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Special Column on the NPC and CPPCC Sessions

Turning Institutional Strength into Governance Efficiency*

By JIN NUO*

In the *Proposal of the CPC Central Committee on Formulating the 14th Five-Year Plan for National Economic and Social Development and the Long-term Goals for 2035* (hereinafter referred to as the Proposal) adopted in the 5th Plenary Session of the 19th CPC Central Committee, "ensuring new upgrade of the governance efficiency" has been set as one main goal of our country's economic and social development in the next 5 years and important decisions made for advancing the modernization of governance system and capability during the 14th Five-Year Period. An accurate grasp of the significance, requirements and methods of delivering this critical goal plays an important role in furthering modernization of governance system and capability, turning our institutional strength into governance efficiency and ultimately making great strides in delivering on our promise of a modern socialist country in all aspects.

Upgrading Governance Efficiency is of Great Significance

Governance system and capability are the epitome of a country's system and its executive capability. In practice, governance body is responsible for implementing and executing the system to achieve certain effects, goals and efficiency. A review of the evolution of governance suggests that a country's governance efficiency is a direct reflection of the modernity of its governance system and ability and an important gauge of the effectiveness of the system. It can be said that upgrading governance efficiency is a critical aspect and goal of advancing modernized governance and has momentous implications on our persistence in and improvements of China's system of socialism with Chinese characteristics.

Since the 18th National People's Congress of CPC, the Central Committee with comrade Xi as its core has held institution building to a more prominent position and has scored historic achievements in upgrading governance, improved socialism with Chinese characteristics, governance system and more modernized governance capability. As General Secretary Xi Jinping pointed out, "we should enhance the institutional enforcement and introduce more stringent oversight for making substantive progress in turning our institutional strength into governance efficiency". There are notable advantages in our state system and governance system. Only when such advantages are transformed into governance efficiency can the system showcase its power in safeguarding and uniting Chinese people of all ethnic groups to tide over difficulties and push forward our undertakings.

As required by the decisions about the 2nd centennial objectives made in the 19th National People's Congress of CPC, by 2035, we need to basically achieve socialist modernization in our

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country, one key aspect of which is modernization of governance system and capability. Currently, we still face some shortcomings and weaknesses in our governance, such as institutional enforcement and oversight. To further upgrade our governance efficiency is in line with the master design for achieving a modernized governance system and capability while taking into consideration the 2nd centennial objectives and the need to focus on both goals and problems. This will be the prioritized goal of the 14th Five-Year Period as required by the ultimate goal of building a modern socialist country in all aspects.

An Accurate Grasp of Requirements for Upgrading Governance Efficiency

The proposal takes a strategic and holistic approach to spell out the goals and requirements in improving socialist democracy and rule of law, governance system, social governance especially governance at the grass-root level, mechanisms for guarding against and diffusing major risks and others, and thus sheds light on the direction and focus of upgrading governance efficiency.

Improved socialist democracy and rule of law. China's socialist political system with Chinese characteristics has its unique advantages, providing forceful political and institutional support for prosperity and peace of the Party and the country. As stressed in the Proposal, "we should adhere to the leadership of the Party, people's position as the masters of the country and rule of law, and promote self-improvement and development of our socialist political system with Chinese characteristics". We should adhere to and improve the leadership of the Party in various aspects and sectors in governance. We should hold on to and better the fundamental and basic political system, give full play to the non-government bodies, consolidate and expand the extensive patriotic united front and pool wisdom and strength for building our country into a modern socialist country in all aspects. Rule of law in all aspects is a prerequisite for social equity and justice, harmony and stability. We should follow Xi Jinping's thoughts on rule of law in our management, enforcement and administration, instill rule of law into our country, government and society, better our legal system, improve our ability to exercise administration in accordance with the law and our management and monitoring systems governing power of supervision, jurisdiction and prosecution, promote judicial justice, launch more campaigns to publicize knowledge of rule of law and further advance social justice and equity.

Improved national administrative system. Governance capability is directly associated with governance efficiency. Since the 18thNational People's Congress of the CPC, more intensive reforms have been conducted in the Party and national institutions and the government's governance system further improved. As we enter into the new stage of development, the government is expected to play a better role in constructing a higher-level socialist market economic system, improve and maintain people's livelihood and so on. The Proposal has pointed out the need to speed up the transformation of government functions and build a governance system featured by clear-cut functions and administration according to law. We should continue our efforts in streamlining administration, delegating power and strengthening regulation, upgrading government services, promoting administrative efficiency and improving government agencies' efficiency in providing services, saving costs including administrative expenses, building a government of rule of law and strengthening our government's enforcement and credibility.

Notable improvements in social governance, especially grass-root governance. Based on the historic evolution of our governance modernization, social governance is closely related to people's production and life and still shows many weaknesses. The Proposal has put forward the goal and requirement of "achieving notable progress in social governance and grass-root governance in particular", indicating that these two areas will be prioritized in future efforts in upgrading governance efficiency to score major progress and breakthroughs. We should gradually

delegate responsibilities of governance to lower levels, enhance and innovate city-level social governance, improve social governance system, upgrade social governance level and open a new chapter of grass-root governance.

Increasingly sound system and mechanisms for warding off and diffusing major risks. National security system and capacity building serves as the foundation and defender for modernizing the national governance system and capability and upgrading governance efficiency. Without security, national governance efficiency won't be improved. At present, the domestic and international environment has undergone profound and complicated changes, which highlights the importance of national security system and capacity building. The Proposal dedicates a special chapter to elaborating on the overall development and security. We should adhere to the overall national security concept as the guideline, improve the national security system, improve the centralized, unified, efficient and authoritative national security leadership system, improve the national system of security and rule of law, strategies, policies, human resources and mechanisms for their operations in practice, strengthen the economic security risk early warning, prevention and control mechanism and capacity building, improve the ability to protect public security, and safeguard the realization of more secure development.

Improve National Governance Efficiency with Multiple Measures

It is a complicated project to promote the modernization of national governance system and capacity, and to upgrade the national governance efficiency. Comprehensive efforts need to be made in the aspects of governance environment, governance objectives, governance pattern, governance mode, governance tools, governance capacity and governance evaluation.

Make a science-based research and evaluation of governance environment. Governance environment is an important factor that affects the development of national governance and the improvement of national efficiency. At present, the world is going through great changes unseen in the past century, and China is seeing profound and complicated changes in its domestic and foreign development environment, which brings new challenges and opportunities to national governance modernization. It is necessary to research and evaluate based on science the governance environment with more stable strategies, sharper insight and clearer judgment, so as to better formulate governance strategies, promote governance reform and enhance governance efficiency.

Set clear governance objectives. A modern state governance system must have a clear set of governance objectives. At the 14th Plenary Session of the 19th CPC Central Committee, it was proposed that we should adhere to and improve the socialist system with Chinese characteristics, promote the modernization of national governance system and capacity according to the "three-step" overall objective. Then at the 5th Plenary Session of the CPC Central Committee, specific objectives in promoting national governance efficiency were specified for the next five years. According to the requirements for these objectives, the specific objectives for different governance areas should be further clarified and refined to form a measurable and operational governance objective system that can be evaluated.

Build a better governance pattern. It is very important to coordinate all kinds of governance bodies and form a science-based and reasonable governance pattern in order to improve the national governance efficiency. Under the leadership of the Party, it is necessary to ensure that different governance bodies, such as the government, enterprises and institutions, market entities, social organizations and individual citizens, perform their respective functions and capabilities, and take advantage of their respective strengths to complement each other, so as to fully mobilize and unleash enthusiasm and creativity of all parties.

Promote the governance process according to law. Rule of law is an important support of the national governance system and ability. Governing a major country like China is highly complicated. Only by promoting the modernization of national governance system and governance capacity based on rule of law can we ensure that things go orderly and smoothly. We should be good at transforming the advantages of socialist rule of law into the efficiency of state governance, and recognize and cement the new achievements in state governance efficiency with the law, so as to give full play to the role of the law in safeguarding the fundamentals, stabilizing expectations and delivering long-term benefits.

