of *ex ante* and *ex post* risk sharing, respectively. They are both market-based

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mechanisms so that the government plays a minor role in achieving risk sharing. In contrast, emerging market economies and developing countries are typically characterized with financial repression where financial system is under excessive government control and intervention and highly underdeveloped. Government ownership or control of domestic banks is prevalent. Interest rates are subject to explicit or indirect capping so that banks can provide cheap loans to privileged large companies and governments. Equity markets and bond markets either do not exist or remain small. Excessive government control of and intervention in securities markets are prevalent. Under these circumstances, capital markets and credit markets can hardly benefit non-state-owned enterprises (non-SOEs), especially those small and medium-sized ones and large swathes of urban and rural households. They are thus hardly capable of shouldering heavy responsibilities of achieving *ex ante* and *ex post* risk sharing and supporting industrial specialization. Alternatively, labor migration, especially rural-urban migration, and the resultant remittances play a significant part in diversifying income sources and become an important means of *ex ante* risk sharing (Du et al., 2011; Balli and Rana, 2015). Special fiscal transfers and government aid become a primary means of *ex post* risk sharing in maintaining consumption in the wake of negative shocks. This pattern demonstrates that *ex ante* risk sharing relies primarily on the market-based mechanism, while *ex post* risk sharing on the government-orchestrated mechanism in emerging market economies and developing countries. Thus, the prevalent state-owned or state-controlled companies in these economies may benefit disproportionately from the government-administered *ex post* risk sharing mechanism, whereas their non-state counterparts from the market-based *ex ante* mechanism. Consequently, the geographic concentration of state-owned enterprises (SOEs) and that of non-SOEs could be significantly shaped by the *ex post* and *ex ante* risk sharing mechanism, respectively.

Using a large data set of China's manufacturing firms for the period 2003–2015, we empirically investigate the impacts of both *ex ante* and *ex post* risk sharing on geographic concentration of manufacturing activities. The case of China provides a unique opportunity among emerging market economies to gauge which risk sharing (*ex ante* vs *ex post*) is more closely related to production specialization. For instance, under repressive financial policies, China's state-dominated banking system channels formal credit to SOEs, while small and median-sized enterprises (SMEs) find it difficult to obtain bank credits (He et al., 2017), which is also typical for developing economies. China still has a dual-economy structure in which rural-urban migration plays an essential part in relieving rural poverty, a feature common to underdeveloped economies. Understanding China could have valuable policy implications for other emerging market economies.

In addition, China is a large country that includes all manufacturing industries³⁸. Industrial agglomeration across China's cities differs substantially (Lu and Tao, 2009; He et al., 2017). A large prefecture-level city sample and differentiated industrial patterns facilitate our empirical analysis, and such investigation is carried out by using consistent measures of risk sharing and industrial classification without a concern over measurement errors and estimation biases which are typically encountered in a cross-country analysis. Finally, the variation in the extent of risk sharing among provinces within China is similar to that across countries (Du et al., 2011), and the barrier to risk sharing across provinces is comparable to that across countries³⁹, making a study in the context of China valuable for both regional and international studies.

Following Kalemli-Ozcan et al. (2003), we define a risk sharing group as a country (China)

³⁸ Most economies are small and have only several sizeable industries.

³⁹ Some of China's provinces income levels are comparable to member countries of the Organization for Economic Co-operation and Development (OECD).

consisting of numerous regions (Cities), and calculate the income-based and consumption-based measures to proxy the degree of the *ex ante* and *ex post* risk sharing among cities within China. We then calculate an index of industrial specialization for each city within China, and check whether a city's degree of risk sharing with the other cities in China is positively associated with the city's degree of industrial production concentration. The results show that a better risk sharing entails a higher degree of industrial specialization. This effect is more pronounced in regions with a greater extent of income-based risk sharing (*ex ante* risk sharing). In contrast, the role of consumption-based risk sharing (*ex post* risk sharing) is more limited, and exerts no salient effects on the overall industrial specialization. In addition, we find that *ex ante* risk sharing has significant positive effects on regional specialization in cities with economic development zones, and the positive effect is more pronounced in cyclical industries.

Taking advantage of our detailed data, we further examine the industrial specialization of SOEs and non-SOEs, and find that *ex ante* and *ex post* risk sharing enhance the industrial specialization of non-SOEs and SOEs, respectively. This is consistent with our observation that the *ex ante* risk sharing channel is primarily market-based while the *ex post* one is mainly government-administered in China's emerging market economy.

Our results remain robust after controlling for a variety of traditional determinants of industrial specialization. Similar results are obtained by using alternative measures for industrial specialization as well as adopting various regression specifications. To guard the potential endogeneity problems, we search for instrumental variables (IVs) that are likely to be exogenous to industrial specialization. Specifically, we use the number of genealogies in each city and the distance between local dialect and Beijing Mandarin as two alternative instrumental variables for risk sharing. We also control for other traditional determinants of regional specialization. The positive relations between *ex ante* risk sharing as well as the total risk sharing and industrial specialization still survive.

Finally, we show that the interregional labor migration and special fiscal transfers play an important role in promoting inter-city *ex ante* and *ex post* risk sharing, respectively, which verifies that the *ex ante* and *ex post* risk sharing channels are primarily market-based and government-controlled ones, respectively, in China.

Our study makes several contributions to the literature on risk sharing and industrial specialization. First, this study is the first one to explicitly examine the effects of *ex ante* and *ex post* risk sharing on industrial specialization separately. Previous studies on risk sharing typically focus on examining the effects of risk sharing on economic activities or identifying the effects via different channels of risk sharing separately. For instance, several studies show that a full risk sharing leads to significant welfare gains (Backus et al., 1992; Obstfeld, 1994; Asdrubali et al., 1996; Lewis, 1996; Crucini, 1999). Kalemli-ozcan et al. (2003) find that the extent of risk sharing is positively related to industrial specialization. Hevia and Servén (2018) relates the degree of risk sharing to macro variables, and finds that higher risk sharing improves the gain from globalization. Asdrubali et al. (1996) identify the channels through capital market, federal government and credit market, and further estimate the components effect of risk sharing in achieving their current degree of risk sharing. Du et al. (2011) and Du et al. (2010) have documented different channels of risk sharing in China and the role of financial markets in achieving risk sharing. Asdrubali et al. (2018) investigate how government consumption smooths out macroeconomic shocks.

Our study complements and extends the literature by unbundling how *ex ante* and *ex post* risk sharing help shape the patterns of industrial specialization. Kalemli-ozcan et al. (2003) has suggested the effects of *ex ante* and *ex post* risk sharing on industrial specialization. However, they use a measure of income insurance (*ex ante*) and, alternatively, a measure of overall

consumption insurance (the whole risk sharing) in the empirical analysis. The difference in the impacts between *ex ante* and *ex post* risk sharing on industrial specialization remains unexplored.

Second, this study further links *ex ante* risk sharing and *ex post* risk sharing to both market-based risk sharing channels and the government-administered risk sharing channels. The market force and government intervention interact solidly throughout the reform of China, providing an excellent setting for examining how *ex ante* and *ex post* risk sharing affect economic activities.

In China's emerging market economy, the conventional primary market-based risk sharing mechanisms, namely, capital markets and credit markets, do not play a significant role in attaining risk sharing. This mainly reflects the underdevelopment of capital markets in China, and the SOE-oriented banking system that has not benefited much non-SOE businesses and households. It is mainly migrant labor's remittances and intergovernmental special transfers constitute the primary channels of *ex ante* and *ex post* risk sharing, respectively. In general, they are relatively primitive forms of risk sharing. Consequently, the *ex ante* risk sharing hinges on market forces, while the *ex post* risk sharing relies on the government's actions. Consequently, the extent of both *ex ante* and *ex post* risk sharing achieved is still limited, which deters industrial specialization and economic growth and results in substantial efficiency losses. This demonstrates an additional negative effect of an underdeveloped financial system which is often ignored in the literature.

Third, a large body of literature has examined the determinants of industrial specialization (Harrigan, 1999; Davis and Weinstein, 1999; Harrigan and Zakrajsek, 2000; van Riet et al., 2004). Besides the traditional determinants, such as production factor endowment, technology and knowledge, economic development, researchers have turned their attention to other determinants. New economic geography (Krugman, 1991) points out the role of economic liberalization in sharpening specialization, and a number of studies investigate the relationship between (financial and trade) openness and specialization (Imbs, 2004; Masten et al., 2008). Brülhart and Trionfetti (2001) focus on how the discriminatory public procurement affects the location of industries. Recently, various studies sought to explore the policy and institutional factors in the distribution of the industrial firms (Duranton and Puga, 2004; Johansson and Olaberria, 2014; Chor, 2010; Nunn and Trefler, 2013; He et al., 2017; Fan et al., 2021). Our study contributes to the literature by focusing on the mechanism of how risk sharing affects industrial specialization, and how risk sharing functions along with government intervention. We show that the market-based *ex ante* risk sharing contributes to the industrial specialization of non-SOEs, while the government-administered *ex post* risk sharing shapes the industrial specialization of SOEs. China's experience has general implications for other economies, especially emerging market economies and developing countries.

The rest of the paper is organized as follows. Section 2 develops our hypotheses. We describe the dataset, variable measures and summary statistics for key variables in Section 3. Section 4 investigates the impact of risk sharing as well as other factors on city-level industrial specialization. Robustness and sensitivity analyses are carried out in Section 5. Section 6 investigates the channels of *ex ante* and *ex post* risk sharing in China. Section 7 concludes.

2. Theory and hypotheses

The extent of risk sharing is expected to help shape the degree of industrial specialization. Production factors such as capital and labor can be allocated to different industries. Individuals and firms in each region face uncertainty in production in each sector. If they specialize in only one industry, once a negative production shock occurs⁴⁰, their incomes will be negatively affected

⁴⁰ The shock can be either region-specific or industry-specific.

so that they will not be able to meet their consumption needs. Thus, regions specializing in a small number of industries face production risks that may cause huge losses to their regional economy and considerable harm to social welfare (Kemp and Liviatan, 1973). If a perfect insurance market does exist, all regions can achieve perfect risk sharing with the help of such means as capital markets and fiscal transfers, and regions can achieve specialization in production to promote their economic growth (Obstfeld, 1994; Kalemli-Ozcan et al., 2003).

Consider a Chinese city, Daqing, which has the world's fourth most productive oilfield. It is a natural choice for the city to specialize in petroleum industry and related sectors. However, owing to its high dependence on petroleum industry which has contributed 50~55% of its GDP, Daqing finds itself being periodically affected by oil price fluctuations. For example, crude oil prices experienced a sharp slump in the period 2014–2015 when Brent crude price fell from 108.18 in January 2014 to 35.74 in December 2015. The oil price shock generated a tremendous impact on Daqing city, leading to a decline in its GDP growth rate from 7% in 2013 to 4.5% in 2014 and -2.3% in 2015. Approximately 2.7 million people who lived in Daqing city suffered significant economic losses. If residents had received revenues from investments or other income sources in other regions or received more government transfers or grants, their personal income would have been much less affected by the fall of GDP in Daqing city.

When interregional risk sharing is weak, individuals and firms in each region would have to share production risks internally through industrial diversification. They engage in different industries and products, and a relatively self-contained local economy may enable the region to better withstand production shocks. Consequently, resources are allocated to both the more productive sectors in which the region has comparative advantage and the less productive sectors that the region is not good at, which results in production efficiency losses. In contrast, when interregional risk sharing is strong, firms are able to endure elevated production shocks and exploit the benefits of industrial specialization. We have:

Hypothesis 1: Industrial production is likely to be more specialized in regions with a higher degree of risk sharing.

The previous studies suggested two mechanisms for insuring regional production risks (Asdrubali et al., 1996; Sørensen and Yosha, 1998; Kalemli-Ozcan et al., 2003). First, *ex ante* risk sharing. Residents in a region can geographically diversify their revenue sources across regions, thereby insuring income risks. Second, *ex post* risk sharing. In response to income fluctuations (transitory production shocks), residents in a region can borrow and lend or receive transfers or grants to smooth their consumption (*ex post* risk sharing).

One way to achieve *ex ante* risk sharing is the geographic diversification of income sources through interregional movements of production factors. By investing in capital markets and keeping stakes in corporations operating in various regions, a region can insure against idiosyncratic shocks and thus can better exploit the advantages of industrial specialization (Greenwood and Jovanovic, 1990; Saint-Paul, 1992; Kalemli-Ozcan et al., 2003; Basile and Girardi, 2010). In addition, the interregional labor flow and the associated cross-region remittances would diversify the geographic sources of labor income and contribute to risk sharing. Provided the importance of industrialization and urbanization and the underdeveloped capital markets in emerging market economies, this labor movement and remittances mechanism is expected to be particularly important for China and other developing countries. For instance, the remittances of migrant laborers are found to play an important part in enhancing income risk sharing in China (Du et al., 2011). Moreover, some types of fiscal flows such as taxes and social security are usually regarded as *ex ante* channels.

Ex post risk sharing takes many forms. Residents of a region can borrow or lend in interregional

credit markets in the wake of a shock to dampen income fluctuations and smooth their consumption (Kalemli-Ozcan et al., 2003). Some types of fiscal flows such as government subsidies and fiscal transfers can serve as a vehicle for consumption smoothing. For example, financial aid from various government-related agencies can help weather income shocks generated by natural disasters (Du et al., 2011).

It is noteworthy that in most emerging market economies and developing countries, like China, state-controlled banks are prevalent so that the government can influence credit allocation, and channel loans or subsidies to its favored industries and enterprises. In this sense, *ex post* risk sharing channels are largely put under the control of the government. In contrast, *ex ante* risk sharing channels, such as capital markets and migration, largely rely on market-based activities.

Along with China's market-oriented reforms, income sources for Chinese households have been increasingly diversified. Incomes from interregional capital and labor flows are expected to grow in importance in household income structure, which is likely to promote *ex ante* risk sharing. Meanwhile, bank credit still favors the state sector. Household credit is rather limited. National and subnational fiscal expenditures are biased toward promoting economic growth instead of supporting residents' livelihood. Thus, the banking sector and government expenditure are likely to play a minor role in enhancing individuals' risk sharing. We expect that *ex ante* risk sharing channels play a much larger part than *ex post* ones. Meanwhile, given the non-state sector accounts for the majority of employment, industrial output, and GDP in China, *ex ante* risk sharing is anticipated to be more influential in shaping industrial specialization than *ex post* risk sharing when we look at the whole economy⁴¹. Hence, we have:

Hypothesis 2: *Ex ante* risk sharing matters more for industrial specialization than *ex post* risk sharing.

Although China has achieved a remarkable economic growth fueled by non-SOEs, the commanding heights of the national economy, i.e., those strategically important sectors, are still under government control and SOEs play an important part. The spatial industrial distribution of SOEs is determined primarily by the industrial plan of the central and local governments with various strategic considerations. Local governments have incentives to design and implement industrial policies for SOEs, and require SOEs to specialize in certain industries (Catin et al., 2005), to achieve high economic growth by exploiting the benefits of specialization. By holding a substantial share of productive capacity in the form of SOEs and enjoying considerable discretion over the allocation of various resources, the local government can adopt industry-specific policies to guide their productions⁴². Thus, SOEs in general may have a higher degree of specialization, but at the same time are more likely to be fragile to production shocks. Nevertheless, the spatial industrial distribution of SOEs is largely independent of the impact of market-based *ex ante* risk sharing mechanisms because the government-administered *ex post* risk sharing mechanisms provide a strong backing to SOEs in the face of production shocks.

Once production shocks occur, the government would give priority to subsidizing and bailing out the SOEs, and the state-controlled banking system would offer credit to SOEs to help them cope with the shock⁴³. Hence, the government-orchestrated *ex post* risk sharing mechanisms are likely to provide insurance safety net for SOEs and enhance the industrial specialization of SOEs.

In contrast, the non-state sector is less likely to benefit from the government safety net as an *ex*

⁴¹ From 1978 to 2017, the private sector contributes more than 50% of tax revenue, 60% of the GDP, 70% of the innovation, 80% of the urban employment and 90% of enterprises according to Xi Jinping's speech at Private Enterprise Symposium in December 1st, 2018.

⁴² Though government competition brings other cities' experience, they usually copy it blindly, which lead to similar industrial structure (Young, 2000; Bai et al., 2004)

⁴³ In addition to government subsidies from special transfers, SOEs also enjoy privileged access to bank loans directed by both central and local governments (Eckaus, 2006).

post risk sharing channel because the bank loans and fiscal subsidy primarily go to SOEs (Eckaus, 2006). Then, the *ex ante* risk sharing working mainly through interregional capital and labor movements would be particularly relevant for the industrial specialization of non-SOEs.

Thus, we expect *ex post* risk sharing to be more relevant to specialization in the state-owned sector, while *ex ante* risk sharing is more important to the industrial specialization in the non-state sector.

Hypothesis 3: The positive effect of *ex ante* (*ex post*) risk sharing on industrial specialization is larger (smaller) in the non-state sector than in the state sector.

Note that industries also differ in their sensitivities to business cycles. The production of cyclical industries would typically magnify GDP fluctuations, whereas the output of non-cyclical industries is less subject to GDP fluctuations and would dampen GDP volatility. Typically, producer goods and durable consumption goods industries are more cyclical than non-durable consumption goods industries (Petersen and Strongin, 1996). For example, food production is considered as a non-cyclical industry because the demand for food will not vary much with GDP fluctuations. Equipment manufacturing is regarded as a cyclical industry, and the demand for equipment would show a larger volatility than does GDP. Besides, cyclical industries are often capital intensive, and tend to have high levels of operation leverage⁴⁴, which in turn increases their production risks. Since cyclical industries are subject more to production shocks generated by cyclical fluctuations, and exhibit a higher volatility facing a production shock, *ex post* risk sharing mechanisms, e.g. interregional credit or government subsidies and fiscal transfers, are likely to incur higher costs than *ex ante* risk sharing mechanisms⁴⁵. As a result, a better risk sharing, particular the *ex ante* one, is likely to be effective in promoting the industrial specialization of the cyclical sectors.

Even though *ex ante* risk sharing is likely to have larger impacts on the specialization of cyclical industries, some cyclical industries consist of mainly heavy industries, which are often industries with strategic importance and thus are subject extensively to the influences of government industrial policies and intervention. If our hypothesis that the government-administered *ex post* risk sharing mechanisms provide a strong backing to SOEs in the face of production shocks is correct, we should expect that *ex ante* risk sharing is more important to the cyclical industrial specialization of the non-state sector.

Hypothesis 4: The positive effects of risk sharing on industrial specialization are more salient in cyclical industries than in non-cyclical industries. *Ex ante* (*Ex post*) risk sharing particularly promotes non-SOE (SOE) industrial specialization in cyclical industries.

Specialization benefits from the dispersion of production risk, but under different institutional environments, the effectiveness of the risk sharing mechanism is different (Kalemli-Ozcan et al., 2003). The market force and local protectionism are two driving forces for market fragmentation and integration (Brandt et al., 2014). The market force tends to push forward industrial specialization by allocating resources to different industries in different geographic locations according to various endowments. Nevertheless, local protectionism is different. Under local protectionism, cities are committed to achieving a comprehensive industrial structure and a maximum self-sufficiency economy (Young, 2000; Bai et al., 2014). Moreover, they help maintain the comparative advantages of local companies through favorable loan and fiscal support, even administrative intervention. Therefore, local protectionism propels the local economy to move

⁴⁴ For instance, capital-intensive industries require a large amount of fixed asset investments, and should have a large scale of production to obtain an adequate investment return. Thus, capital-intensive industries are vulnerable to economic downturn, as they still need to pay fixed costs.

⁴⁵ Panjin city in Liaoning province specializes in petroleum industry and related sectors, which are typical cyclical industries. Dominated by large state-owned enterprises, Panjin city relies on the government-orchestrated *ex post* risk sharing mechanisms to maintain its specialization. Around 42.1% of its fiscal revenue in 2018 comes from the intergovernmental transfer system and fiscal subsidies.

toward a similar and comprehensive industrial structure across the country.

With the progress of economic reform and opening-up, China set up a list of special economic zones that concentrate the efforts and resources to build a sound infrastructure, create a high-standard business environment and form an efficient administration. Special economic zones are conducive to promoting the power of the market force, which further improves the effectiveness of *ex ante* risk sharing. Meanwhile, *ex post* risk sharing with the help of special transfers and credit resources is very important for the specialization of state-owned enterprises. Thus, we expect the effect of *ex ante* risk sharing on industrial specialization to be more pronounced in the cities with a higher degree of marketization, while *ex post* risk sharing still stimulates SOEs' industrial specialization.

In addition, economic shocks can be either persistent or temporary. The *ex ante* mechanism helps people smooth income, and is effective in insuring both permanent and temporary production shocks. Instead, *ex post* risk sharing is less effective in coping with highly persistent shocks, because fiscal transfers and bank credits help smooth consumption in the post-shock period but are helpless in achieving income diversification (Asdrubali et al., 1996; Corsetti et al., 2008). For instance, once production shocks (persistent shocks) affect a region specializing in a specific technology or project, inhabitants would likely suffer income decline and transfer to other industries. Risk sharing through *ex ante* channels would help smooth income, and inhabitants would not need to change their jobs. In areas with high *ex ante* risk sharing, inhabitants would be more likely to stay in their current jobs and gain experiences, for they expect high incomes in the future. As for *ex post* risk sharing, savings and fiscal transfers are not reliable means of risk sharing in the long run. Inhabitants still have a high incentive to switch to other industries. As a result, both risk sharing mechanisms are relevant to industrial specialization decisions, only the *ex ante* mechanism is effective in insuring persistent production shocks. Based on the above discussion, we have:

Hypothesis 5: *Ex ante* risk sharing plays a more salient part for industrial specialization than *ex post* risk sharing in cities with economic development zones or in sectors with high-persistence shocks, while *ex post* risk sharing still stimulates SOEs' industrial specialization.

3 Data, measures and summary statistics

3.1 Measuring risk sharing

The risk sharing group is a country (China) consisting of numerous regions (prefecture-level cities). We measure how much risk in a city within China is shared with other cities in the country by estimating the sensitivity of the city's income and consumption to idiosyncratic (city-specific) GDP fluctuations. Asdrubali et al. (1996) developed a panel regression method by estimating the proportion of idiosyncratic GDP shocks that are insured through various channels. To see how these measures work, we consider the following equations:

$$\Delta \log GDP_{it} - \Delta \log CONS_{it} = v_t + \beta_1 \Delta \log GDP_{it} + \epsilon_{it} \quad (1)$$

$$\Delta \log GDP_{it} - \Delta \log INC_{it} = v_t + \beta_2 \Delta \log GDP_{it} + \epsilon_{it} \quad (2)$$

$$\Delta \log INC_{it} - \Delta \log CONS_{it} = v_t + \beta_3 \Delta \log GDP_{it} + \epsilon_{it} \quad (3)$$

where $\Delta \log GDP_{it}$ is the growth rate of real GDP per capita for city i in year t . $\Delta \log INC_{it}$ is the growth rate of real income per capita for city i in year t . $\Delta \log CONS_{it}$ is the growth rate of real consumption per capita for city i in year t . v_t is the time fixed effect.

The overall degree of risk sharing is reflected in regression Model (1). If there is a perfect risk sharing, consumption does not co-move with GDP, which means the coefficient β_1 is equal to 1.

For most cities, the risk cannot be fully shared, and the coefficient lies between 0 and 1.

The extent of risk sharing can be further classified into two components: *ex ante* and *ex post* risk sharing. Equation (2) gauges the degree of income smoothing as *ex ante* risk sharing. Income smoothing is to maintain the stability of household income and minimize the transmission of GDP fluctuations to household income. It is mainly *ex ante* risk sharing because consumers diversify their income sources and asset allocation in advance to reduce income volatility arising from the idiosyncratic GDP shocks. If income smoothing is perfect, the co-movement of income and GDP would be driven down to zero, which implies $\beta_2 = 1$. An imperfect *ex ante* risk sharing implies $0 < \beta_2 < 1$. Thus, β_2 is a proxy of the extent of *ex ante* risk sharing.

Equation (3) addresses *ex post* risk sharing. It is likely that individual income would fluctuate as a result of various shocks. If *ex post* risk sharing channels such as direct fiscal transfers and grants are provided when individual income is hit after a negative shock, individual consumption would be much less affected. β_3 in Equation (3) captures the consumption smoothing provided by *ex post* risk sharing channels. When $\beta_3 = 1$, the co-movement of individual consumption and individual income would become zero, and perfect *ex post* risk sharing would be achieved. Usually, β_3 ranges from 0 to 1.

According to Asdrubali et al. (1996), Sørensen and Yosha (1998) and Kalemli-Ozcan et al. (2003), *ex ante* risk sharing channels incorporate those stemming from factor income movement and capital market investment return, which are achieved by portfolio diversification and multiple sources of income, while *ex post* risk sharing channels include borrowing and lending which smooth consumption. Specifically, capital market investments and security holdings, and remittances of income are *ex ante* risk sharing channels. Fiscal transfers take place in both *ex ante* and *ex post* risk sharing. Taxes and social security are usually regarded as *ex ante* channels, but direct transfers and grants to individuals are more likely to work after the shock as *ex post* risk sharing channels.

In our risk sharing measurement, it is not difficult to find $\beta_1 = \beta_2 + \beta_3$ through Equations (1) to (3). That is, the extent of total risk sharing is the sum of that of *ex ante* and that of *ex post* risk sharing.

Our analysis is based on prefectural-level cities in China. We exclude from the sample the four province-level municipalities, i.e., Beijing, Chongqing, Shanghai and Tianjin, because they are not comparable to other prefecture-level cities in the sample. Owing to the lack of data for Xizang and Taiwan, our sample contains 209 prefecture-level cities in 26 provinces. Appendix 1 lists the number of prefecture-level cities in each of the 26 provinces in our sample.

To construct the measures of risk sharing, we use GDP, consumption and income data at city level over the period from 2003 to 2015⁴⁶. Since cities in China consist of both urban areas and rural ones, we follow Xu (2008) and Du et al. (2011) to measure the city-level household income as the average of urban household disposable income and rural household net income in each city, and household consumption is measured as the average of urban and rural consumption expenditure per capita in each city⁴⁷. We use consumer price index (CPI) to convert household income and household consumption into real per capita values in 1990 Yuan. Because the price index at the city level is unavailable for most cities, we use the province-level CPI in the

⁴⁶ The data for urban household disposable income and rural household net income at the city level is available since 2002. The ASIF Data after 2015 is not yet available for our study period.

⁴⁷ Urban Household Survey and Rural Household Survey are conducted by the National Bureau of Statistics of China. Statistical criteria for urban rural survey were not united before 2014. After 2013, Rural Household Survey Yearbook has stopped publishing rural household net income data, which is replaced by rural disposable income. Disposable income for urban households is similar to the disposable income measure employed in the previous literature, which is the total income including personal income, operating income, capital income and direct transfers minus operating expenditure, taxes and social security contributions. Net income for rural households excludes operating expenditure, taxes and contributions to the collective, but does not exclude social security contributions and capital expenditure like money lent to the relatives. Consumption expenditure is composed of food, clothes, residence, household equipment, transport and communication, cultural and educational entertainment, health care and other expenditures.

calculation. To measure local disposable income and consumption, we first use data collected from the *Rural Household Survey Yearbook*, and the *Urban Household Survey Yearbook*. These survey yearbooks provide us with data on disposable income and consumption for urban and rural households in each city. The province-level CPI data are obtained from the *Comprehensive Statistical Data and Materials on 60 Years of New China* and China National Bureau of Statistics. Appendix 1 presents the mean values of annual average growth rates of GDP, household income and household consumption in each sample province over the years 2003-15.

3.2 Measuring industrial specialization

Industrial specialization is measured on the basis of the data drawn from *Annual Survey of Industrial Firms* (ASIF) conducted by China's Bureau of Statistics for the period of 2003-2015. ASIF covers all enterprises with annual sales of five million RMB or above in manufacturing industries.⁴⁸ For each firm in this dataset, we can access the information on the firm's 2-digit, 3-digit and 4-digit primary industry codes. The industry census data set also allows us to collect information on the firm's address, ownership structure and other financial conditions.

To measure regional specialization, we first extract the names of city and province from each firm's address in the ASIF dataset. We focus on prefecture-level cities, and estimate the industrial specialization index using firms' primary 2-digit industry code⁴⁹. In 2011, China started to use the new Industrial Classification for National Economic Activities (GB/T4754-2011) to replace the old classification system (GB/T4754-2002). To obtain a consistent measure of industry code, we convert the old industry codes to the new classification system. We estimate the city-level industrial specialization index for each sample year and then take the average over the sample period. Following Kalemli-Ozcan et al. (2003), we define the local industrial specialization as

$$Spec^i = \sum_{s=1}^S \left(\frac{OUTPUT_i^s}{OUTPUT_i^M} - \frac{1}{J-1} \sum_{j \neq i} \frac{OUTPUT_j^s}{OUTPUT_j^M} \right)^2 \quad (4)$$

where S is the number of industrial sectors and J is the number of cities in the risk sharing group. $OUTPUT_i^s$ is the gross industrial output value of sector s in city i . $OUTPUT_i^M$ is the total industrial output of all manufacturing sectors in city i . This measure takes industrial structure into account and reflects the deviation of the share of an industry in a city's output from that of the national average, which captures the degree of industrial specialization. The patterns of industrial specialization are different across regions, but they must be embodied in the concentration of output value.