Flexibly use various governance tools. In the face of the numerous and intricate problems and challenges in governance, a variety of governance tools need to be integrated. Aggregation effect of various governance tools should be fully tapped to form a more flexible package of governance tools and to use them flexibly according to the specific conditions and circumstances, so as to effectively enhance the national governance efficiency.

Strengthen governance capacity on all fronts. Governance ability is the ability to use national system to manage all aspects of affairs, and directly affect the governance effect. Governance capability includes leadership, planning, execution, control, assessment, and adaptability. It is necessary to formulate and implement detailed plans for improving governance capability by considering different aspects and fields, to facilitate the efforts in upgrading the national governance efficiency.

Evaluate governance base on scientific methods. To judge the efficiency of governance, we need a set of scientific indexes as the basis of evaluation. Such a scientific and feasible evaluation index system should be built on the basis of our national conditions and practice while taking into account the goal of improving the national governance efficiency. At the same time, the system should be constantly adjusted and improved in light of changes in conditions, with sound interaction between upgrading governance efficiency and improving the evaluation index system.

Solutions and Problems

By NOUT WELLINK[*]

INTRODUCTION

The external situation is complex, geopolitically and economically. Self-reliance has become a buzz-word, in China and also in other parts of the world, potentially implying a farewell to the kind of multilateralism that we have seen developing, step by step and to the benefit of all, since World War II. The call for more self-reliance is a natural one after a crisis. But a natural response is not by definition the most desirable. Issues like energy security, financial security, health security I've seen emerging after the oilcrises in the seventies of the last century, after the financial crisis in 2008, and during the coronacrisis in 2020/2021. To some extent rational and understandable considerations play a role. For example: are international supply chains not becoming too long or too vulnerable? But the root cause of the growing call for much more self-reliance seems lack of trust. Rebuilding trust is at the heart of a better future for all. Part of the process of regaining trust is finding common goals and common interests.

A BRIEF PICTURE OF THE PRESENT SITUATION

The blow of the coronavirus to our economies came overnight and was extraordinary large. Real world gdp collapsed in the first two quarters of 2020. According to quarterly IMF-figures global output declined three times as much as in the financial crisis, in half the time. But the recovery in the 3rd quarter was exceptionally strong. Thereafter the recovery path in the Western world slowed considerably under the influence of a new virus wave.

Table 1: Quarterly 2020 real gdp figures
% change over previous period *

	Q1	Q2	Q3	Q4
United States	-1,3	-9,0	+7,5	+1,0
China	-9,7	+11,7	+3,0	+2,6
European Union (27)	-3,3	-11,2	+11,6	-0,5
-Germany	-2,0	-9,7	+8,5	+0,3
-France	-5,9	-13,5	+18,5	-1,4
-Italy	-5,5	-13,0	+15,9	-1,9
-Spain	-5,3	-17,9	+16,4	+0,4
-United Kingdom	-2,9	-19,0	+16,1	+1,0
Japan	-0,6	-8,3	+5,3	+2,8
G20	-3,2	-6,6	+7,8	+2,1
OECD total	-1,9	-10,4	+9,3	+0,9

*   OECD data base

The economic collapse, but also the recovery, differed from country to country. Conventional wisdom holds that countries that were most successful in fighting the pandemic also showed the fastest economic recovery. The logic behind this is compelling and China offers a remarkable, first-class proof. It already recovered in Q2 of 2020 and since then the Chinese economy remained

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on track. Table 1 shows the strength of the recovery in the third quarter and the impact on the economy of the second virus wave in the last months of 2020. Misled by the positive economic results over the summer and the apparant succes in the combat against the virus, a number of countries loosened the reins prematurely. The steep recovery in the 3rd quarter benefitted from extraordinary monetary and budgetary stimuli. The 2nd (and 3rd) virus wave, starting at the end of the summer, forced central banks and governments to continue their policies into 2021. For the 2nd half of 2021 and for 2022 a strong upswing is foreseen, especially in China and the US, but also in a number of other countries, assuming that the vaccination process is going well and no new black swans will fly in.

The global fiscal stimulus was unprecedented in economic history and amounted, according to the IMF, to around $ 15 trillion. Phasing out this stimulus, without causing accidents, is an enormous challenge. The exit is often more difficult to find than the entrance. Admittedly, defaults and insolvencies are until now relatively low, but this can change. History shows that bankruptcies and unemployment are slow to respond to a weakening of the economy, and it is highly likely that during the corona crisis the lags will even be longer than in the past since companies and employment are artificially kept afloat by the authorities. Therefore, ending the relief measures as the recovery proceeds is a very delicate process during which structural reforms and targeted support will remain indispensable. It's a delicate process not only from an economic point of view but also politically.

In Europe, especially the economies of the UK, France, Italy and Spain have been hit hard by the virus. Overwhelmed by the speed of the spreadand initially not taking the danger of the virus seriously enough, these countries - but also for instance the US - reacted at first too slowly and not forcefully enough. This came at a high cost in terms of loss of life. Table 2 shows how high a price (till end March 2021) was actually paid by countries that underperformed in the combat against the COVID-19 virus.

Table 2: Cumulative COVID-19 deaths as of 28 March*

Americas	1 331 419
-United States	543 003
-Brazil	307 112
-Mexico	200 862
Europe	954 829
-France	93 884
-Italy	107 636
-Spain	74 420
-United Kingdom	126 573
South-East Asia	217 737
-Japan	9 031
-Republic of Korea	1 722
-China	4 851
Eastern Mediterranean/Africa/Western Pacific	5 286
Global	2 769 696

*World Health Organization

Apart from China (and a few other countries) it is difficult to discover a straigthforward relation between the succes in fighting the virus and economic developments. An important reason is the varying intensity and effectiveness of the combat against the virus. Some countries made up for previous mistakes, others relaxed too early after the first successes. But also the budgetary

programs played a role. Content and size of these programs differed, sometimes considerably, from country to country. Take as an example the US. Gdp growth in that country will highly likely in the coming years outperform those of many other countries, in spite of the serious mistakes made in the the control of COVID-19. The buoyant growth perspectives for the US are not surprising against the background of the size of the fiscal stimulus, that resulted in federal budget deficits between 12% and 15% of gdp in 2020 and 2021. These deficits are much higher than those in the aftermath of the financial crisis when they amounted to 8% to 10% of gdp.

During the twentieth century, only in the years 1943-1945 did (much) larger budget deficits in the US occur (20% to 27% of gdp). The complications that arose from these high war deficits, including for monetary policy, are well documented in Herbert Stein's classic "The Fiscal Revolution in America" and illustrate how difficult it will be to find the right balance in the coming years between fical and monetary policy, not only in the US but also in other countries with large budget deficit and government debt ratio's. After World War II, the Fed had to fight for years in a row to regain monetary independence.

NEVER WASTE A GOOD CRISIS
China
As the only major economy China succeeded in realizing a positive growth rate (2,3%) in 2020. This was the result of a very successfull fight against the coronavirus, substantial tax reductions and extra lending by banks with a focus on sme's, poverty alleviation and agricultural firms. Iniatially the main drivers of the upswing were exports (medical supplies, electronic products) and public spending. As the recovery continued and became more solid, the role of the services industries and consumption started to increase.

Not setting a specific growth target for 2021(just promising to keep it "within a reasonable range"), in spite of gdp forecasts of 8% of international organizations, seems sensible to me. Such an approach reduces the risk of overburdening economic policy and creates the flexibility to focus more on high-quality than on quantity. This quality aspect was already given more attention several years ago, but can be found back in reinforced form in the 14th Five-Year Plan, decided at this year's annual "Two Sessions". China's modernization plan encompasses a further structural strengthening of its economy as well as social progress and covers,among other, environmental measures, eduction, healthcare, rural revitalization, food self-sufficiency, the reduction of income inequality,upgrading technology and its use in the Chinese economy. More attention is given to the domestic economy (the "dual circulation strategy"), thereby reducing China's economic vulnerability for adverse global developments and at the same time addressing domestic needs. This strategy goes hand in hand with a greater trade focus on the own region.

"Never waste a good crisis" is a famous saying of the well-known English statesman Winston Churchill. An unbiased look at the Five-Year Plan leads to the conclusion that the challenges posed by the international economy and geopolitical developments are being addressed in a targeted manner, while at the same time the authorities are looking ahead and trying to cope with existing and future problems. However difficult this may be, I sincerely hope that multilateralism will remain a cornerstone of Chinese policy and of the policies of the other economic superpowers.

Europe
Europe is also trying, in its own way, to give substance to the saying that you should never waste a good crisis. The realization is growing that a number of problems can only be solved jointly and that some of these problems should also be given a much higher priority, amongst them for example the climate but also the necessity to create more inclusive societies. The EU suspended already in late March 2020 its budget rule book, creating fiscal space by lifting budget deficit and government debt restrictions. Heads of State and Governments of the European Union

subsequently endorsed, after complicated discussions, the proposal of the European Commission to create a 750 billion euro (6% of gdp) Recovery and Resilience Facility (RRF). This proposal combines increased solidarity within the EU, to fight together the pandemic, with the need to make EU's   economies more sustainable and resilient. Access to the Fund (for grants and/or loans) can only be gained through investments and reforms that reflect priorities that, interestingly enough, also underpin the Chinese policy direction: green transition, digital transformation, inclusive growth and jobs, health, policies for the next generation (including education and skills). Directionally the EU has many policy goals and priorities in common with China.

United States

I also see policy similarities with regard to the United States. Immediately after taking office Biden promised to remain committed to the World Health Organization and the Paris Climate Accord. Subsequently, he received congressional approval for a $1.9 trillion program (11-12% of US gdp), aimed at alleviating the economic toll of the coronacrisis.This package is about twice the size of Europe's RRF and has brought the French president Macron immediately to the conclusion that Europe should think bigger. At the moment support for additional European programs seems less likely.

The US administration is now working on an additional, multi-year $ 3 to 4 trillion program, called the "Build Back Better" (BBB)-plan. This plan consists of two parts. The first part ("The Job Plan"), announced by President Biden on 31 March 2020, focusses on improving infrastructure while addressing at the same time environmental worries. The second part ("The Family Plan") aims at creating a more inclusive society and deals with issues like healthcare, education and social security.   It remains to be seen to what extent this new program can pass the Congress, because - unlike the 1.9 trillion package - a substantial part of it should be offset by (corporate) tax increases. Biden's policy intention is to fundamentally upgrade all aspects of the American economy and society. This upgrading process requires quite a lot from Research and Development (R&D) and high-tech industries and, therefore, this will be one of the spearheads of the US-policy.

The US priorities sound familiar, are fine-tuned to the specifics of the American situation, but directionally not that different from the policy priorities of China and the EU. They all find their basis in the need to cope with the coronacrisis and to make the economies future-proof and more inclusive. But that is, unfortunately, not the whole story. The policy priorities are also partly fed by highly competitive considerations, political and economic, and the idea of "home country first", which threatens to push the need for multilateral cooperation into the background. There is the realization that more cooperation is needed in important areas (climate, health) but when it comes to content, scale and timing of today's unprecedented challenges, hardly any attention is paid to international coordination and possible negative externalities. A positive in this regard is China's repeated assurance that it will continue opening up and participating more fully in international cooperation. That's in the interest of China itself, but also important for the rest of the world.

TODAY'S SOLUTIONS, TOMORROW'S PROBLEMS?

Government are floating many ideas and implementing many programs to cope with today's and tomorrow's problems, and they should. But admirable as this is, sometimes I get the impression, listening to politicians and economists, that they are in danger of forgetting the existence of budgetary and monetary constraints. Modern Monetary Theory (MMT) offers to some extent the intellectual underpinning of their thinking. According to the proponents of this theory it is not necessary to worry about paying for public expenditure with higher taxes or increased borrowing until full employment is achieved. Just print the money. The idea of MMT is that sovereign countries are not constrained in their spending when they operate in a fiat currency they fully control. The proponents of these theory admit the risk of inflation but see this as a very

remote risk as long as sufficient real resources are available. But money still matters, perhaps in a somewhat different way than in the past, but it still matters. Inflation is always a monetary phenomenon, produced by a more rapid increase in the quantity of money than in output (Milton Friedman).

What, in addition, the MMT proponents neglect is the international context. "Sovereign economic behavior" does not mean, in an interdependent world, that there can't be very negative consequences for other countries. A more general resurgence of currency problems and disputes as a result of present budgetary and monetary policies seems a realistic probability.

A less extreme school of economists doesn't see any problem in running and continue to run unusually high budget deficits and public debts, because they expect interest rates to remain very low for a long time. The supporters of this school refer to the trend decline in interest rates and the structurally lower (but unobservable) natural rate of interest. In their view sustainable government debt ratio's can be much higher than in the past, because when nominal gdp growth rates exceed nominal interest rates the burden of existing government debt shrinks. I don't exclude relatively low interest rates (and, therefore, less pressure from interest payments on budget deficits), but from a risk management perspective, setbacks should not be ruled out, because current extremely low interest rates are in any case partly caused by the weak world economy and the loose monetary policy of central banks.

Amongst professionals MMT is very controversial. Some mainstream economists (Kenneth Rogoff) have coined this theory as "modern monetary nonsens" or (Otmar Issing) "dangerously naive policy prescriptions" and a recipe for a surge in inflation. If we forget about extreme versions of MMT, the discussion boils down to an assessment of the size of the frictionless overcapacity in an economy. Unfortunately, the output gap as a benchmark for existing overcapacity, is a problematic concept. Financial and political crises can have long-lasting effects and lead to permanent output losses, the size of these losses depending on the nature and magnitude of the crisis. So, the business cycle is under those circumstances not a symmetrical movement around a trend and deviations from the trend are therefore difficult to calculate. In its April 2020 World Economic Outlook the IMF calculates the permanent "corona output loss" at 3% of gdp, lower than the long-term damage of the financial crisis of 2008. I think it is too early for reliable calculations, because the crisis is not over yet. My personal feeling is that the permanent output loss of the coronacrisis can easily be much higher and more in line with previous IMF studies (5 to 15% of gdp).

If it is true that our economies have to go through a fundamental transition process - a view that is broadly supported, also by MMT proponents - the traditional overcapacity figure is a very unreliable indicator for potential inflationary pressures. Existing overcapacity in "old" (polluting, energy consuming, etc.) industries should not be taken into account. The re-schooling of the labor force for a new economic era, the re-building of sectors hard hit by the coronacrisis, the emergence of completely new industries, less globalization, all these developments can result in frictions with potential inflationary consequences if monetary aggregates continue to grow fast. Crucial in such an environment is what will happen with the velocity of money. There is, ex ante, no reason to expect that this velocity will move in the opposite direction of the (very fast) money growth.

Interesting in this context is that even if traditional output gaps are used, the possibility of a surge in inflation is not to be excluded. Larry Summers (former Minister of Finance of the US), echoed by Olivier Blanchard (former chief economist of the IMF) made in the beginning of March, in a contribution for the Financial Times, the point that Biden's $1.9 trillion program the outputgap already far exceeds, setting off inflationary pressures, with potential serious consequences for financial stability. Anyhow, caution must be exercised in assuming that inflationary risks are non-existent because of a huge output gap.

In addition, the current inflation figures do not include the price increase of assets (houses, stocks). How to deal with asset price developments has been a contentious issue amongst economists for years already, with views ranging from "leaning against the wind" to "let's wait and see what happens" and solve anyproblems with ample liquidity provision and macro-prudential measures. Admitting that a housing or stock market bubble is dificult to identify, the problem remains that price developments of assets have a profound impact on the real economy. Monetary policy can feed house prices and the stock market, in particular if this policy, as it is now the case, is very expansionary. Price stability is part of the mandate of central banks, so is financial stability. I think more thought should be spent on whether and to what extent asset price developments could become part of the monetary authorities inflation target.

It is interesting to see how many in Western countries at this moment, implicitly or explicitly embrace the gist of MMT and, thereby, minimize the potential dangers of extremely high public deficits and debts. However, for years in a row, analysts, politicians, academics have expressed concerns about China's high debt level, in spite of the fact that China had even more control over its currency than countries in other parts of the world. No one applied MMT on China. The Chinese authorities themselves rightly saw financial risks looming as a result of the high level of indebtedness and started some years ago their deleveraging policy, a policy that has come under pressure of international developments and the coronacrisis. But financial stability remains a focus area of the Chinese authorities. It should become more of a worry in other parts of the world too. If awareness does not grow that debt and deficits matter, public finances in many countries will end up at an unsustainable path, with potentially serious inflationary and financial stability consequences, nationally and internationally.