3.3 Other variables

We also control for other traditional determinants, which, if omitted, may bias the estimates of the effects of risk sharing on industrial specialization. First, population and population density are included to control for the labor market effect (Kalemli-Ozcan et al., 2003). Imbs and Wacziarg (2003) find that economic development and regional specialization have an "inverted U-shape" relationship. So, GDP per capita and its squared term are added into our regressions. Second, factor endowment is crucial to the formation of industrial specialization (Krugman, 1991; Ellison and Glaeser, 1999). A high level of factor endowment can reduce costs and attract firms to produce in a specific region. To control for this impact, we compute the share of agricultural sector output in GDP and the ratio of mining sector gross output to total GDP⁵⁰ as a proxy of the city's natural

⁴⁸ ASIF also covers enterprises in mining and production and distribution of electricity, gas and water industries. The location choice for these industries is heavily influenced by resource endowments.

⁴⁹ In Section 5, we also use firms' primary 3-digit and 4-digit industry codes to estimate specialization. Similar results are obtained.

⁵⁰ As China City Statistics Yearbooks do not have the mining sector GDP, we construct the variable using gross output data from the ASIF.

resource endowments and fixed asset investment per capita as a proxy of the city's capital resource endowments. Young (2000) suggests that local protectionism in China brings about market segmentation, that is, cities have similar industrial structure. Regarding local protectionism, Bai et al. (2008) show that local governments that have a higher ratio of government expenditure to GDP are more likely subject to financial pressure, and thus are more likely to implement protection policies and obtain fiscal revenues for the public sector's expenditure. Following Bai et al. (2008), we use the ratio of local government expenditure to its GDP to capture the severity of local protectionism. Finally, Rosenthal and Strange (2001) show that knowledge can promote industrial specialization. We use the primary and secondary school enrollments as proxies. We also employ the freight volume to control for the influence of internal trade on industrial specialization. Data on these variables are drawn from *China City Statistics Yearbooks* and China National Bureau of Statistics. Variable definitions and data sources are shown in Appendix 2.

3.4 Summary statistics

Table 1 shows the summary statistics for our key variables. The city-level industrial specialization index is estimated by Equation (4). The mean value of city-level total risk sharing (*RS*) is 0.436, which is consistent with the finding of Du et al. (2011). The mean values of the *ex ante* risk sharing (*Ex ante RS*) and *ex post* risk sharing (*Ex post RS*) are 0.371 and 0.064, estimated using Equations (2) and (3), respectively. It suggests that the *ex ante* channels play a dominant role in risk sharing across prefecture-level cities in China.

Table 1: Summary statistics

Note: This table reports the summary statistics. N, mean, sd, min, p10, p50, p90, max stand for the number of sample observations, mean, standard deviation, minimum, 10-percentile, median, 90-percentile, and maximum, respectively. Variable definitions and data sources are contained in the Appendix

variable	observation	mean	sd	min	p10	p50	p90	max
Industrial Specialization Measurement								
Spec	209	0.140	0.123	0.020	0.041	0.099	0.315	0.784
HHI	209	0.200	0.137	0.065	0.086	0.152	0.392	0.852
Gini	209	0.701	0.108	0.461	0.555	0.689	0.845	0.952
Risk Sharing Measurement								
RS	209	0.436	0.166	0.025	0.252	0.415	0.624	1.099
Ex ante RS	209	0.371	0.168	-0.525	0.212	0.365	0.559	0.953
Ex post RS	209	0.064	0.121	-0.369	-0.042	0.063	0.156	1.067
Risk Sharing Channel Variables								
Migration ratio	2717	0.414	0.303	0.141	0.222	0.330	0.667	3.649
Capital market	2717	0.211	0.355	0.000	0.000	0.096	0.527	7.360
General transfer	1449	0.024	0.026	-0.041	-0.004	0.019	0.059	0.177
Special transfer	1449	0.021	0.031	-0.025	0.001	0.015	0.049	0.532
Credit market	2717	2.045	0.987	0.560	1.209	1.762	3.351	10.739
Control Variables								
POP	209	5.836	0.703	2.955	4.860	5.907	6.639	7.042
POPDEN	209	0.045	0.030	0.004	0.013	0.041	0.083	0.248
GPC	209	0.014	0.011	0.003	0.005	0.010	0.027	0.089
AGR	209	0.128	0.078	0.005	0.037	0.118	0.234	0.434
MIN	209	0.039	0.061	0.000	0.001	0.014	0.115	0.328
FAI	209	0.340	0.614	-1.328	-0.491	0.332	1.215	1.808
EDU	209	0.135	0.035	0.085	0.101	0.132	0.171	0.442
FISCAL	209	0.132	0.045	0.048	0.084	0.123	0.198	0.326
FREIGHT	209	3.989	0.707	1.852	3.031	4.019	4.925	5.862
Instrumental Variables								
Clanship	209	3.871	1.932	0	0.693	3.932	6.368	8.422
Dialect	209	2.347	0.463	1	2	2	3	3

To gain an insight on the impacts of risk sharing on industrial specialization, we examine the

patterns of industrial specialization over different ranges of local risk sharing. In Table 2, we consider the whole, *ex ante* and *ex post* risk sharing separately. For each type of risk sharing, we divide the sample into three subsamples, i.e., the cities with low, intermediate and high levels of risk sharing, and present the descriptive statistics for each subsample. When we look at the whole risk sharing, the mean (median) values of industrial specialization index increases from 0.106 (0.077) to 0.189 (0.136) as the level of risk sharing increases from the low-level group to the high-level one. Similarly, we find a significant increase in both the mean and median values of industrial specialization, i.e., from 0.099 (0.072) to 0.191 (0.141), as the level of the *ex ante* risk sharing increases from the low-level group to the high-level one. In contrast, the level of specialization does not change materially with the level of *ex post* risk sharing, which suggests an insignificant relationship between *ex post* risk sharing and industrial specialization.

Table 2 Descriptive statistics for industrial specialization sorted by the risk sharing index

Note: This table provides the descriptive statistics for the industrial specialization index (*Spec*). *Spec* is sorted by the risk sharing index *Risk sharing (RS)*, *Ex ante RS* and *Ex post RS*. Mean, median, standard deviation, 10-percentile, 90-percentile are reported in the table. P1 contains one-third of the sample observations, which have the lowest value of the risk sharing index. P3 contains the one-third of the sample observations, which have the highest value of the risk sharing index.

	Risk sharing			Ex ante Risk sharing			Ex post Risk sharing		
	P1	P2	P3	P1	P2	P3	P1	P2	P3
mean	0.106	0.126	0.189	0.099	0.130	0.191	0.151	0.120	0.148
median	0.077	0.100	0.136	0.072	0.104	0.141	0.100	0.089	0.095
s.d.	0.085	0.104	0.157	0.083	0.101	0.157	0.144	0.095	0.126
[10%,90%]	[0.039,0.195]	[0.038,0.294]	[0.060,0.432]	[0.038,0.180]	[0.042,0.260]	[0.065,0.432]	[0.047,0.324]	[0.041,0.260]	[0.039,0.347]

In Figures 1-3, we display the scatterplots based on simple regressions of the city-level industrial specialization index on the total, *ex ante*, and *ex post* measures of risk sharing, respectively. The solid regression-fitted lines for both whole and *ex ante* risk sharing have clear positive slopes, but the line turns slightly negative for the *ex post* risk sharing. These results provide further evidence that there are positive relations between industrial specialization and the whole and *ex ante* risk sharing.

Figures 1-3: Industrial specialization and the measures of risk sharing

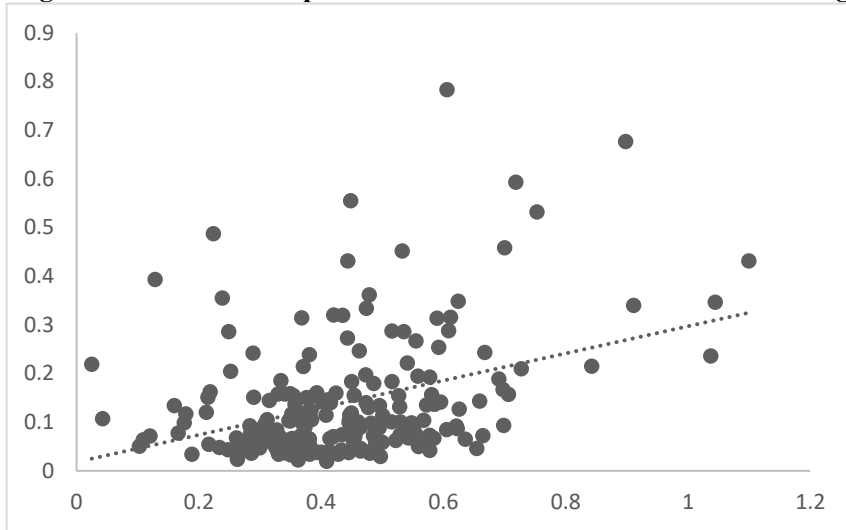


Figure 1: Specialization vs the whole risk sharing

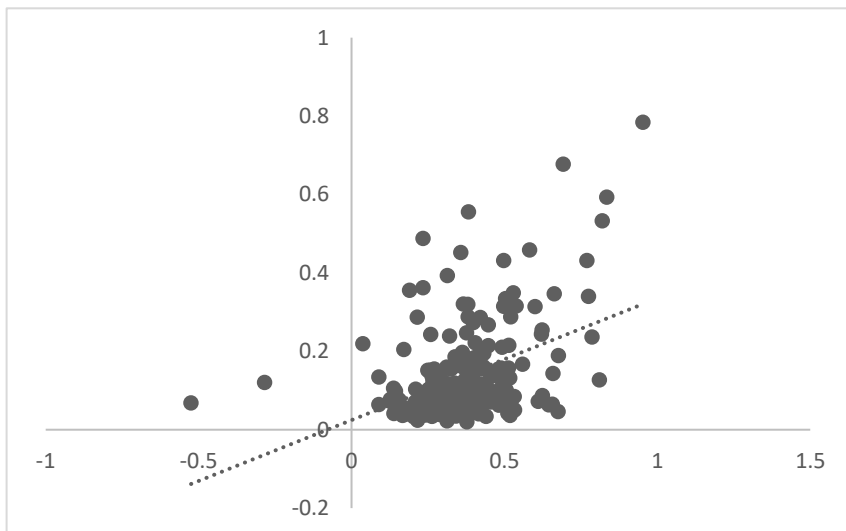


Figure 2: Specialization vs the *Ex ante* risk sharing

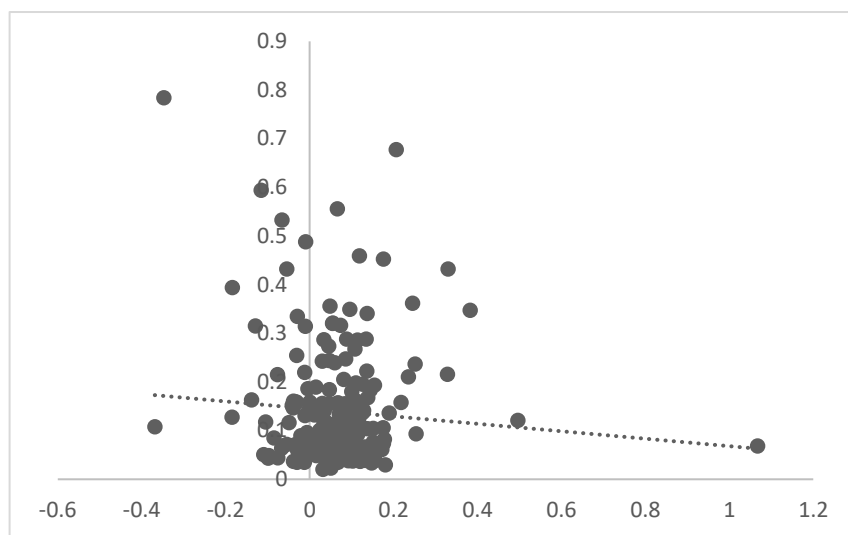


Figure 3: Specialization vs the *Ex post* risk sharing

4. Empirical results

4.1 Baseline results

We explore the relationship between risk sharing and industrial specialization using cross-sectional regressions. In all regressions, the dependent variable is the city-level industrial specialization index defined in Equation (4). Following Kalemli-Ozcan et al. (2003), we conduct all regressions using city-by-city manufacturing gross output as weights to limit the influence of some small-size cities with highly specialized industrial structure⁵¹.

In Table 3, the first three columns report regression estimates when we include only one of the three risk sharing measures in each regression separately. The whole and *ex ante* risk sharing indices produce positive and statistically significant effects on industrial specialization. Nonetheless, the estimated coefficient of the *ex post* risk sharing index is negative but statistically insignificant. These results support the hypotheses that the degree of risk sharing, in particular, *ex ante* risk sharing, is important for the geographic concentration of industrial production. This implies that risk sharing does matter for industrial specialization and the *ex ante* risk sharing channels are the primary force in shaping this pattern in China. The variation in the *ex post* risk sharing is rather weak in accounting for the inter-city variations in industrial specialization.

Next, we control for an array of other possible determinants of industrial specialization. The estimated coefficients of the whole and *ex ante* risk sharing are still positive and statistically significant at the 1% confidence level, but the magnitude of the estimated coefficients is small. According to these estimates, a one standard deviation increases in the overall risk sharing index increases industrial specialization by 0.201, and a one standard deviation increase in the *ex ante* risk sharing index leads to an increase of industrial specialization by 0.224. Taking an extreme case, we find that moving from the scenario without risk sharing to the scenario of perfect risk sharing would increase the industrial specialization index by 0.149, about 1.06 times of the sample

⁵¹ Kalemli-Ozcan et al. (2003) and Asdrubali et al. (1996) use manufacturing GDP and population, respectively. We use manufacturing gross output as weights. The results using population as weights are nearly the same. As population is included as a control variable, we do not use the population weights in our main results.

mean.