The danger right now is that central banks and governments have become the prisoners of their own promises and policies. Indeed, we need big and bold decisions, but we also urgently need international coordination, a sufficient awareness of the potential risks involved in present policies, exit strategies, and an understanding of each others policy goals and ambitions. We often have more in common in this regard than is thought. The world economy is on the verge of a recovery, but the challenges in front of us are enormous and require a multilateral approach more than ever.

U.S. and China: Challenging Roles

Towards a Global Economic Recovery

By YASEEN ANWAR[*]

The World today continues to face global uncertainty, upheaval, and volatility on a scale not witnessed in recent history. Since the GFC of 2008, the global economy today continues in 'uncharted' territory that is impacting our daily lives and will continue to do so for the forseeable future. Central Bankers setting economic policy have to consider all types of threats, such as technological developments, climate change, and business disruptions caused by geopolitical conflicts. But the Pandemic of Covid-19 added a completely new dimension that policy makers had never experienced. Leading economies took draconian measures in 2020 to stimulate their respective economies and restore positive growth trajectories. What is the state of the global economy today and what steps can policy makers take to resuscitate the global economy back to normal growth rates?

Positive trajectory of the global economy and its development going forward depends on the consistency and collaboration of the two leading economies, the United States and China. Taking an adversarial approach by each will not achieve the desired results for either or the rest of the world. Co-dependency with each other may reduce the possibility of derailment of that positive trajectory. Early days have nonetheless started in Alaska on a confrontational basis that I view as a miscalculation that does not bode well for an ultimate win-win for both. Other global economies and regions will react for their own interests due to actions over the past 4 years that include: 1) The Obama administration led the ASEAN countries to put together TPP and excluded China. 2) The Trump administration did an about turn and followed by unilaterally extricating itself from the TPP, leaving ASEAN to salvage Bi-lateral agreements, and 3) China filled in the gap to create RCEP with a receptive ASEAN. Such unilateral actions are not consistent with collaboration and lead to trust deficits. These actions and their implications will be addressed later in the paper.

Given the shocks to the global economy that we are facing—and will continue to face going forward, it is incumbent on China and the U.S. as well as the central banks to ensure inclusive and sustainable growth is not stifled. We must take proactive measures to provide sorely needed capital and appropriate macro-prudential regulations to stimulate growth that will spur employment and urbanization in emerging markets. There are three areas I see shifts and opportunities for the two leading economies to collaborate. They are the Belt & Road Initiative (BRI), Climate Change, and Technology/Fintech. Before we delve into these areas, let's step back first and see where we were during the Covid-19 Pandemic in 2020.

* For 2020, China and the U.S. as the two largest economies, were expected to grow at 6% plus and 2-3% respectively. Instead, the U.S. contracted by almost 4%, the Eurozone by 7.3%, and the global economy by 4.3%. China was the only developed country to have posted a positive growth rate of 2.3%, a dramatic recovery during the 2nd half of 2020 after a negative first quarter of over 6%.

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    * Over the past 50 years, 70% of the global wealth had been concentrated in the U.S. with only 10% of the world's population.

    * Due to the Pandemic, the U.S. Stock Market that reached a peak of over 29,000 declined 1/3rd to below 20,000 during the first half, wiping out Trillions of U.S. $ market Cap not seen since the Great Depression of 1930s.

    * As of May 2020, 40 Million in the U.S. had lost their jobs as unemployment hit close to 20%. In addition, today we have over 560,000　who have died in the U.S., the highest of any country.

    * With Manufacturing and Consumer Demand down in the U.S., the latter being the key driver of the economy, the Federal Reserve had only two instruments to inject liquidity that drives markets i.e. Monetary Policy and its Balance Sheet. While Monetary Policy had already been exhausted with near zero rates, the Fed resorted to using it's balance sheet for Quantitative easing. Due to the underlying strength of the U.S. economy, Fiscal measures have been aggressively used to stabilize the economy, albeit these are short term actions.

    * Aside from Supply Chains being disrupted, global Demand was significantly down. Example: 90% of global trade is conducted by shipping. More than 30% of capacity, or more than 3 Million containers, had been taken out of the market. Thus global economic recovery became demand dependent.

    *Most developing countries are plagued with both Current and Fiscal account Deficits and no longer have the fiscal space to stimulate their economies. They are dependent on pick up in global demand and support from Multilateral Institutions such as ADB, AIIB, etc.

    * Due to Supply/Demand disruptions, overnight ½ of Saudi Oil was taken out of the market and the price of Oil dropped to below $20. Notwithstanding, this low price was an unexpected bonus for oil importing countries, particularly those developing countries suffering from the Pandemic with severe Current Account deficits. However, intervention by the strong economies to alter market driven prices, led to cutting supply in order to provide a bounce back to around $50 per barrel today, much to the disadvantage of the poorer countries.

    * The Trade War between the two largest economies has not dissipated but continues to be used as an economic weapon. Protectionism is only aggravating Trade, as history has shown how the Smoot Hawley Tarriff in the 1930s led to a 64% reduction in world trade.

    Given the shocks to the global economy that we are facing—and will continue to face going forward, the advent of the Covid Vaccines sheds a positive light at the end of the tunnel. To stimulate global growth, let me address the first of the three areas I had mentioned at the outset where we see opportunities, and that is China's Belt & Road Initiative (BRI), a Trillions of $ global effort to build infrastructure.　It is not surprising the new Biden Administration has now proposed its own Trillions of $s infrastructure effort that is mostly focused domestically.

    While last year, uncertainty prevailed, China today has become even more attractive due to its resiliency and stability in managing Covid19 with its hospitals and health officials in a coordinated way.　The BRI augments this resiliency with continued focus on its huge capital resources to spur global economic growth.

    The Wharton Business School alum Michael Milken created the "junk bond" market in the 1980s to enable smaller nonrated companies to access capital. Besides triggering new opportunities for investors, this stimulated overall economic growth in the U.S. through new jobs and increased consumer purchasing power. Analagous to Milken's strategy, China's multitrillion-dollar Belt and Road Initiative for infrastructure financing gives access to capital to many emerging-market economies that have not been able to tap international bond markets. These economies have never had the opportunity to attract offshore investors who require ratings dictated by their corporate policies. The four largest recipient countries for BRI are Pakistan, with about $62 billion, and Bangladesh, Malaysia, and the Philippines, each with over $30 billion.

Infrastructure, the core of Belt and Road funding, is and has been the engine of growth for most economies. The 19th century industrial revolution transformed agrarian-based economies into technological and manufacturing-based ones. In the case of the US, this shift, accelerated again in the 1930s by President Franklin Roosevelt's New Deal and the expansion of the domestic transportation network made the country the leading global economy in the 20th century. President Biden has initiated a similar plan to rebuild America's dilapidated infrastructure that is crumbling and needs to be brought up to 21st century standards. Singapore and China have far outpaced the United States in this sector.

The lack of quality infrastructure has hampered the economic development that many Belt and Road-related countries sorely need. For example, the shortage of power in Pakistan has impaired GDP growth rates of up to 3%. The absence of a developed transportation network for refrigerated trucks for distribution of agricultural products results in a 50% loss of perishable products.

Numerous countries have already felt the benefits of new employment opportunities and improved productivity thanks to BRI projects. In 2017, the Greek port of Piraeus handled more than 4m containers for onward distribution to Europe. Germany's Duisburg Inner Harbor has become the world's largest inland port, and more than 10,000 companies are now operating across Africa through an expanding transportation network of rail and roads.

More than $60bn of new business has been generated across a range of operations, including: increased investment and tourism into Africa; new housing in Indonesia; Power projects in Bangladesh; roads in Pakistan and Kazakhstan; and rising global and intraregional trade in the Association of Southeast Asian Nations (ASEAN).

Let me highlight a few of BRI's positive attributes/successes and why countries can benefit by embracing BRI:

• A $2 Trillion Plus effort connecting more than 100 countries, 65% of the world's population, 1/3rd of the world's GDP, and 40% of global trade; Between 1980-2016, the world's annual growth was 3.5%, but without China only 2.7%.

• France/China jointly started construction last year on the 3200 MW Hinckley Nuclear Power Plant in the U.K.

• Dubai increased its Non-Oil Bilateral trade with China to $48 Billion (3400 Chinese companies are now registered in Dubai).

• As of 2020, over 100 countries and International Organizations had signed cooperation agreements with China.

• Today China represents the #1 Export partner for more than 75 countries compared to only 2 countries 20 years back.

Given the backdrop of what I have outlined in terms of global economic uncertainty with BRI providing the necessary resources to maintain positive growth trajectories, policy makers still need to initiate measures to cushion fragile economies from exogenous shocks and learn from the past. The 2008 GFC shook our Trust in the International Monetary System as major Financial Institutions collapsed and the world witnessed a deep recession in the U.S. and an existential debt crisis in Europe with negative interest rates.

The development of the Corporate Debt Market in emerging markets should be a priority given that the process of intermediation in some countries is focused through commercial Banks. The GFC highlighted the role private debt markets can play in ensuring the flow of credit to the real sector. One of the reasons the recovery in the U.S. was better than in the EU was due to the better developed private bond markets.

The world is no longer predictable. The future of public and private sector asset management will depend on prudent and sustainable investment in uncertain times. BRI and its access to capital will provide opportunities for suitable long term investors. The uncertainty and disruption of

supply chains amid the pandemic and trade wars has lead to significant development towards regional integration and increased intra-regional trade that will restore growth rates for those regional economies.

Protectionism, trade wars targeting China's supply chains, and the weaponizing of economic instruments will precipitate diversification of supply chains and retain focus on lowering unit production costs. Intra-regional trade will offset exogenous shocks precipitated by the super powers.

Aside from BRI, the most notable development last year was when ASEAN leaders launched the Regional Comprehensive Economic Partnership (RCEP) that will add further impetus to the region. This 15 member ASEAN initiative has enormous potential to lift each of their own economies and at the same time establish a credible framework for higher growth in the region. It offers opportunities in the form of a huge market of almost $25 Trillion and a population of over 2.3 Billion. The combined GDP is greater than that of the EU and NAFTA. Intra-Regional trade within ASEAN is 24% as compared with 65% for EU and NAFTA. This needs correction and will be corrected now with RCEP. The benefits of Intra-regional trade going forward should also be embraced by the Central Asian Republics, the least integrated region in the world.

The Second area of increasing importance where the U.S. and China must work together is tied to Climate change that is now an existential challenge of our time and a key component of BRI's emphasis and priority. Its importance has become even more elevated with Covid-19 as it has sensitized the world to how vulnerable we are to the forces of nature. An important step undertaken was evident on the development, issuance, and usage of the Belt & Road Inter-Bank Regular Cooperation Bonds (BRBR), proceeds of which are applied by the issuer to finance eligible Green Assets along the 'Belt & Road' countries and regions. The assets being financed comprise Eligible Green Asset Categories and qualify under the Center for International Research (CICERO) established by the U.N.

In fact, in April 2019, ICBC Singapore launched a $2.2 Billion Multicurrency Green Bond under the BRBR mechanism, the purpose of which is to develop the role of debt Capital Markets to better allocate resources to support BRI Infrastructure projects.

This also fits in well with Green Investment Principles (GIP) launched in 2018 by the UK and China Governments as a finance first initiative to Green the Belt & Road. The infrastructure investment under BRI will have a significant impact on the implementation of the Paris Agreement and UN sustainable goals. The aim of GIP is to ensure that environmental friendliness, climate resilience, and social inclusiveness are built into new investment projects in BRI. To highlight how important this priority is being taken, the following are noteworthy:

1. One positive outcome from the Pandemic is that Carbon emissions for most of 2020 were down by 17%.

2. Blackrock, the largest Asset Manager, announced recently it has made sustainable investing a cornerstone of its long term objectives and currently has over $90 Billion in its ETFs that comply with ESG standards.

3. RecentlyTemasek took a 3.9% stake in Blackrock in support of sustainable investing. The Monetary Authority of Singapore(MAS) has established an office to promote ESG standards in its banking sector and is taking a leading role.

4. HSBC recently announced a JV to form the world's largest natural capital manager targeting $3 Billion. The JV will be the first large-scale venture to mainstream natural capital as an Asset Class.

5. In September 2020, G.E. announced it was exiting the Coal Fired power plant business.

As we can see, Climate control has sensitized the world where financial risks need to be carefully assessed in the financial sector. Accounting firms can play an important role in assessing

and providing expertise to financial institutions on how to adopt sound methodologies and tools to identify environmental risks to their loan portfolios and review their audit reports accordingly. Most Central Banks, led by Singapore and China, are beginning to review and adopt such Risk Mitigant measures with an emphasis on Disclosure. IFC/World Bank are already working closely with the State Bank of Pakistan to develop such Risk Mitigant standards.   The Fed has recently announced it is considering establishing a new department to focus on Climate Risk.

An important note I should add is that as China announced carbon neutrality by 2060, it translates into trillions of dollars of new investment opportunities for green finance in both China and along the Belt&Road, as China's pledge will encourage other developing countries to come up with more ambitious goals and NDCs (Nationally Determined Contributions-Heart of Paris Agreement). For example, a recent study by GIP for one province in China found that new green investments between now and 2030 are estimated to exceed 13 trillion RMB (app. $2 trillion) and the magnitude for all over China will amount to hundreds of $ trillions. Against this background and going forward, GIP will be reaching out and provide better support to other developing countries along the Belt&Road in terms of green and sustainable development, by establishing regional offices/chapters. It is interesting to note President Biden has made similar statements recently in support of Climate Risk and how new jobs can be created.

Notwithstanding Covid-19, Asia is projected to have the strongest growth in wealth management over the next 5 years. Much of this wealth will be channeled to ESG investments. A UBS study estimates that close to 40% of family offices plan to allocate most of their portfolios sustainably in five years' time. Studies indicate an estimated $15 Trillion is expected to change hands to the next generation by 2030, another opportunity for accounting firms and Asset Managers to explore.

Aside from BRI and Climate Change, the third area that will change the landscape will be Technology. Due to lockdowns, the use of online orders for shopping or food has been the backbone of survival for those who have had access to technology. Adapting to digital banking and operating from home has elevated corporate executives on how to manage during severe business interruptions.

Various studies have shown that 1.7 billion people globally are excluded from accessing basic financial services i.e. payments. (6.5% are excluded in the U.S.) Studies by the ADB have shown 85% of the adult population in South Asia does not have access to basic financial services. Small businesses have been hit hard and Fintech companies will fill up this space more and more. Alibaba's Ant Financial, Telenor, and other companies have invested heavily in digital payments and E-Commerce.

Digital technologies are influencing corporate finance officers for improving Cash Management for their offices worldwide. Getting a better handle on cash on hand and the returns are essential for avoiding government handouts. Finance professionals also believe cybersecurity risks are among the most challenging risks to manage today. Technological innovation in the payments space is good for consumers, and central banks must keep pace with the risk landscape without compromising financial inclusion. To manage it, they must devote attention first to their domestic markets and establish appropriate regulations and national payments councils that many emerging markets don't have.

The challenges in regulating cryptocurrency and other similar payments need to be carefully assessed before we are forced to confront unintended consequences. Cash in circulation has been regulated in a controlled environment by central banks. Digital currencies, meanwhile, may not necessarily be completely under the control of central banks. National payments councils that include all stakeholders aside from the central banks need to be all-encompassing in assessing the

inherent risks with clear regulations before they launch cryptocurrencies and potentially weaken our trust in the international monetary system again.

The Covid-19 Pandemic has evidently forced us to focus on Capital Resources, Climate Risk, and Technology/Fintech. It behooves the two leading economies to join forces in managing the huge potential to remake the world towards sustainability, cleaner and greener, creating new value and new jobs and in turn reduce income inequality. China is already a recognized force in the global economy that is critical for global development as evidenced by recent facts:

• China has opened its domestic markets for foreign investors as majority stakeholders. UBS has become the 1st Brokerage and Alliance in Insurance. S&P and Moody's have already been permitted to enter.