Turning to control variables, we find a negative and statistically significant impact on industrial specialization of city size as measured by the logarithm of population, which is consistent with the previous findings. The population density has a significantly negative impact on industrial specialization. Theoretically, industries with high transportation costs are inclined to concentrate in areas with high population densities, because the close-to-market location reduces transportation costs. However, population agglomeration also produces congestion costs that impede the concentration of industries in populous areas with low transportation costs. Our result lends partial support to the observation that industrial production seems to be concentrated in sparsely populated regions due to high congestion costs.

Next, the estimated coefficients of GDP per capita (GPC) are positive and statistically significant, while those of GDP per capita squared (GPC2) are negative and sometimes statistically significant. In contrast to the findings of Imbs and Wacziarg (2003), our results seem to lend support to an “inverted U-shaped” relationship between economic development level and local industrial specialization. We interpret this result as the consequence of the evolution of the market-oriented economic reforms in China. In the central planning period, every city had a full array of industries and a low level of industrial specialization. In the reform era, cities began to spin off the less competitive industries, devote resources to their core industries, and exhibit a positive correlation between industrial specialization and economic development. When economic development reaches a certain level, demand for new types of goods is generated, which is beyond what the old industrial structure can provide. Then, factors such as transportation costs and locating to the market start to work, causing a fall in specialization (Imbs and Wacziarg, 2003). The share of mining sector output in GDP (MIN) has little impact on industrial specialization. The fixed asset investment per capita (FAI) and the share of the primary sector in GDP (AGR) have a negative and significant effect on industrial specialization. In addition, the estimated coefficient of the ratio of primary and secondary school enrollments to population (EDU) is positive and statistically insignificant. Finally, local protectionism (FISCAL) and freight volume (FREIGHT) have an insignificant impact on industrial specialization, which implies that the government policy and internal trade have little impact on industrial specialization.

Table 3 Basic regression results

Note: The basic regression results are provided in Columns (1)-(3), in which the dependent variable is the city-level industrial specialization index. Regressions in Columns (4)-(6) include more control variables. Robust t-statistics are in parentheses, and *, **, *** stand for statistical significance at the 10%, 5%, and 1% level, respectively.

VARIABLES	Spec (1)	(2)	(3)	Spec (4)	(5)	(6)
RS	0.279*** (4.464)			0.149*** (2.651)		
Ex ante RS		0.312*** (3.858)			0.164*** (3.343)	
Ex post RS			-0.077 (-0.718)			-0.014 (-0.159)
POP				-0.065*** (-2.876)	-0.061*** (-2.660)	-0.071*** (-3.040)
POPDEN				-0.903*** (-3.362)	-0.881*** (-3.653)	-1.081*** (-3.835)
GPC				8.160** (2.537)	7.903** (2.442)	6.433** (2.024)
GPC2				-84.957* (-1.822)	-78.712* (-1.850)	-58.283 (-1.312)
AGR				-0.377*** (-2.652)	-0.356*** (-2.604)	-0.381*** (-2.743)
MIN				0.046 (0.327)	0.055 (0.374)	0.091 (0.537)
FAI				-0.093*** (-3.030)	-0.091*** (-2.977)	-0.083*** (-2.661)
EDU				0.384 (0.968)	0.290 (0.764)	0.371 (0.894)
FISCAL				0.070 (0.300)	0.104 (0.465)	0.001 (0.002)
FREIGHT				-0.002 (-0.094)	-0.003 (-0.169)	-0.004 (-0.221)
Constant	0.020 (0.766)	0.025 (0.890)	0.147*** (12.003)	0.435** (2.340)	0.420** (2.599)	0.576*** (3.470)
Observations	209	209	209	209	209	209
R-squared	0.142	0.183	0.006	0.404	0.409	0.372

The lack of significant effects of *ex post* risk sharing on industrial specialization could be a consequence of several factors. First, the extent of *ex post* risk sharing is much smaller than that of *ex ante* risk sharing. The *ex post* risk sharing channels such as special fiscal transfers and government subsidy are still rather weak in helping households weather negative income shocks, probably because local governments have limited fiscal capacity to provide fiscal subsidies and local government expenditure is typically biased toward infrastructure investment in most cities in China. Second, under financial repression, the state-controlled banking system offers very limited amounts of household credit (other than mortgage loans for property purchases), which are unlikely to provide effective risk sharing *ex post*. Furthermore, the corporate credit market is highly government-oriented, i.e., SOEs have privileged access to bank loans, whereas non-SOEs are typically disadvantaged. The government-controlled banking system distorts the allocation of resources, lowers the extent of *ex post* risk sharing achieved, and impedes industrial specialization.

When we look around the world, the relative strength of *ex ante* vis-à-vis *ex post* risk sharing varies from country to country and changes from time to time. For example, in the United States, the contribution of credit markets (*ex post* channel) to consumption smoothing fell from 45% to 19%, while that of capital markets (*ex ante* channel) increased from 34% to 48% from 1970 to 1990 (Asdrubali et al., 1996). *Ex post* channels contributed more than 40% to risk sharing in the European Community and OECD countries from 1966 to 1990 (Sørensen and Yosha, 1998). Cross-country analysis shows that *ex post* risk sharing takes place more generally, because cross-country portfolio holdings, as a major form of *ex ante* risk sharing, faces substantial obstacles.

When we examine a specific country, the patterns are much more varied. Among developed countries, United States, Italy, United Kingdom and Canada rely more on *ex ante* channels, while in Japan and Spain risk sharing is achieved mainly through *ex post* channels (Kalemli-Ozcan et al., 2003). The case of China will help us understand and further explore the *ex ante* vs *ex post* risk sharing channels in emerging economies and developing countries.

4.2 Industrial specialization of SOEs and non-SOEs

The impacts of risk sharing on industrial concentration may well differ between SOEs and non-SOEs. SOEs are typically subject more to the influences of governments' industrial policy and industrial development planning than do non-SOEs. Thus, the industrial distribution of SOEs may be less affected by *ex ante* risk sharing. To examine the differential effects of risk sharing arrangements on SOEs and non-SOEs, we first re-estimate the level of industrial specialization according to Equation (4) for SOEs and non-SOEs separately. Panel A of Table 4 shows that the mean and median levels of industrial specialization of SOEs across cities are statistically significantly higher than those of non-SOEs with the magnitude of the former being around 3-4 times as large as that of the latter. This suggests that local governments may pay attention to the need for industrial concentration to improve economic efficiency in their industrial planning, and the clustering of SOEs in certain sectors could be a result of this planning policy. In contrast, the market forces such as risk sharing remain weak so that the extent of industrial specialization of non-SOEs remains far below that of SOEs.

Panel B presents the regression results of the effects of risk sharing on SOE and non-SOE industrial specialization. In Columns (1)–(3), the whole, *ex ante* and *ex post* risk sharing all produce positive effects on industrial specialization of SOEs, and those of the whole and *ex post* risk sharing measures are statistically significant. In Columns (4)–(6), the whole and *ex ante* risk sharing measures produce positive and significant effects on the industrial specialization of non-SOEs, while the *ex post* risk sharing has negative but insignificant effects on specialization. This result is consistent with the pattern of the findings from the whole sample analysis in Table 3 since non-SOEs dominate the sample in terms of firm number. Moreover, the magnitude of the estimated coefficients of the two risk sharing measures is higher than that in Table 3. Consistent with our hypothesis, these results show that risk sharing affects the industrial specialization of both SOEs and non-SOEs, while *ex ante* and *ex post* risk sharing are the primary channels for non-SOE and SOE industrial specialization, respectively.

Table 4 SOEs vs Non-SOEs

Note: The basic descriptive statistics are displayed in Panel A. Besides the mean and median values, we provide comparison tests. The mean comparison test is a simple t test, and the null hypothesis is that the mean difference is zero. The median comparison test is Wilcoxon rank-sum test, and the null hypothesis is that the median difference is zero. Superscript * stands for statistical significance at the 5% level. In Panel B, the dependent variable for Columns (1)-(3) is the industrial specialization index calculated for state-owned enterprises, while the dependent variable for Columns (4)-(6) is the industrial specialization index calculated for non-state-owned enterprises. In Panel B, control variables are included but not reported, which include variables POP, POPDEN, GPC, GPC2, AGR, MIN, FAI, EDU, FISCAL, FREIGHT and a constant term. Robust t-statistics are reported in parentheses. Superscripts *, **, *** stand for statistical significance at the 10%, 5%, and 1% level, respectively.

	SOE			Non-SOE			dif
Mean	0.456			0.138			0.318*
Median	0.441			0.098			0.343*
VARIABLES	SOE (1)	(2)	(3)	Non-SOE (4)	(5)	(6)	
RS	0.119* (1.71)			0.160*** (2.934)			
Ex ante RS		0.016 (0.262)			0.181*** (3.591)		
Ex post RS			0.159** (2.11)			-0.023 (-0.253)	
Constant	1.066*** (6.690)	1.163*** (6.810)	1.178*** (7.863)	0.374** (1.995)	0.354** (2.186)	0.526*** (3.148)	
Observations	209	209	209	209	209	209	
R-squared	0.338	0.328	0.340	0.411	0.420	0.374	

Two features of SOE industrial specialization are noteworthy. First, as mentioned above, SOEs exhibit a significantly higher degree of industrial specialization than non-SOEs. As a matter of fact, the distribution of SOEs across industries is directly influenced and even to some extent controlled by governments at various levels. The governments typically take into consideration the endowment of resources and production factors and regional comparative advantage in industrial planning. The governments promote industrial concentration through government-orchestrated resource allocations, especially in some key industries which are believed to be the commanding heights of the national economy as well as the local economy. With government efforts, coupled with market-oriented economic reforms, SOEs exhibit an increasing concentration, especially in sectors of strategic importance. In the Fourth Plenary Session of the Fifteenth Central Committee of the Communist Party of China (1999), the policy was set for the reform of SOEs: SOEs should concentrate on industries that are vital to the maintenance of national security, natural monopoly industries, important public goods industries and high-tech industries, and exit from other industries. This reform policy could contribute to the pattern of elevated industrial specialization of SOEs.

Second, *ex post* risk sharing plays a striking role in shaping SOE industrial specialization, while *ex ante* risk sharing casts significant effects on non-SOE specialization. Comparatively speaking, the government has direct control or influence over *ex post* risk sharing channels. SOEs are the primary beneficiaries of the income flow generated by these *ex post* risk sharing channels. Once idiosyncratic risks severely affect business operation of an industry, fiscal subsidies and favorable loan policy from local governments will help SOEs get out of trouble. The SOE sector and consumers working in this sector would find their income less subject to industry-specific shocks. For the non-SOE sector, firms and consumers working in the sector do not have favorable access to the government's fiscal subsidies such as special transfers and state-controlled credit markets. Thus, they would rely primarily on *ex ante* risk sharing schemes to shield idiosyncratic risks.

4.3 Cyclical and non-cyclical industries

Industries also differ in their correlations with economic fluctuations. The outputs of cyclical industries are highly positively correlated with and would magnify GDP fluctuations. For instance, capital goods and durable consumer goods industries such as the steel industry and automobile industry thrive disproportionately when the economy booms, and they will decline disproportionately when the economy slumps. Non-cyclical industries produce or distribute goods and services people always need. Non-durable goods, mainly nondurable consumer goods, such as food, water and gas, are less likely influenced by economic boom or downturn.

In a city, cyclical industries more likely suffer from local production shocks. The effect of risk

sharing arrangement on industrial specialization is expected to be more pronounced in cyclical industries than in non-cyclical industries. We re-estimate the level of industrial specialization by considering the two types of industries, i.e., cyclical and non-cyclical industries⁵². In particular, we modify the specialization measure to examine the role of risk sharing in cyclical and noncyclical industries separately. From the descriptive statistics in Panel A of Table 5, the extent of specialization for cyclical industries looks slightly smaller than that for non-cyclical industries, but there are no statistically significant differences between the two.

Table 5 Cyclical vs non-cyclical industries

Note: Basic descriptive statistics are displayed in Panel A. Besides mean and median statistics, we provide comparison tests. Mean comparison tests are a simple t test, and the null hypothesis is the mean difference is zero. Median comparison test is Wilcoxon rank-sum test, and the null hypothesis is the median difference is zero. * stands for statistical significance at the 5% level. In Panel B, the dependent variable for columns (1)-(3) is the cyclical industry specialization index. The dependent variable for columns (4)-(6) is non-cyclical industry specialization index. In Panel C, the dependent variable for columns (1)-(3) is the specialization index calculated for stated-owned enterprises in cyclical industries. The dependent variable for columns (4)-(6) is the specialization index calculated for non-stated-owned enterprises in cyclical industries. In Panels B and C, control variables are included but not reported, including variables POP, POPDEN, GPC, GPC2, AGR, MIN, FAI, EDU, FISCAL, FREIGHT and a constant term. Robust t-statistics are reported in parentheses, and *, **, *** stand for statistical significance at the 10%, 5%, 1% level, respectively.

	Cyclical			Non-Cyclical			dif
mean	0.154			0.160			-0.006
median	0.113			0.136			-0.023
VARIABLES	Cyclical Industries			Non-Cyclical Industries			
	(1)	(2)	(3)	(4)	(5)	(6)	
RS	0.177*** (2.939)			-0.094 (-1.639)			
Ex ante RS		0.173*** (3.267)			-0.063 (-1.022)		
Ex post RS			0.016 (0.167)				-0.050 (-0.979)
Constant	0.353** (2.104)	0.357** (2.292)	0.521*** (3.242)	0.409*** (3.606)	0.380*** (3.296)	0.321*** (3.286)	
Observations	209	209	209	209	209	209	
R-squared	0.377	0.374	0.335	0.232	0.224	0.220	
VARIABLES	SOE Cyclical			Non-SOE Cyclical			
	(1)	(2)	(3)	(4)	(5)	(6)	
RS	0.068 (1.054)			0.182*** (3.045)			
Ex ante RS		-0.019 (-0.266)			0.183*** (3.304)		
Ex post RS			0.130* (1.800)				0.010 (0.102)
Constant	1.130*** (7.220)	1.205*** (7.344)	1.195*** (8.379)	0.294* (1.739)	0.295* (1.892)	0.467*** (2.906)	
Observations	209	209	209	209	209	209	
R-squared	0.338	0.335	0.343	0.386	0.384	0.340	

⁵² Cyclical sectors include manufacture of wood, bamboo, rattan, palm, and straw products, process of timber, manufacture of furniture, manufacture of paper and paper products, printing and recorded media, manufacture of articles for culture, education and sport activity, processing of petroleum, coking, processing of nuclear fuel, manufacture of chemical raw materials and chemical products, manufacture of chemical fibers, manufacture of rubber, manufacture of plastics, manufacture of non-metallic mineral products, smelting and processing of ferrous metals, smelting and processing of non-ferrous metal, manufacture of metal products, manufacture of general purpose machinery, manufacture of special purpose machinery, manufacture of electrical machinery and equipment, manufacture of communication equipment, computers and other electronic equipment, manufacture of measuring instruments and machinery for cultural activity and office work, and other manufacturing. Non-cyclical sectors include processing of food from agricultural products, manufacture of foods, manufacture of beverages, manufacture of tobacco, manufacture of textiles, manufacture of textile, apparel, footwear, and caps, manufacture of leather, fur, feather and related products, and manufacture of medicines.