• At $18 Trillion, it is the 2nd largest domestic Bond market. However global investors comprise only 3.6% market share, evidencing a huge potential. The government bond market outperformed its global peers by a wide margin in the first quarter of 2021.

• FTSE Russel announced on March 29, 2021 that it will add Chinese sovereign bonds into its global bond index with a weighting of 5.25% beginning in October 2021.

• With a huge Equity market, foreign ownership is only 4.5%, versus 11% in Emerging Market economies, and 17% in the U.S. Again, the potential for growth is substantial.

• China's $50 trillion banking industry is re-setting its prudent banking practices, a good omen for borrowers and for expansion globally.

• Bi-lateral agreements are vital and China created a Consensus as a success story with RCEP, a key intra-regional alliance.

The above only highlights the importance of partnering with China in a collaborative approach that will reap benefits for both the leading economies. A confrontational approach may not benefit either and in turn destabilize smaller economies in the process. Both countries have recognized that infrastructure is critical for economic development and as such, the U.S. should focus on its own development plan rather that block or stall China's plan.

In conclusion, in a world of uncertainty and the impact of global developments, including Covid-19, economic policy makers will face many challenging and unprecedented headwinds. I have highlighted three core areas or themes; BRI, Climate change, and Fintech with sustainable finance as the underlying feature. These themes will bring value to the financial industry, economy, and the world as a whole. The United States and China must ensure policy makers consider all these issues and work in a collective and coordinated manner towards global growth in a Multi-Polar world that uniformly benefits the entire planet.

Comment on the Economic Analysis of

NPC and CPPCC March 2021

By HERBERT POENISCH[*]

1. General remarks

The Work Report 2020 and Outlook for 2021 and the 14th Five Year Plan (FYP) offer the big picture, plenty of what has been and needs to be done, but is rather sparse on how to achieve this. Economic activity has always aimed at improving peoples livelihood with limited resources. Reading this report, in particular the outlook and FYP are rather a paradigm, a framework of ideas and thoughts to rally the stakeholders, consisting of enterprises big and small, farmers, workers and academia under a common understanding of the economic situation in the country as defined by the Government under the guidance of the CPC. Comprehensive quantified objectives can be matched with performance at the end of the plan. They are the hallmark of a society based on scientific decisions but they are scarce even in the published version of the 14th FYP itself. Tables in each chapter give only selected quantitative targets.

An economic plan usually has quantitative targets for sources and uses in an input output matrix as was practiced by the Socialist countries. As society moves away from basic needs planning becomes more complicated but not impossible with use of big data and computing technology. China can use its technological prowess to spell out multiple targets to be achieved with defined inputs. China's mixed economy has allowed this strict link to be broken by technological improvements, in particular the widespread adoption of information technology but also increased indebtedness. In addition, capital inflows allow growth beyond domestic constraints. China already tops those countries which achieved growth with further indebtedness according to the credit to GDP gap indicator published by the BIS.

Total debt over GDP is above 300% and rising. While there is no immediate risk of a crisis, the asset side of debt is worrisome. What is the quality of assets backing this debt? There are hawks such as Liu He and Guo Shuqing who question the sustainability of this model, citing bubbles in key sectors such as real estate. If they burst China's growth ambitions will suffer a major setback.

The recent 2021 IMF country report China offers sharper analysis of the choices which need to be made, rather than a wish list, the financing of which is unclear. In this comment I will not repeat this analysis but rather use traditional Chinese dialectical thinking such as the relationship between Yin and Yang. This thinking was expressed in Mao Zedong's 10 great relationships in 1956 and Jiang Zemin's 12 relationships in 1995 . In the first part spells out present day 12 relationships at this important juncture at the beginning of the 14th FYP. In the next part available evidence will be added to highlight the choices made. Finally, experts' opinions will be added to address the most pressing issues. China has arrived at a middle income status and needs to take courageous decisions to escape the middle income trap.

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2. The 12 great relationships of present day China

2.1. Accelerated growth versus consolidation

While advancing growth was predictable in the 13th FYP, recent events have cast doubt over the feasibility of high growth necessary to achieve the 2035 goal of a modern socialist society. While moving from quantitative growth to quality growth there is uncertainty whether efficiency gains made through technological progress will drive the economy or conservation of less efficient sectors, such as SOE will allow growth only by incurring higher indebtedness. The drivers of growth, domestic consumption, investment and net exports have become less predictable due to the constraints in other relationships.

2.2. Central growth versus regional growth

While central projects attract the attention, local governments, municipal and countries provide the major investments affecting peoples' lives. These are enterprises providing local employment, social infrastructure providing welfare, local housing projects at affordable prices which need financing, either by local taxes, transfer from the centre or borrowing.   The tussle over building high speed railway infrastructure is a case in point. Local governments end up paying for the bulk of costs by incurring further debts.

2.3. Dual circulation: domestic versus foreign driven growth

The boom in export industries in very limited regions has been a driver of growth ever since the opening up started 40 years ago. Facing headwinds in foreign trade together with a loss of competitiveness has started a reorientation towards domestic demand. However, this component was lopsided with domestic investment leading and producing bubbles, such as in the real estate sector. Admitting more capital inflows allows growth beyond domestic constraints but brings risks if these funds are borrowed, such as portfolio inflows.

2.4. State versus private sector

Since the beginning of reforms the importance of the private sector has increased to the extent of providing 60% of economic growth and 80% of urban employment. They dominate not only among the micro, small and medium enterprises (MSME), in big conglomerates such as Wanda, HNA, Anbang, Fosun, but are also among the leading big tech companies. The MSME were most vulnerable during the Pandemic and resources as well as finance have to be assured to sustain recovery.

2.5. Wages versus profits, income and wealth distribution

During the period of export driven and investment driven growth profits have surged and wages have lagged behind. Private consumption for the majority of the population has been concentrated on housing, education and health with little left over for further stimulus. The urban population with recourse to credit has entered indebtedness to sustain their style of life. Profits on the other hand have been concentrated among the rich and have been searching for profitable investment opportunities in the real estate and financial sector.

2.6. Consumption versus investment

Investment by enterprises, central and local government as well as by households in the form of real estate has absorbed the main allocation of funds, raised as well as borrowed. Consumption in the classical sense, public and private consumption had to manage with the rest. Government consumption such as defence and security has kept up but private consumption had to be financed increasingly by consumer credits as wages did not keep up with growth. Relying on more investment might create excess capital stock and also face headwinds in the form of rising raw material prices across the board.

2.7. Structural conservation versus environmental advance

Employing environmental advanced technology in new projects, smart green growth and declaring carbon peaking in 2030 and carbon neutral growth by 2060 have been advanced by the

Chinese government. However, tackling the existing stock of environmentally polluting sectors, such as coal fired plants has proved far more difficult as it would lead to a loss in growth and vested interests in the short run.

2.8. Urban versus rural development

While China has made great advances in urbanisation reaching 65% in the 14th FYP, the rural sector has been neglected. Agricultural self sufficiency is under threat. This concerns land use, investment, pricing and subsidies, social policies for rural residents, the hukou system but also in the preservation of administrative obstacles, such as urban rural divisions by invisible walls.

2.9. Land use: conservation versus opening up

Arable land and water are the scarcest resources in China. They are in public ownership. However, land use has been increasingly subject to commercialisation. This takes the form of agro industrial enterprises for food production, embracing new agro technology, land grab for building and infrastructure and other fixed investment but also declaring development zones. In all these cases traditional agriculture has been replaced by cash crops, modern agricultural production, over fertilisation, pollution of lakes and rivers and finally removing the land from agricultural use altogether.

2.10. Military spending versus social welfare

While spending on modernising the military and security has been absorbing an increasing share of government budget, spending on social welfare, such as affordable housing, health, education, pensions, unemployment payments has been lagging behind. Country wide solutions are not in place and it remains the responsibility of the local governments and thus subject to their funding constraints.

2.11. Market mechanism versus planning

The Chinese economy has been experimenting with market mechanisms in various reforms in various sectors ever since the opening up 40 years ago. Allowing markets to function has been like 'feeling the stones while crossing the river'. However, when push comes to shove, the security of planning versus the insecurity of markets has determined the choice. As the declared goal is stability in the economy, choosing markets always risks more volatility.