Panel B of Table 5 shows the results for the two types of industries. In Columns (1) – (3), we estimate Equation (4) by focusing on cyclical industries. The estimated coefficients of the variables of the whole and *ex ante* risk sharing are positive and statistically significant. Columns (4) – (6) estimate Equation (4) in the subsample of non-cyclical industries. The estimated coefficients of all the three risk sharing measures are statistically insignificant. Consistent with our expectation, risk sharing arrangements are important for geographical specialization in cyclical industries.

In Panel C, we further estimate the SOEs' and non-SOEs' specialization in cyclical industries. Consistent with our expectation, the whole and *ex ante* risk sharing arrangements play a significant part in insuring the production risks and promoting industrial specialization of non-SOEs in the cyclical sectors. By contrast, only *ex post* risk sharing measures produce statistically significant effects on SOE specialization in cyclical industries. Local governments also have incentives to carry out industrial policies for SOEs, and require SOEs to specialize in certain industries, so as to achieve high economic growth by exploiting the benefits of specialization. Naturally, local governments will cover the downside risk of specialization by providing continuous credit support or government subsidies to the SOE sector. In this sense, local governments can use fiscal subsidies and state-controlled bank loans to provide a safety net for the SOE sector (*ex post* risk sharing), which facilitates the industrial specialization of SOEs.

Note that, our finding that *ex post* risk sharing promotes SOE industrial specialization when all industries are examined suggests that government policies play an increasingly important part in shaping SOE industrial specialization pattern. In addition, we observe the significant effects of risk sharing on SOE industrial specialization among cyclical industries. Cyclical industries consist of mainly heavy industries, which are often industries with strategic importance and thus are subject extensively to the influences of government industrial policies and intervention. Consequently, the *ex post* risk sharing channels are important in shaping SOE industrial specialization.

4.4 Economic development zones

As part of its economic reform, China designated four cities as special economic zones in 1980, and extended similar reform policies to 14 coastal opening-up cities in 1984. By the end of 2015, there were about 219 national-level economic and technological development zones in 158 cities. At the beginning, economic development zones were established to attract foreign direct investment (FDI), where enterprises received various benefits including tax exemptions or reductions, better infrastructure and facilities, more transparent regulations and simplified administrative procedures (Cheng and Kwan, 2000). These economic development zones serve the Chinese economy very well. With rapid development over 20 years, these areas have established relatively sound legal and institutional environments in order to attract and retain FDI, and played an instrumental role in spurring the regional economy⁵³. Besides, national-level economic zones are independent of the local governments of the cities hosting them, according to the regulations of the State Council, China's cabinet. It helps reduce the degree of local government intervention. For example, development zones can submit project applications directly to the State Council without the approval of local governments. Thus, cities with such national-level economic development zones are expected to have a more open and market-oriented

⁵³ ZONE cities have more market-oriented land and FDI policy, transparent regulations and simplified administrative procedures according to the following policy documents: No.85, 1991, from the General Office of the State Council; No.134, 1993, from the General Office of the State Council; No.15, 2005, from the General Office of the State Council; No.28, 2010, from the State Council; No.257, 2006, from the Ministry of Commerce and Ministry of Land and Resources; No.209, 2010, from the Ministry of Commerce and Ministry of Land and Resources; No.94, 2012, from the Ministry of Finance.

economy with better economic institutions.

There are several ways through which the reform and opening-up policy embodied in the cities hosting national economic development zones could shape the impacts of risk sharing arrangements on industrial specialization. First, the legal rules are potentially important determinants of what rights contract holders have, while the quality of law enforcement will determine how well these rights are protected. A strong legal and institutional environment can protect the interests of minority shareholders and improve the access of businesses and consumers to external financial markets, which in turn increases the efficiency of risk sharing arrangements. Second, streamlined regulation and simplified administration reduce the transactions costs of factor flows. In a broad sense, production factor flows include population flow, technology flow, capital flow, information flow and natural resources flow. As factor flows are the fundamental approach to resource allocations, they also strengthen the role of risk sharing mechanisms, especially *ex ante* channels. Finally, these economic development zones are policy-favored areas, which enjoy abundant credit and transfer resources than other cities. This is particularly important for the SOE sector, which relies more on *ex post* risk sharing channels. Thus, it is expected that risk sharing arrangements would have a larger impact on industrial specialization in cities with more open and market-oriented economies.

We obtain the list of national-level economic and technological development zones from the Ministry of Commerce of the People's Republic of China. We further classify cities into ZONE cities, where there are at least one economic and technological development zones, and OTHER cities otherwise. We then re-estimate our main specifications in the subsamples of ZONE cities and OTHER cities separately. Columns (1)–(3) of Panel A of Table 6 focus on the ZONE cities. The estimated coefficients of the whole and *ex ante* risk sharing indexes are both positive and statistically significant⁵⁴. For the other no-zone cities in Columns (4)–(6), the risk sharing indexes do not have significant effects on industrial specialization. Consistent with our expectation, ZONE cities have better market institutions. Consequently, risk sharing, especially *ex ante* risk sharing, is more effective in promoting industrial specialization.

Table 6 Alternative samples

Note: Panel A looks at the subsample of cities with national economic and technological development zones and the subsample of cities without such zones. We download the list of National Economic and Technological Development Zones from the website of the Ministry of Commerce of the People's Republic of China. Regressions in Columns (1)–(3) are based on the subsample of cities having at least one National Economic and Technological Development Zone (ZONE sample) while the regressions in Columns (4)–(6) are conducted in the subsample of cities without development zones (Non-ZONE sample). In Panel B, all regressions are conducted in the ZONE sample. The dependent variable for Columns (1)–(3) is the specialization index calculated for state-owned enterprises, while that for Columns (4)–(6) is the specialization index calculated for non-state-owned enterprises. Panel C follows Campbell and Mankiw (1987) to analyze shock persistence. In an AR(p) process, $\Delta x_t = \mu + \sum_{i=1}^p \varphi_i \Delta x_{t-i} + \varepsilon_t$, persistence of the shock is defined as $1/(1 - \sum_{i=1}^p \varphi_i)$. We use the real GDP per capita growth rate time series from 1990 in order to lower the estimation error and choose three lags which is consistent with Asdrubali et al. (1996). Regressions in Columns (1)–(3) are carried out in the low-persistence sample while those in Columns (4)–(6) are in the high persistence sample. In Panel D, all regressions are for the high-persistence sample. The dependent variable for Columns (1)–(3) is the specialization index

⁵⁴ The estimation results remain the same when we add entry year fixed effects controlling for different waves effect.

calculated for state-owned enterprises, while that for Columns (4)–(6) is the specialization index calculated for non-state-owned enterprises. In all these panels, control variables are included but not reported, including variables POP, POPDEN, GPC, GPC2, AGR, MIN, FAI, EDU, FISCAL, FREIGHT and constant. Robust t-statistics are in parentheses, and *, **, *** stand for statistical significance at the 10%, 5%, and 1% level, respectively.

VARIABLES	Zone Samples			Other Samples		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.183*** (2.842)			0.130 (1.568)		
Ex ante RS		0.211*** (2.703)			0.120 (1.564)	
Ex post RS			0.088 (0.487)			-0.040 (-0.425)
Constant	0.244 (1.228)	0.211 (1.244)	0.462** (2.123)	0.536* (1.724)	1.038*** (3.183)	0.643** (2.174)
Observations	107	107	107	102	102	102
R-squared	0.411	0.411	0.358	0.403	0.403	0.383
VARIABLES	SOE ZONE Samples			Non-SOE ZONE Samples		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.130 (1.334)			0.197*** (3.284)		
Ex ante RS		-0.002 (-0.020)			0.226*** (2.920)	
Ex post RS			0.477** (2.536)			0.096 (0.564)
Constant	1.064*** (3.894)	1.221*** (4.322)	1.220*** (5.330)	0.195 (0.970)	0.160 (0.914)	0.429* (1.952)
Observations	107	107	107	107	107	107
R-squared	0.306	0.296	0.334	0.461	0.460	0.399
VARIABLES	Low Persistence Sample			High Persistence Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.059 (0.856)			0.233*** (2.639)		
Ex ante RS		0.078 (1.331)			0.245*** (2.795)	
Ex post RS			-0.035 (-0.220)			0.010 (0.086)
Constant	0.680*** (3.187)	0.659*** (4.003)	0.747*** (4.134)	0.118 (0.429)	0.094 (0.331)	0.303 (1.110)
Observations	105	105	105	104	104	104
R-squared	0.529	0.533	0.525	0.369	0.370	0.297
VARIABLES	SOE High Persistence Samples			Non-SOE High Persistence Samples		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.327*** (3.469)			0.192*** (3.618)		
Ex ante RS		0.291 (1.454)			0.296*** (3.484)	
Ex post RS			0.324** (2.124)			0.091 (0.786)
Constant	0.817** (2.101)	0.906* (1.972)	1.114** (2.613)	0.168 (0.485)	0.102 (0.300)	0.393 (1.160)
Observations	104	104	104	104	104	104
R-squared	0.501	0.375	0.413	0.418	0.436	0.311

In Panel B of Table 6, we examine the impacts of risk sharing arrangements on SOE and non-SOE industrial specialization in ZONE cities separately. In Columns (1)–(3), the degree of the *ex post* risk sharing has positive and statistically significant effects on the industrial concentration of SOEs, while the whole and the *ex ante* risk sharing produce insignificant effects. In Columns (4)–(6), the whole and *ex ante* risk sharing arrangements cast positive and statistically significant effects on non-SOE industrial specialization, while *ex post* risk sharing produces positive but insignificant effects. Compared with the corresponding whole-sample results in Table 4, Panel B, the magnitude of the estimated coefficients of the *ex post* risk sharing measure in Column (3) and the *ex ante* risk sharing measure in Column (5) is larger in the ZONE city sample analysis. This suggests a potent influence of the *ex ante* and *ex post* risk sharing mechanisms on industrial

specialization in ZONE cities, which is made possible by the strong economic institutions, extensive production factor flows, and abundant financial and fiscal resources in these zone-hosting cities.

4.4 Permanent vs. temporary shocks

Economic shocks can be either permanent or temporary. *Ex ante* risk sharing helps smooth residents' income, and thus is effective in insuring against both permanent and temporary production shocks. In contrast, *ex post* risk sharing relies on borrowing and lending to smooth residents' consumption, and is more effective in dealing with temporary production shocks. When highly persistent shocks occur, portfolio investment and income diversification would help the city to smooth income and weather shocks so as to continue to specialize in the sectors with comparative advantage. Compared with the group of regions with lower-persistence shocks, regions facing higher-persistence shocks tend to have a larger and more significant capital market channel (*ex ante*) for consumption smoothing, but have a smaller and nearly insignificant credit market channel (*ex post*).

We further investigate the effect of risk sharing on industrial specialization in scenarios of persistent and temporary fluctuations. In reference to the measurement of persistence of economic fluctuations, Campbell and Mankiw (1987) define it as $1/(1 - \sum_{i=1}^p \varphi_i)$ in an AR(p) process: $\Delta x_t = \mu + \sum_{i=1}^p \varphi_i \Delta x_{t-i} + \varepsilon_t$. In order to lower the estimation error, we use the time series data of real GDP per capita growth rate starting from 1990, which is the best we can find at the city level, and choose one, two, and three years lagged values which are consistent with Asdrubali et al. (1996). Sorting the sample cities by the persistence of economic fluctuation, we split the sample into the low-persistence group and high-persistence group based on the sample median.

In Panel C of Table 6, we examine the effects of risk sharing on industrial specialization in the two subsamples separately. It is interesting that the statistically significant results are concentrated in the high-persistence group, i.e., the whole and *ex ante* risk sharing significantly promote industrial specialization. Moreover, the magnitude of the estimated coefficients is relatively larger than that of our basic regression results in Table 3. On the contrary, in the low-persistence group, there is no influence of risk sharing on specialization. Our interpretation is that risk sharing appears to be more important when facing persistent shocks and there are fluctuations that amplify the gain from risk sharing for a given level of industrial specialization. If a region has a perfectly diversified economy, it will be immune to idiosyncratic production shocks. Risk sharing mechanism is found to be useless in these regions. High-persistence shocks make the risk sharing mechanism indispensable to the determination of industrial structure. Besides, in our previous results, *ex ante* risk sharing plays the dominant role in coping with production risks. *Ex post* risk sharing can hardly work well in the face of high-persistence shocks as households need to constantly borrow much for a long period in the credit market or the government needs to regularly provide special fiscal transfers, which are costly and infeasible. *Ex ante* risk sharing naturally works well in a high-persistence environment, and it reinforces the relationship between risk sharing and industrial specialization in high-persistence samples.

We further examine the responses of SOE and non-SOE industrial specialization to risk sharing in the cities with high-persistence shocks. In Panel D of Table 6, Columns (1)–(3) look at the SOE specialization. The degrees of the whole and *ex post* risk sharing significantly promote SOE industrial specialization. Columns (4)–(6) report the results for the non-SOE industrial specialization. The degrees of the whole risk sharing and *ex ante* risk sharing have positive and statistically significant effects on non-SOE industrial specialization. This is consistent with the results in Panel B. Provided the dominance of non-SOEs in terms of sample firm number, *ex ante*

risk sharing plays a more important part in shaping the industrial specialization pattern in cities that are subject to persistent economic shocks.

5. Robustness tests

5.1 Sensitivity tests

In this section, we test the sensitivity and robustness of our basic results. We first consider the robustness of our results to alternative measures of local industrial specialization. We re-estimate Equation (4) using two alternative measures, namely Herfindahl index and the Gini index

$$HHI^i = \sum_{s=1}^S \left(\frac{OUTPUT_i^s}{OUTPUT_i^M} \right)^2 \quad (5)$$

$$Gini_i = \frac{1}{2S^2\mu} \sum_j \sum_k |s_{ij} - s_{ik}| \quad (6)$$

HHI^i is a direct measure of industrial specialization. S is the number of industrial sectors. $OUTPUT_i^s$ is the gross industrial output value of sector s in city i . $OUTPUT_i^M$ is the total industrial output of all manufacturing sectors in city i . If all economic activities in city i concentrate on a specific industry, $HHI^i = 1$. Similarly, if all economic activities in region i spread evenly among s number of industries, then the Herfindahl index would be $HHI^i = 1/s$. The index ranges from 0 to 1.