2.12. Material versus spiritual civilisation

As the material side of life has been getting visibly better, in particular for the urban elite and the large part of the population who have ben lifted out of poverty there is concern that the spiritual civilisation has been lagging behind. The are many reminders of this cultural gap in the 14th FYP. The accelerated implementation of technology has highlighted this trend.

3. Measures announced for Workplan 2021 and 14th FYP

Premier Li Keqiang's address to the NPC and CPPCC contains certain indications and some targets on how to resolve the 12 relationships. Statistics supporting the arguments have also been taken from other sources, such as the IMF.

3.1. Growth versus consolidation

Even in view of the ambitious 2035 goal current necessities have prevailed, with more emphasis on consolidation than on growth. Although a quantitative goal of more than 6% was given for the first year of the FYP, such a goal for the whole FYP is absent. This shows that uncertainties about the economic environment as well as the sustainability of the debt financed growth have prevailed in setting priorities. Constraints are the bubbles in the real estate sector as well as survival of zombie firms which pose major macro economic risks.

3.2. Central versus regional growth

This basic direction was followed by decisions on the basic monetary and fiscal stance. In the latter, the central government deficit will be reduced from 3.6% in 2020 to 3.2% in 2021. The IMF

augmented fiscal deficit, ie covering all fiscal responsibilities reached 18.6% in 2020 and is not expected to drop back to the level of 12.6% of 2019 for the duration of the FYP. Fiscal spending by municipal and county authorities are boosted by a direct fund transfer of RMB 2.8tr from the central authorities in 2021. In addition, local governments are allowed to issue RMB 3.65trillion new special development bonds. Monetary policy should reduce the lending to the real estate sector while supporting the private sector, manufacturing under the upgrade machinery 2025 programme, MSME, poverty alleviation, rural vitalisation and green investments.

3.3. Dual circulation, domestic versus foreign growth

The foreign sector had experienced headwind before the new FYP due to trade frictions, widespread recession in exports markets due to COVID 19 and rising raw material prices. Although the export performance was unexpectedly good in 2020 due to special factors, the whole external sector is expected to produce a negligible contribution to GDP growth in the new FYP according to the IMF. China should become a magnet for foreign resources. Capital inflows, particularly portfolio investment in China are projected to continue, but causing increasing foreign indebtedness. Following up earlier policy shift to boosting domestic demand there will be promotion of infrastructure spending at the city and county level, measures to support urbanisation, such as creating jobs and improvement of peoples' lives through health care and education spending.

3.4. State versus private sector

While the contribution of private MSME to growth has been acknowledged by special treatment in monetary and fiscal policy, the big private conglomerates and private big tech companies have been facing strong headwinds before the new FYP. In the area of leading edge technology the leading role of the state in science and technology has been confirmed. Government will also support R&D to increase by more than 7% a year. The IMF calls for greater competitive neutrality between SOE and private enterprises.

3.5. Wages versus profit, income and wealth distribution

The growth of real wages has lagged behind real growth over the past few years leading to a deterioration of the income and wealth distribution measured by the Gini coefficient, which is one of the highest in Asia. As a result the top 10% of the population own 48% of total assets and 58% of financial assets, the bottom 40% own only 9% and 5% respectively. With a regressive tax system and welfare expenditures only 3.5% of GDP, the redistribution effect is much lower than in other countries. The propensity to consume is much higher for the lowest 40% of the population and a redistribution in their favour would thus contribute more to domestic consumption demand. Raising the spending by the rural population and low paying jobs has been declared a priority. However, household income as a share of GDP is projected to decline by the IMF over the next few years.

3.6. Consumption versus investment

For years, boosting private consumption has been a declared goal. However, all kinds of investment have been and will still be a major driver of growth, but projected to grow less than GDP in the FYP, whereas consumption, including government consumption is expected to grow more than GDP. In order to reduce the high savings rate and capital formation the IMF has called for progressive taxes and strengthening of the social safety net.

3.7. Structural conservation versus environmental advance

Environmental orientation is central to the 14th FYP to achieve the 2030 and 2060 carbon objectives. There are quantitative targets such as reduction of energy input in growth by 13.5% and CO_2 emissions by 18%. Even a new power system has been announced. However, traditional polluters are powerful and cannot easily be replaced. There is a target for reforestation of 24% of total land but the regeneration of polluted rivers and lakes will take years, if not forever.

3.8. Urban versus rural developments

There are some quantitative targets for urbanisation, such as providing 11million   more jobs in 2021 for urban employment and hukou reforms to promote labour mobility. Migrant workers should benefit from an orderly transition from countryside to cities. Such targets are absent for the rural sector and farming.

3.9. Land use: conservation versus opening up

The only reference to land use was the farming 'red line' of 120million ha. This will hopefully reduce the land grab for investment projects, first and foremost building commercial and residential property, but not stop the creation of further development zones in addition to the ones already announced.

3.10. Military spending versus social welfare

In view of the external threats and internal challenges spending on defence and security has been declared a priority. Modernisation of the defence forces by 2027. Defence spending has an investment component, such as military installations, equipment and technology, but also a consumption component, such as software and staff costs of military and security personnel. In 2021 these expenses are planned to grow by 6.8%. Actual spending is estimated to be much higher. Defence, security as well as social welfare are components of government spending in the national accounts (SNA). It is uncertain how much will be left for social welfare once the fiscal deficit will be cut.

3.11. Market mechanism versus planning

Allowing the market mechanism to function more widely has been declared but when it comes to solving particular problems, such as reigning in lending to the real estate sector, central decisions resembling planning are taken, such as credit allocation to various groups of banks. If the market were to play a greater role, mechanism have to be in place to correct the market outcome to achieve national priorities, such as a fairer income and wealth distribution. However, these are not in place and corrections are rather administrative decisions.

3.12. Material versus spiritual civilisation

While modernisation, in particular through technology and creativity has been singled out as the major feature of the Report and the 14th FYP, many sections are devoted to strengthening moral leadership of the CPC and socialist thinking and behaviour of the people, citing intellectual and cultural needs. Even President Xi has lamented the misuse of technology for gaming and entertainment. Some sources say that young people spend about 30% of their time on this.

4. Major challenges which need to be addressed

While Premier Li Keqiang has alluded to resolving major challenges, they lack clarity and a transparent policy framework for resolution. They have been brushed under the carpet.

4.1. Ageing problem

While the strategy to address ageing has been mentioned and old age insurance for 95% of pensioners,   the FYP lacks addressing any backlash from the inevitable demographics of China's population. After all, supply of labour can be manipulated only to a certain extent, but the implications for labour supply, productivity and demand for social welfare are not clear. The proposed raising the retirement age might serve as a temporary remedy.

4.2. Reduce debt levels

Although there are indications for reducing the dependence of growth on further indebtedness, any meaningful reduction of indebtedness in the medium term, such as the deflation of the real estate bubble are not clear. Furthermore, the increase of foreign borrowing has not been accounted for. In addition, many private enterprises borrowed in offshore zones which is not included in the total external debt. A drastic reduction in debt could put economic growth at risk.

4.3. Fiscal imbalances

The inconsistency between the fiscal responsibilities of the centre and local governments has not been addressed. Cities and countries continue to receive presents from the centre, local governments continue incurring debt through bond issues and LGFV as their fiscal responsibilities are not met by an adequate share of taxation. Fees from land use continue to constitute an important income for them.

4.4. Inequality of income and wealth

This has been identified as major drag on boosting domestic consumption. This needs courageous measures rather than a declaration to augment low incomes.　The primary income distribution needs to be corrected by progressive taxation and by providing adequate social safety net, public health and education for all.

4.5. Role of private enterprises and markets

While a hybrid economy offers many advantages as mentioned in the FYP, it has many drawbacks. First and foremost is the uncertainty which one will prevail. In addition, choosing one will determine other choices. As the private sector is the backbone of China's economy, it cannot be starved of finance. If banks are reluctant to lend extensively to the private sector, the financial markets as well as FinTech should fill this gap.