$Gini_i$ provides an alternative measure of geographic concentration of industries. s_{ij} and s_{ik} are the gross output share of sector j and sector k in city i , respectively. S represents the total number of sectors and μ denotes the average sector share. Gini index ranges from zero to one, reflecting the inequality of industry distribution. If all industries in a city have the same output share, Gini index takes value of zero and there is a perfectly diversified industrial structure. When a city concentrates on a specific sector, which means a completely specialized industry structure, the Gini index equals one.

In Panel A of Table 7, Columns (1)–(3) use the Herfindahl index as a measure of industrial specialization, whereas Columns (4)–(6) employ the Gini index. Because the “Gini index” ranges from zero to one and is similar across cities, we carry out the logit transformation of it to obtain the dependent variable. It is shown that when both measures are used, the estimated coefficients of the whole and *ex ante* risk sharing indicators are positive and statistically significant.

Panel B of Table 7 reports the sensitivity of our basic regressions to the alternative estimation method and alternative industry classifications. In Columns (1)–(3), we restrict the measures of risk sharing to a range from zero to one⁵⁵. In Columns (4)–(6), we calculate the industrial specialization index at the three-digit industry level and use it as the dependent variable.⁵⁶ All the results remain qualitatively equivalent. Risk sharing, in particular *ex ante* risk sharing, continues to be an important factor in shaping local industrial specialization.

Note that cities within a province are able to share their risks through interaction with other cities in the same province or with cities in other provinces (Ho et al., 2015). If *ex post* risk sharing is more likely to be a government orchestrated risk sharing mechanism, we should expect that *ex post* risk sharing should be more relevant to the risk sharing within a province. The rationale is that protectionism at the provincial level prevents a city from relying on financial resources in another province to bail out production risks. The more powerful the municipal government is, the more likely the city is able to use the financial resources within this province to insure its production risks. To provide further support to the hypothesis, we split the sample into large cities

⁵⁵ In theory, the level of regional risk sharing should vary from zero to one. Restricted regression allows us to rule out the impact of outliers that strongly affect the regression lines.

⁵⁶ We obtain similar results using four-digit level industry classification. For brevity, these results are not reported.

and small cities, based on whether the size of a city's GDP is above or below the median level of GDP within a province. Panel C reports the estimation results in both small and large cities. Consistent with our expectation, the *ex post* risk sharing has a more pronounced effect on industrial specialization in large cities, while it has no effect in small cities. A possible explanation is that large cities have a better access to fiscal resources within the province and can allocate more financial resources to SOEs.

As shown in Figures 1-3 providing the scatterplots of the relations between the three risk sharing indices and industrial specialization, some of the risk sharing measures could be suspected to be "outliers" which may be caused by the estimation error. To check the robustness, we conduct a sensitivity test by excluding the estimated coefficients with a level of low statistical significance. Columns (1)-(3) of Table 7, Panel D, report the estimation results in samples with estimated coefficients significant at the 10% level⁵⁷. All the results remain qualitatively unchanged.

The risk sharing mechanism mainly works through the dispersion of a city's risk among other cities over a long time period. The longer the sample period used to estimate risk sharing, the lower the measurement errors (Kalemli-Ozcan, et al., 2003). Therefore, longer time-series data is instrumental to the estimation of risk sharing indicators by minimizing the short-term disturbances. The baseline results in Table 3 are derived using cross-sectional regressions, where the risk sharing indicators are estimated with the whole sample period time-series data. Nevertheless, people may be concerned about whether there is a time dimension in the relationship between risk sharing and industrial specialization and whether this relationship still holds when considering the time dynamics. To address this concern, we estimate risk sharing over time and across regions. We follow Kose et al. (2009) by estimating the basic regression models (1)-(3) over nine-year rolling periods⁵⁸, and obtain the estimates of risk sharing over each 9-year period. Correspondingly, we also construct the averages of the specialization indices and control variables over the same 9-year period⁵⁹. We repeat the benchmark regression analysis by controlling for both city and year fixed effects. The results in Columns (4)-(6) of Panel D show that our empirical results remain qualitatively unchanged⁶⁰.

Table 7 Sensitivity tests

Panel A: Alternative measures of industrial specialization. Panel B: Alternative methods. Panel C: Small and large cities. Panel D: Other tests

Note: In Panel A, the dependent variable of Columns (1)-(3) is the HHI Index estimated by Equation (5). The dependent variable of Columns (4)-(6) is the logarithm of the Gini Index estimated by Equation (6). In Panel B, Columns (1)-(3) report the estimation results with the constraint that the risk sharing index β ranges from zero to unit. Columns (4)-(6) report the results of 3-digit industry classification. Panel C reports the estimation results in small cities (columns (1)-(3)) and large cities (columns (4)-(6)). Panel D provides additional tests. Columns (1)-(3) reports the estimation results in samples with estimated risk sharing coefficients significant at the 10% level. Columns (4)-(6) reports the estimation results using time varying risk sharing estimates over nine-year rolling periods. Control variables are included but not reported, including variables POP, POPDEN, GPC, GPC2, AGR, MIN, FAI, EDU, FISCAL, FREIGHT and constant. Column (4)-(6) additional controls the year and city fixed effects. Robust t-statistics are in parentheses, and *, **, *** stand for statistical significance at the 10%, 5%, 1% level, respectively.

⁵⁷ Due to the small sample size, we do not use samples with estimated coefficients significant at the 5% or 1% level.

⁵⁸ For example, the extent of whole risk sharing in 2011 is equal to β_1 , which represents the estimates for the period from 2003 to 2011.

⁵⁹ We also use the annual specialization indices and control variables and obtain similar results. For brevity, these results are not reported, but available upon request.

⁶⁰ The results remain unchanged after controlling city and province-year fixed effects.

VARIABLES	Herfindahl Index			Gini Index		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.177*** (2.943)			0.579*** (2.950)		
Ex ante RS		0.188*** (3.591)			0.621*** (3.402)	
Ex post RS			-0.005 (-0.053)			-0.029 (-0.091)
Constant	0.570*** (2.807)	0.561*** (3.130)	0.738*** (4.070)	3.020*** (4.994)	2.982*** (5.299)	3.569*** (6.420)
Observations	209	209	209	209	209	209
R-squared	0.435	0.438	0.395	0.538	0.540	0.517
VARIABLES	OLS Regression with Constraint			3-digit Industry Codes		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.150*** (2.605)			0.155*** (2.776)		
Ex ante RS		0.188*** (3.050)			0.169*** (3.539)	
Ex post RS			0.023 (0.222)			-0.013 (-0.141)
Constant	0.434** (2.338)	0.399** (2.433)	0.573*** (3.347)	0.504*** (2.707)	0.491*** (3.030)	0.651*** (3.951)
Observations	209	209	209	209	209	209
R-squared	0.403	0.410	0.372	0.446	0.451	0.409
VARIABLES	Small			Large		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.126*** (2.804)			0.227*** (3.414)		
Ex ante RS		0.144*** (3.137)			0.244** (2.486)	
Ex post RS			0.008 (0.108)			0.225*** (2.822)
Constant	-0.031 (-0.250)	-0.098 (-0.680)	0.101 (0.656)	0.332 (0.992)	0.193 (0.516)	0.536 (1.481)
Observations	98	98	98	111	111	111
R-squared	0.742	0.746	0.698	0.564	0.522	0.502
VARIABLES	Samples with estimated risk sharing coefficients significant at the 10% level			Time varying		
	(1)	(2)	(3)	(4)	(5)	(6)
RS	0.387*** (5.961)			0.031*** (3.884)		
Ex ante RS		0.421*** (4.522)			0.027*** (2.926)	
Ex post RS			0.054 (0.362)			0.004 (0.581)
Constant	-0.038 (-1.420)	-0.021 (-0.608)	0.153*** (4.302)	-0.816* (-1.822)	-0.692 (-1.533)	-0.647 (-1.392)
Year & City FE				YES	YES	YES
Observations	187	196	37	1045	1045	1045
R-squared	0.223	0.227	0.004	0.984	0.984	0.983

5.2 Endogeneity

There could be concern over the endogeneity of the relationship between risk sharing and industrial specialization. For example, cities that specialize in certain industries may have greater incentives to participate inter-regional risk sharing arrangements. To address this kind of concern, we use two distinct indicators of cultural barriers, specifically the number of genealogies in each city and the distance between the local dialect of a city and Beijing Mandarin, as the two alternative instrumental variables for risk sharing.

China has a long history of being a patriarchal society. In the traditional Chinese society, a clan was a large extended family where family members lived together and helped each other. Clanship, i.e., all members with a common patrilineal ancestor, built and sustained trust among clan members, which facilitated daily communications and lowered transactions costs. The culture of clanship naturally contributes to a practice of classifying people into groups with different

affinities. People would trust those who belong to the same clan more, and other people without blood relations less even when they lived nearby. Moreover, people from the same village, city or region are trusted more than those from outside. Clanship is bound up with local residents from their birth and gets strengthened throughout their whole life. People who live in the cities rich in clanship are expected to generate a strong cultural identity and emotional attachment to their clan and in turn their hometown. As found by Spolaore and Wacziarg (2015), people with different cultural identities are less likely to exchange with each other. Thus, given the persistence of the clanship culture, it is reasonable to expect that clanship generally shapes the current residents' local identity and further obstructs cross-city risk sharing by increasing interaction between residents within a city and deterring interpersonal exchanges between cities. The Chinese Genealogy Knowledge Service Platform in Shanghai Library provides comprehensive statistics of genealogies in China, including 76755 genealogies with their family names, genealogical ancient locations, starting time, printing methods and collection locations. Some of the genealogies' full texts are available online. Following Zhang (2020) and Fan et al. (2021), we use the number of genealogies in each city (*Clanship*) to measure the strength of the cultural legacy of clanship.

China, an old civilization with a vast land area and varied ethnic groups, has manifold and complex languages and dialects. Mandarin is the official language of China. It is formulated on the basis of Beijing Mandarin phonologically. However, Beijing Mandarin is only one of the 17 dialects of Chinese Han language, and is not even the dominant dialect in most cities⁶¹. For example, people in Shanghai speak Wu in their daily conversation rather than Beijing Mandarin. The literature highlights the importance of languages on cross-border exchanges (Grinblatt and Keloharju, 2001; Melitz and Toubal, 2014). Obviously, local dialects become a barrier to communication and mutual trust when residents in a city interact with people from other cities or provinces with a different dialect. A larger difference between dialects means a higher cost of cross-region economic exchanges. For instance, it is found that dialects, as a form of cultural identity, lead to "border effects" in intra-national migration and trade in China (Su et al., 2018; Wang and Ruan, 2019). Following Spolaore and Wacziarg (2015), we use language trees, a method borrowed from cladistics, to measure the distances among dialects within Han Chinese. Language trees denote the ancient relations among different dialects, reflecting the long-standing situations of economic and cultural exchanges between different cities and regions. Because our study is not conducted on the basis of city or province-pairs, we employ the distance between a local dialect and Beijing Mandarin to measure cultural barriers. Given Mandarin is the official language based on Beijing Mandarin, people would normally communicate with those speaking a different dialect in Mandarin. Nevertheless, a greater distance between a local dialect and Beijing Mandarin typically means it is more difficult for local residents to learn to speak Mandarin and less comfortable for them to communicate in Mandarin. Thus, they face more barriers to build trust in people from other regions around China, and are less likely to conduct economic and social exchanges with non-locals. Thanks to *Language Atlas of China* published by Commercial Press in 2012, we obtain the information on the dominant dialect in each city and the ancient relationship between different dialects. We use the distance between a local dialect and Beijing Mandarin (*Dialect*) to measure the dialect distance, and examine its effects on risk sharing (Appendix table 3 provides the language trees of Chinese Dialect).

The IV regression results are reported in Table 8. In Panel A, the second stage regressions show that the whole and *ex ante* risk sharing indices produce positive and statistically significant impacts on local industrial specialization, providing further support for the importance of *ex ante* risk sharing in promoting industrial specialization. From the first stage regression results in Panel B,

⁶¹ Zhang (2021) plots a map of different dialects' geographic distribution in China.

we observe that the number of genealogies in each city and the distance between local dialect and Beijing Mandarin are negatively correlated with the extent of risk sharing, both the whole risk sharing and the *ex ante* risk sharing. These results are consistent with the expectation of a negative relationship between cultural barriers and inter-city risk sharing⁶².

Table 8 Instrumental variable regressions

Note: This table reports the 2SLS regression results by using the number of genealogies in each city (Column (1)-(2)) and the distance between the local dialect of a city and Beijing Mandarin (Column (1)-(2)) as the two alternative instrumental variables. Panel A and Panel B report the second stage regression and the first stage regression, respectively. Control variables are included but not reported. Robust t-statistics are in parentheses, and *,**,*** stand for statistical significance at the 10%, 5%, and 1% level, respectively. The F-statistic in the first-stage provides the F statistic for the significance of the instrument, and the Prob>F is the p-value for weak instrument test. Panels C and D provide the results of exclusion restriction test. We use the residual from the second stage to conduct the regression on the instrumental variable and display the results in Panel C. Panel D reports the WLS results like Columns (4)-(6) in Table 3, but we employ the instrumental variable as an independent variable together with the risk sharing measure. Robust t-statistics are in parentheses, and *,**,*** stand for statistical significance at the 10%, 5%, and 1% level, respectively.

VARIABLES	(1)	(2)	(3)	(4)
Panel A Second Stage				
RS	0.511*** (3.041)		0.499** (2.519)	
Ex ante RS		0.783*** (3.065)		0.656*** (2.721)
Controls	YES	YES	YES	YES
Panel B First Stage				
Clanship	-0.029*** (-4.145)	-0.020*** (-3.633)		
Dialect			-0.101*** (-3.160)	-0.083*** (-3.351)
Controls	YES	YES	YES	YES
Observations	209	209	209	209
F-statistic	17.2	13.2	10.0	11.2
Prob > F	0.0001	0.0004	0.0018	0.0010
Panel C Residual regression on instrument				
Clanship	-0.005 (-1.603)	-0.005 (-1.578)		
Dialect			-0.019 (-1.551)	-0.018 (-1.454)
R2	0.012	0.011	0.009	0.008
Panel D Test of exclusion restriction				
RS	0.146*** (2.796)		0.147*** (2.660)	
Ex ante RS		0.154*** (3.728)		0.163*** (3.403)
Clanship	-0.014 (-1.308)	-0.014 (-1.303)		
Dialect			-0.048 (-1.463)	-0.044 (-1.506)
Controls	YES	YES	YES	YES

A valid instrument should satisfy both the relevance condition and exclusion restriction condition. From the first stage regression results, *Clanship* and *Dialect* are negatively and

⁶² Detailed results of first stage and second stage regressions are reported in Appendix 5.

statistically significantly correlated with the extent of both the whole and *ex ante* risk sharing. The associated F-value is 10 or above, which is sufficiently large to alleviate the concern over a weak instrumental variable (Staiger and Stock, 1997).

With regard to the exclusion restriction condition, i.e., the instrumental variable does not affect industrial specialization through channels other than risk sharing, we implement two additional tests on the exclusion restrictions. First, if the IV influences industrial specialization through other channels, the residuals of the second-stage regression should be correlated with the IV. The results in Panel C of Table 8 show that the correlation between the two variables is small and statistically insignificant at the conventional confidence level. Second, if the instrumental variable influences industrial specialization only through risk sharing channels, the IV should have statistically insignificant effects on industrial specialization conditional on risk sharing. In Panel D of Table 8, we regress industrial specialization on both the instrumental variable and risk sharing measures. The results show that all the estimated coefficients of the instrumental variables become statistically insignificant.

6. The nature of *ex ante* and *ex post* risk sharing channels

The causal mechanism of our main hypothesis is that the *ex ante* risk sharing channel is primarily market-based while the *ex post* one is mainly government-administered in shaping China industrial specializations. If our hypothesis is correct, we should observe that market factors and government-administered factors are the primary determinants of *ex ante* and *ex post* risk sharing, respectively. To provide further evidences, we use a standard risk sharing regression model that contains indicators of the various channels controlling for time and city fixed effects.

$$\Delta \log GDP_{it} - \Delta \log CON_{it} = v_t + \vartheta_i + \beta_2 \Delta \log GDP_{it} + \gamma \Delta \log GDP_{it} \times Channel_{it} + \epsilon_{it} \quad (7)$$

where $Channel_{it}$ is the set of indicators of *ex ante* or *ex post* risk sharing channels in region i . A positive value of the estimated coefficient vector γ indicates that the greater the value of these channel variables in a city, the greater the amount of risk sharing achieved there. In addition, to examine the specific channels of *ex ante* and *ex post* risk sharing separately, we conduct regressions with specifications of the following Equations (8) and (9), respectively. These channel regressions are similar to Equation (7) in specification but examine whether some potential channels truly contribute to *ex ante* or *ex post* risk sharing. If the estimated coefficient γ is statistically significant, that potential channel variable proves an effective *ex ante* or *ex post* risk sharing channel.

$$\Delta \log GDP_{it} - \Delta \log INC_{it} = v_t + \vartheta_i + \beta_2 \Delta \log GDP_{it} + \gamma \Delta \log GDP_{it} \times Channel_{it} + \epsilon_{it} \quad (8)$$

$$\Delta \log INC_{it} - \Delta \log CON_{it} = v_t + \vartheta_i + \beta_2 \Delta \log INC_{it} + \gamma \Delta \log INC_{it} \times Channel_{it} + \epsilon_{it} \quad (9)$$

6.1 *Ex ante* risk sharing channels

Capital markets

Capital markets primarily refer to bond markets and equity markets. China's capital markets have not achieved the goal of providing finance for large swathes of corporations, especially non-SOEs. China's corporate bond market is underdeveloped. According to China Securities Regulatory Commission (CSRC), the ratio of corporate bond issues outstanding to GDP in 2016 remained as low as 20.86%, and SOEs constituted 91% of the issuers. China's stock market has enjoyed rapid expansion since its formation in the early 1990s. The ratio of stock market capitalization to GDP surged from only 3.93% in 1992 to 68.28% in 2016. Nonetheless, China's equity market has long tilted toward SOEs, which still made up 38% of the listed firms at the end of 2016. The limited corporate coverage of the equity market is accompanied by a low participation rate (18%) of Chinese households in stock markets, according to China Household

Finance Survey, which is much lower than that in the U.S.⁶³ Moreover, China's equity markets are characterized with pervasive insider trading and speculations, which is manifested in high turnover rates of 249.2% (2016) in Shanghai and Shenzhen stock exchanges, much higher than those in most of matured financial markets (Allen et al, 2019). These deficiencies weaken the effectiveness of capital markets in resource allocation and risk diversification. To gauge the impact of capital markets on risk sharing, we construct a variable of *Capital markets* as the ratio of the sum of stock market capitalization and the outstanding principal balances of corporate bonds (long-term and short-term) to GDP (He et al., 2017).

Industrialization and urbanization process

China's industrialization and urbanization process has encouraged large numbers of redundant rural laborers to leave farming and the countryside to move either to cities within the same province or to the booming coastal provinces and cities (this form of migration is called *litu lixiang* in Chinese). However, because of the household registration system (*Hukou*), these migrant workers do not officially migrate to cities, but only take temporary jobs there. Typically, they remit a big chunk out of their wages back to their families in the countryside. Hence, rural-urban migration has substantially altered the sources of household income in rural China, especially in the poorer inland provinces. The remittance of non-farming income by migrant labor has become an increasingly important source of income for rural households (de Brauw and Giles, 2008) and, at the same time, an effective instrument for interregional risk sharing. Du et al. (2011) show that some alternative channels, such as urbanization and alternative finance, play important roles in promoting interprovincial consumption risk sharing. We use *Migration ratio*, the ratio of migration outflow and inflow over the population in a city, to gauge the size of migrant labor.

General fiscal transfer

China's fiscal transfer system differs from most western countries in that most of the local (both provincial and municipal) government's fiscal resources rely on transfers from the central government⁶⁴. In 1994, a far-reaching central-local government tax sharing reform resulted in a higher central government revenue and lower local government revenue. General transfers are determined in the government budget at the beginning of each year, which can hardly respond to emergency needs. General transfers aim to fill the gap between local revenue and local expenditure, as well as reduce economic disparity among regions⁶⁵. The amount of general transfers is calculated by a standardized method and listed in the government budget that must be approved by the local-level People's Congress in the beginning of the year. Under the flypaper effect, local governments have incentives to expand public spending, even for less efficient uses, in order to obtain a larger amount of general transfers from the upper-level governments in the next year. Gradually, general transfers become a conventional arrangement to alleviate disparity among different regions, and thus act more like a long-term institutional arrangement to balance interregional economic development; it varies little with the economic fluctuations during the year. In this sense, it can be regarded as an *ex ante* risk sharing mechanism.

6.2 Ex post risk sharing channels

Credit markets

China has a bank-centered financial system. According to the measures from World

63 According to the 2016 wave of Survey of Consumer Finances (SCF) in the US, more than 50% of households participate in the financial market by holding stocks or mutual funds.

64 Shen et al. (2012) provided a comprehensive review of fiscal decentralization in China.

65 The central-local government transfer system is especially important for inland cities. In hinterland cities in Xizang and Qinghai, nearly 90% of local budget counts on the central government transfers.

Development Indicators, the ratio of bank credit to GDP in China is 156.22% in 2016, much higher than the world average 87.13%. However, most of the credit is controlled by state-owned banks. SOEs enjoy a privileged access to bank credit, while non-SOEs have difficulties in gaining access to loans and struggle in the credit market. Household credit, especially consumption credit, is extremely limited. In addition, the Chinese government still maintains a strict regulation of bank operations. The government's dual role as the regulator and as the dominant owner in the banking sector diminishes the effectiveness of both the state-owned banks and the entire credit market⁶⁶. We use the ratio of the sum of loans and deposits to GDP as the proxy variable for the development of credit markets (see Appendix 2 for details).

Special fiscal transfers

Government fiscal transfers include both general transfers and special transfers. According to the *Administration Measures for the Special Transfer Payments from the Central Government to Local Governments* promulgated by Ministry of Finance in 2015, the central government provides funds for the local government to cope with natural disasters or other emergencies. In other words, special transfers are subsidies granted by the central government to the local government that undertakes specific-purpose tasks, including the aid for natural disasters, environmental protection, public transport, strategic industries, small firms, and renewable energy. Special transfers are made only if the local government undertakes corresponding tasks, so that they depend heavily on the government's strategic plan and economic performance in that year⁶⁷. Thus, special transfers are a representative *ex post* risk sharing channel. For instance, after the Wenchuan Earthquake in May 2008, special transfers to Wenchuan City rose by 14.4 times, increasing from 87 million yuan in 2007 to 1259 million yuan in 2008, while general transfers went up from 91 million yuan in 2007 to 204 million yuan in 2008. Beyond that, many fiscal subsidies come from special transfers helping enterprises share the risk after the production shock occurs. For example, local governments can subsidize the semiconductor industry from the strategic industry special funds after the outbreak of the China-US trade war. Special transfers are a direct way to share risk among cities, and not surprisingly, become an important means of risk sharing.

6.3 Regression results

Table 9, Panels A, B, and C, examine the channels of whole risk sharing, *ex ante* risk sharing, and *ex post* risk sharing, respectively. In each panel, we present estimation results for each potential risk sharing channel by including the interaction term between each risk sharing channel and output growth one by one. In addition, we also conduct a regression by putting all the interaction terms with potential risk sharing channels together to test their robustness⁶⁸.

In Panel A, Column (1), we find that migration has a positive and significant effect on the whole risk sharing. Its effect remains significant in Panel A, Column (6), when all the potential channel variables are included in the regression together. In Panel B, Columns (1) and (4), the regressions show that migration is a significant and robust *ex ante* risk sharing channel. This testifies to the important role of migration in achieving *ex ante* as well as whole risk sharing. The large-scale movement of labor across provinces and cities began after Deng Xiaoping's tour of South China in early 1992 to launch a new round of economic reforms that further promoted industrialization and urbanization. Increasing numbers of migrant workers have flowed from rural areas to cities within the province or large cities in other provinces. As a consequence, the share of total rural net income accounted for by non-farming income increased substantially from 26% in 1990 to 58%

⁶⁶ Even after several waves of deregulation and marketization, the central or local government is still the biggest shareholder of most of China's banks.

⁶⁷ Note that the local governments' revenue relies heavily on the fiscal transfer system. For example, China's local fiscal revenue was 14664 billion RMB in 2016, including general transfers of 3186 billion RMB and special transfers of 2071 billion RMB from the central government.

⁶⁸ As a robustness, we employ the initial year value of the channel variables and re-estimate the results, and obtain similar results.

in 2006 (National Statistics Bureau, 2007), to which the increasing value of remittances contributes a significant part. This not only reflects the industrialization process, but more importantly is evidence of the geographic and structural diversification of income sources of rural households.

Panel A, Column (2), suggests that capital market development significantly reduces the whole risk sharing when it is examined separately; nevertheless, Column (6) shows that the effect of capital markets is not robust when we include other potential risk sharing channels into the regression. From Panel B, Columns (2) and (4), we observe that capital market development plays a negligible part in achieving *ex ante* risk sharing in China. Although China's capital markets have developed fairly rapidly over the past three decades, the direct or indirect participation of households in capital markets still remains far from common and widespread. The cross-region or inter-city ownership of stocks and bonds is still relatively scarce so that it has not played a significant part in risk sharing.

In Panel A, Column (3) displays that general transfers do not have statistically significant effects on risk sharing, while Column (6) shows a 10% statistically significant negative effect of general transfers on the whole risk sharing conditional on other potential risk sharing channels. In Panel B, Columns (3) and (4), general transfers generate a positive but insignificant impact on the extent of *ex ante* risk sharing. This is not surprising. After the tax sharing reform in 1994, general transfers from the central government to provincial and municipal governments have become a regular arrangement to alleviate the disparity in fiscal revenues among regions. Moreover, general transfers are determined in the government budget at the beginning of each year, which can hardly respond to the changing local fiscal needs.

As shown in Panel A, Columns (4) and (6), special transfers play a striking role in improving the degree of whole risk sharing. Results in Panel C, Columns (1) and (3), demonstrate that special transfers serve as a significant *ex post* risk sharing channel. This substantiates our prediction that special fiscal transfers play a primary role in insuring residents' income and consumption in the wake of production shocks.

In Panel A, Columns (5) and (6), credit markets exert a negative and insignificant effect on the degree of the whole risk sharing. Similarly, in Panel C, Column (2) and (3) show that credit markets play an unpronounced role in affecting *ex post* risk sharing. Thus, credit markets are not an important channel for *ex post* risk sharing and the whole risk sharing. China's state-controlled banks favor enterprises that are state-owned or important to the local economy. When firms suffer from idiosyncratic shocks, SOEs are more likely to obtain credit, while non-SOEs are not. In addition, the formal credit markets including the banking system do not widely provide consumption loans. Hence, as the SOE sector accounts for a relatively small fraction of local GDP, the majority of economic agents get left out in formal credit markets. Thus, credit markets produce insignificant effects on consumption risk sharing, and even impede *ex post* risk sharing.

Table 9 Channels of consumption risk sharing in China

Panel A: Channels of the whole risk sharing in China. Panel B: Channels of *ex ante* risk sharing in China. Panel C: Channels of *ex post* risk sharing in China

Note: Panel A, Panel B and Panel C report the analyses of the channels of whole, *ex ante* and *ex post* risk sharing, respectively. Year fixed effects and city fixed effects are included but their estimates are not reported for brevity. Robust t-statistics clustered at the province level are in parentheses, and *, **, *** stand for statistical significance at the 10%, 5%, 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \log \text{GDP}_{it}$	0.883*** (30.800)	0.940*** (28.881)	0.916*** (16.979)	0.992*** (22.851)	0.965*** (16.594)	0.884*** (12.411)
$\Delta \log \text{GDP}_{it} \times \text{migration ratio}$	0.071** (2.013)					0.130*** (3.537)
$\Delta \log \text{GDP}_{it} \times \text{capital market}$		-7.945** (-2.164)				-7.529 (-1.659)
$\Delta \log \text{GDP}_{it} \times \text{general transfer}$			-1.256 (-0.832)			-3.173* (-1.818)
$\Delta \log \text{GDP}_{it} \times \text{special transfer}$				2.134*** (2.757)		2.545*** (4.107)
$\Delta \log \text{GDP}_{it} \times \text{credit market}$					-2.085 (-1.073)	-1.049 (-0.431)
Observations	2717	2717	1449	1456	2717	1449
R-squared	0.544	0.544	0.540	0.556	0.544	0.547
	(1)		(2)		(3)	(4)
$\Delta \log \text{GDP}_{it}$	0.855*** (37.781)		0.870*** (49.148)		0.907*** (43.662)	0.895*** (41.190)
$\Delta \log \text{GDP}_{it} \times \text{migration ratio}$	0.037*** (3.305)					0.018** (2.074)
$\Delta \log \text{GDP}_{it} \times \text{capital market}$			2.432 (1.467)			-0.535 (-0.257)
$\Delta \log \text{GDP}_{it} \times \text{general transfer}$					1.324 (1.147)	1.231 (1.107)
Observations	2717		2717		1449	1449
R-squared	0.633		0.633		0.551	0.552
	(1)		(2)		(3)	
$\Delta \log \text{INC}_{it}$	0.535** (2.265)		0.640** (2.596)		0.633** (2.085)	
$\Delta \log \text{INC}_{it} \times \text{special transfer}$	2.278*** (3.764)				2.057*** (3.743)	
$\Delta \log \text{INC}_{it} \times \text{credit market}$			-0.052 (-1.571)		-0.056 (-1.221)	
Observations	1456		2717		1456	
R-squared	0.302		0.207		0.305	

The channels of both *ex ante* risk sharing and *ex post* risk sharing incorporate market-based ones and government-administered ones. For advanced economies, capital markets and credit markets are the primary market-based mechanisms of *ex ante* and *ex post* risk sharing, respectively. In an emerging market and developing economy like China, these two primary market-based channels do not play the expected role in helping achieve risk sharing. The relatively underdeveloped capital markets and credit markets and the limited access to them make the formal financial system far from being able to provide appropriate, affordable and timely access to financial products and services for the majority of businesses and households. Consequently, the formal financial system is not able to help cities achieve risk sharing. Instead, migrants' remittances, a comparatively primitive form of market-based *ex ante* risk sharing mechanism, and the government-administered special transfers in response to emergency needs play the most significant part in attaining risk sharing for the cities. This shows that the market economy development in China is still rather insufficient and unbalanced. At the same time, the regular intergovernmental general transfers are not sufficient to ensure risk sharing. The special transfers made in response to emergency needs are particularly useful in providing subsidies to SOEs and households to achieve *ex post* risk sharing in the wake of some unexpected events. This displays the dwindling power of the government system in maintaining risk sharing. Hence, the Chinese economy is currently at such a stage that the market economy development has not been sufficient to allow the primary market-based channels such as capital markets to play a significant part in achieving risk sharing. At the same time, however, the general fiscal transfers are not strong enough to maintain *ex ante* and *ex post* risk sharing, either, although special transfers are instrumental to *ex post* risk sharing.

7. Conclusion

We dissect the relationship between risk sharing and industrial specialization in China. Unlike previous research based on a cross-country analysis, we concentrate on China as a representative of emerging market and developing economies, and conduct further exploration of the relationship between risk sharing and industrial specialization among prefecture-level cities in China. First, we unbundle the mechanisms of risk sharing into *ex ante* risk sharing and *ex post* risk sharing, and find that *ex ante* risk sharing as well as the whole risk sharing is important in promoting industrial specialization, whereas *ex post* risk sharing does not produce a significant impact. Second, our data sources allow us to refine the measurement of industrial specialization by separating SOE and non-SOE sectors and cyclical and non-cyclical industries. The effects of risk sharing on industrial specialization are more pronounced for the non-SOE sector and cyclical industries. Furthermore, the *ex post* risk sharing is significant in shaping the industrial concentration of SOEs, whereas the *ex ante* risk sharing primarily promotes the industrial specialization of non-SOEs. Third, whether institutional environment and the persistence of fluctuations affect the efficacy of risk sharing was discussed and modeled in the previous research (Obstfeld, 1994; van Wincoop, 1994; Asdrubali et al., 1996; Acemoglu and Zilibotti, 1997; Feeney, 1999). We provide empirical evidence for these theoretical models and show that risk sharing plays a more essential role in encouraging industrial specialization when the institutional environment is more appropriate and the economic fluctuation is more persistent. Fourth, we use the number of genealogies in each city and the distance between local dialect and Beijing Mandarin as instrumental variables to address the endogeneity concern in our intra-country setting, which provides a new efficient instrumental variable for risk sharing in the future research. Fifth, our research shows that interregional labor migration and special fiscal transfers are the primary means of *ex ante* and *ex post* risk sharing, respectively, in China. Capital markets and credit markets, which are the conventional dominant forces of *ex ante* and *ex post* risk sharing, respectively, in advanced economies are rather underdeveloped and far from inclusive, and thus they fail to play a significant part in promoting risk sharing.

This study demonstrates that the significant deterrent effect of the underdevelopment and the ownership-based discrimination of the capital market and the credit market on the attainment of risk sharing and the deepening of industrial specialization in China's emerging market economy. This is a negative side effect and cost of the underdeveloped financial system that lead to considerable efficiency losses. It is anticipated that a country can benefit tremendously from the efficiency gain from enhanced risk sharing and industrial specialization if its financial system is better developed. In this sense, our findings point to a largely ignored benefit of financial development in promoting economic growth and development, which is particularly relevant for emerging economies and developing countries.

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Appendix 1. City distribution and time series growth rates in China (2003–2015)

province	cities	GDP p.c.	income	consumption
Hebei	11	8.23%	7.58%	7.14%
Shanxi	6	10.46%	8.05%	7.35%
Inner Monogolia	4	14.49%	9.55%	7.84%
Liaoning	14	9.93%	8.67%	7.75%
Jilin	7	11.47%	7.60%	8.76%
Heilongjiang	11	7.81%	8.67%	9.31%
Jiangsu	11	11.27%	8.28%	7.59%
Zhejiang	9	9.92%	8.27%	7.20%
Anhui	11	10.85%	8.83%	7.85%
Fujian	8	9.78%	7.23%	7.25%
Jiangxi	6	12.37%	9.00%	8.34%
Shandong	14	10.31%	8.02%	7.27%
Henan	13	9.54%	8.58%	8.39%
Hubei	10	10.05%	8.01%	6.76%
Hunan	11	10.65%	7.69%	7.15%
Guangdong	18	9.40%	7.12%	6.11%
Guangxi	8	9.66%	7.86%	6.75%
Hainan	2	10.00%	7.83%	6.62%
Sichuan	12	10.80%	8.39%	7.62%
Guizhou	3	13.24%	8.22%	8.28%
Yunnan	3	9.11%	8.25%	9.02%
Shannxi	7	12.74%	9.60%	8.88%
Ningxia	5	9.54%	7.55%	6.94%
Qinghai	1	13.42%	6.58%	7.33%
Gansu	2	12.88%	7.47%	7.09%
Xijiang	2	7.99%	6.27%	7.36%

Notes: We present the annual average growth rates of several key variables for sample cities within each sample province. GDP per capita is the gross domestic product per capita. Income is the average of urban household disposable income and rural household net income. Consumption is measured as the average of urban and rural consumption expenditure per capita. The growth rates are calculated in terms of real Yuan in each year and take the average value for the period 2003–2015. All the growth rates are the averages of the sample cities in this province. Sources: Urban Household Survey, Rural Household Survey, China City Statistics Yearbooks, Comprehensive Statistical Data and Materials on 60 Years of New China, China National Bureau of Statistics.

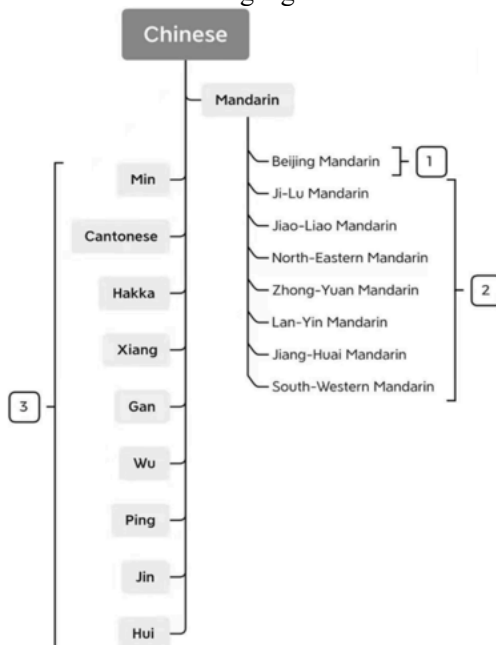
Appendix 2. Variable definition and data sources

variable	definition	data sources
Spec	industrial specialization index following Kalemli-Ozcan et al. (2003)	Annual Survey of Industrial Firms
HHI	industry Herfindahl index based on Herfindahl index, measuring industry concentration in a city	Annual Survey of Industrial Firms
Gini	industry Gini index based on Gini Coefficient, measuring the distribution of different industries in a city	Annual Survey of Industrial Firms
RS	whole risk sharing index	Urban Household Survey, Rural Household Survey, China City Statistics Yearbooks
<i>Ex ante</i> RS	<i>Ex ante</i> risk sharing index	Urban Household Survey, Rural Household Survey, China City Statistics Yearbooks
<i>Ex post</i> RS	<i>Ex post</i> risk sharing index	Urban Household Survey, Rural Household Survey, China City Statistics Yearbooks
Migration ratio	the ratio of migration outflow and inflow over population	China City Statistics Yearbooks
Capital market	the ratio of stock market capitalization and corporate bond (long-term and short-term) outstanding principal balance to GDP	China City Statistics Yearbooks; Wind Financial Terminal
General transfer	the ratio of net general transfer (inflow minus outflow) to GDP	China City Finance Statistics Yearbooks
Special transfer	the ratio of net special transfer (inflow minus outflow) to GDP	China City Finance Statistics Yearbooks
Credit market	the ratio of loans and deposits to GDP	China City Statistics Yearbooks
POP	the logarithm of population (10 thousand)	China City Statistics Yearbooks
POPDEN	population density (10 thousand/sq km)	China City Statistics Yearbooks
GPC	gross domestic product per capita (real million yuan)	China City Statistics Yearbooks
AGR	the ratio of agricultural sector GDP to total GDP (%)	China City Statistics Yearbooks
MIN	the ratio of mining sector gross output ($\div 10$) to total GDP (%)	Annual Survey of Industrial Firms, China City Statistics Yearbooks
FAI	the logarithm of fixed asset investment per capita	China City Statistics Yearbooks
EDU	the ratio of primary and secondary school enrollment to population (100%)	China City Statistics Yearbooks
FISCAL	the ratio of fiscal expenditure to total GDP	China City Statistics Yearbooks
FREIGHT	the logarithm of freight (in million tons)	China City Statistics Yearbooks
Clanship	the logarithm of the number of genealogies	Shanghai Library
Dialect	the distance between local dialect and Beijing Mandarin	Language Atlas of China

Note: The inflation prices for each province are drawn from Comprehensive Statistical Data and Materials on 60 Years of New China and China National Bureau of Statistics.

Appendix 3. Chinese Dialect Language Tree

Note: This image provides the language tree and detail distance scores for each dialect. Not only Madarin, other dialects also have sub-branches, but they all equal to the same score 3 and are unnecessary to list them here. Data source: Language Atlas of China



Appendix 4. Spearman rank correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Spec	1												
2 RS	0.30*	1											
3 <i>Ex ante</i> RS	0.35*	0.83*	1										
4 <i>Ex post</i> RS	-0.01	0.33*	-0.17	1									
5 POP	-0.52*	-0.34*	-0.40*	0.03	1								
6 POPDEN	-0.41*	-0.28*	-0.34*	0.05	0.42*	1							
7 GPC	-0.01	0.08	0.11	-0.03	-0.18	0.20*	1						
8 AGR	-0.09	-0.04	-0.09	0.08	0.18	-0.24*	-0.81*	1					
9 MIN	0.24*	0.22*	0.20*	0.09	-0.22*	-0.31*	-0.17	0.05	1				
10 FAI	-0.04	0.12	0.13	-0.02	-0.19*	0.19*	0.93*	-0.80*	-0.13	1			
11 EDU	0.12	-0.01	0.10	-0.23*	0.00	0.21*	-0.10	-0.11	-0.03	-0.08	1		
12 FISCAL	0.25*	0.09	0.09	0.02	-0.23*	-0.50*	-0.69*	0.53*	0.23*	-0.56*	-0.03	1	
13 FREIGHT	-0.37*	-0.14	-0.22*	0.10	0.62*	0.38*	0.36*	-0.36*	-0.09	0.36*	-0.05	-0.47*	1

Note: This table provides spearman rank correlations of risk sharing indicators and specialization. * indicates statistical significance at the 1% level.

Appendix 5. detail results of IV regression

VARIABLES	(1)	(2)	(3)	(4)
RS	First	Second	First	Second
		0.511*** (3.041)		0.499** (2.519)
<i>Ex ante</i> RS			0.783*** (3.065)	0.656*** (2.721)
Clanship	-0.029*** (-4.145)		-0.020*** (-3.633)	
Dialect				-0.101*** (-3.160)
POP	-0.010 (-0.323)	-0.063*** (-2.957)	0.020 (0.849)	-0.075*** (-3.571)
POPDEN	0.245 (0.476)	-0.620* (-1.737)	0.181 (0.443)	-0.692* (-1.837)
GPC	-15.218** (-2.123)	16.200*** (3.080)	-3.897 (-0.695)	11.997** (2.326)
GPC2	209.066** (2.138)	-152.889** (-2.099)	96.945 (1.272)	-129.179* (-1.789)
AGR	0.145 (0.945)	-0.058 (-0.503)	-0.061 (-0.509)	0.003 (0.031)
MIN	0.162 (1.042)	-0.092 (-0.783)	0.127 (1.066)	-0.164 (-1.345)
FAI	0.066 (1.594)	-0.100*** (-3.351)	-0.036 (-1.079)	-0.039 (-1.197)
EDU	-1.139*** (-3.198)	1.142*** (3.593)	-0.535* (-1.873)	1.035*** (3.458)
FISCAL	-0.991*** (-3.425)	0.615** (2.486)	-0.537** (-2.365)	0.551** (2.302)
FREIGHT	-0.026 (-0.962)	0.024 (1.249)	-0.024 (-1.141)	0.026 (1.243)
Constant	0.766*** (4.635)	-0.038 (-0.212)	0.314** (2.291)	0.098 (0.628)
Observations	209	209	209	209
R-squared	0.607	0.339	0.696	0.289

Note: This table provides details about IV model specification and estimation results for both first stage and second stage. Robust t-statistics are in parentheses, and *, **, *** stand for statistical significance at the 10%, 5%, 1% level, respectively.

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