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Global Impact of Policies of China's 14th Five Year Plan

By JAYA JOSIE[*]

The National People's Congress that approved the 14th Five Year Plan of the Communist Party of China (CPC) took place at the beginning of 2021, a very significant year indeed. On 23 July 1921 the Communist Party of China (CPC) was founded. In July 2021 the A few days later, on 30 July 1921, the Communist Party of South Africa (CPSA) was also established. The CPSA was banned in 1950 and later remerged as the South African Communist Party (SACP). In July 2021 both the CPC and the SACP will be celebrating 100 years of struggle for building socialism and societies free from oppression, inequality and poverty.

During the early 1920s many other communist parties were established internationally and many played a key role in moving their countries towards economic development and the securing the rights of men and women workers. Today women and men in the world have worker's rights enshrined in constitutions and international Charters. In countries that were colonized in Africa, Asia and Latin America the communist parties were in the vanguard of the struggle against colonialism, slavery and oppression. Leading up to the Second World War communist parties mobilised against fascism and colonial oppression. During this period the CPC was an inspiration to many liberation movements and progressive movements fighting against colonialism. In particular the Long March of the CPC under the leadership of Chairman Mao and other leaders was an example of how liberation could be achieved by mobilising the people from all groups in society. The victory of the Soviet Revolution in Russia in 2017 was a key element in maintaining stability among Communist Parties internationally.

The 1920s through to 1945 were traumatic years for the world. It was characterised by the Great Economic Depression and followed by the rise of Fascism in Europe and the rise of an expansionist Japan in South East Asia. Colonialism was entrenching itself in Africa and Latin America was experiencing an unprecedented assault on its democracy with the imposition of Neo-colonial regimes in many countries. The Middle-East also became the target of for change and control by European and American powers. These event ultimately led to the Second World War in 1939. The invasion of China and other South East Asian countries by the Imperial Japanese Army extended the Second World War into South East Asia. The defeat of Fascism in Europe, and the defeat of Japan in 1945 was the culmination of struggles of people and workers from all over the world. In Europe, China, South Africa and other parts of Africa members of Communist parties played a key role in the defeat of Fascism and Japanese expansionism. In 1949 the Communist Party of China finally took control of China and the 1952 Congress of the Party launched the First Five Year Plan to be implemented from 1953 to 1957.

The First Five Year Plan saw the launch of China's ambitious industrialization strategy to move China from underdevelopment and poverty to a developing country. From 1953 to 1978 China became an inspiration to many underdeveloped, developing and colonized countries. China played a key role in supporting liberation movements in Africa, Asia and Latin America. In Africa in particular the support of China, the Soviet Union and Cuba was crucial for the liberation struggle in many African countries and resulted in the liberation from colonialism and apartheid of these African countries. In South East Asia China played a key role in the victory of the Communist Party of Vietnam against French colonialism and eventually the victory of the Vietnamese again

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the United States imperialist invasion and the reunification of Vietnam in 1975, and the liberation of Cambodia and Laos. There is absolutely no doubt that the Communist Party of China has made a global impact since 1921.

In 1968 there were massive international student protests against the war in Vietnam, against Apartheid in South Africa and colonialism in Africa. In France and the USA students were also protesting against university authorities and against the war in Vietnam. In South Africa students were also protesting against apartheid colonial education. In the same year I had left school and just started work. I grew up in a very poor family in which all nine of us lived in two bedrooms with the only income coming from the wages of my mother and   eldest sister. Much of the poverty and inequality in South Africa was caused by the apartheid colonial policies of the minority white government protecting white wealth and privilege. While there was much suffering by the majority of the oppressed people there was also much hope as the youth and students continued protesting. Workers were also being organised into unions and went on massive strikes in opposition to oppressive labour laws.

Black students organized themselves into the South African Students Organization (SASO) under the leadership of Steve Biko. SASO mobilized Black students in particular in universities and schools across the country. Many of the students and youth were impacted and inspired by the youth of China during the cultural revolution, and the young people participating in the war in Vietnam. The period from 1968 to 1976 was an exciting period for young people in South Africa. In 1972 I went to Europe, the USA and Canada on a mission on behalf of SASO to engage other student organizations and raise awareness about apartheid oppression in South Africa. In London I met up with leaders of the South African Communist Party (SACP) and the African National Congress (ANC) liberation movement. I volunteered to work underground for the SACP. By !973 many student leaders were arrested and placed under banning orders and house arrest. I was among the students that was placed under house arrest. In 1974 Mozambique was liberated from Portuguese colonialism and there was much celebration in South Africa. The apartheid government responded with the arrests and detentions and there was massive repression of students and activists. I decided to escape and join the SACP and the ANC liberation movement based in Southern Africa.

In June 1976 school students from Soweto and other Black Townships in South Africa organized massive peaceful demonstrations against apartheid education. The police responded with the shooting of many students and arrests of activists. June 1976 was a turning point in the history of the liberation of South Africa. Many young people also left South Africa and joined the liberation movement and the SACP. The impact of the events in China and Vietnam played an important role in inspiring young people in Africa and other developing countries.   In 1978 in China the CPC introduced the process of economic reforms and since then the CPC has led China to become the second strongest economy in the world. In the developing world in general, and in Africa in particular we have been encouraged and supported by China.

By 1990 the apartheid government decided to release Nelson Mandela and the other leaders of the SACP and decided to negotiate a settlement in which all people in South Africa will have equal rights and participate in government. I participated in developing the economic policies for the SACP and the ANC and towards the end of 1993 I was part of the SACP, ANC and Labour delegation that visited China for discussions with the CPC. We had very fruitful discussions and all of us were impressed at the great progress that China had made since 1978. When I visited China in 1993 the streets of Beijing were full of bicycles and public transport was not well developed. When I returned to China in 2015 Beijing was a modern and well developed city with highly developed urban transport and infrastructure. I have travelled extensively in China and visited many cities and places. I have lived and worked in Haining and Shanghai and spent time

in Hangzhou. I have seen how the CPC and the people of China have welcomed and supported people from the developing world. I have seen how China has taken a lead in the BRICS group of countries by hosting the New Development Bank.

The impact of the Five Year Plans since 1953 have had a significant impact on the people of China. At the Congress to launch the 14th Five Year Plan the CPC announced that China has indeed eliminated absolute poverty in country. The United nations has also applauded China's efforts in meeting many of the Sustainable Development Goals (SDG) for its people. On the global level China's Belt and Road Initiative (BRI) is making great impacts in Asia, Africa and Eurasia. Today we see China's investment in infrastructure in Africa and Eurasia that is making positive impacts on the lives and economies of the countries in these regions. The most important policy instrument for investment in the OBOR is the Asian Infrastructure Investment Bank (AIIB). It is important to note that none of these achievements would have been possible without the role of Communist Party of China (CPC) and its pursuit of socialism with Chinese characteristics.

I continue to work in China and interact with Academics and Party members and other officials. I feel honoured to be able to lecture and contribute to the training and development of young students in China and other parts of world studying at Zhejiang university. I am also honoured to be part of the International Committees at Renmin University and the Academy for Internet Finance (AIF) in Zhejiang University.   It is my very small way to say thank you to China for its great contribution in our liberation in South Africa in particular and Africa in general.

China – Leading to World Recovery – and Beyond

By Peter Koenig[*]

China's annual parliamentary meeting (4-11 March), known as the "Two Sessions", the Chinese People's Political Consultative Conference (CPPCC) and the National People's Congress (NPC), may be the most important of such meetings in recent years. The event is also celebrating the 100th Anniversary of the Communist Party of China (CPC).

The conference will define China's internal and external development strategies, as well as her future role on the world stage. China is the only major economy that has mastered the covid-induced economic crisis, ending 2020 with a 2.3% growth. Compare this with economic declines way into the red for the US and Europe, of 25% to 35%, and 10% to 15%, respectively.

These figures may only be indicative. The bulk of the economic fallout from western governments' mishandling of the covid crisis, i. e. bankruptcies, trade disruption, unemployment and housing foreclosures – a massive slide into poverty – may only be registered in 2021 and beyond.

The greed-driven capitalist system has already plunged tens of millions of westerners – and perhaps hundreds of millions in the Global South – into destitution.

What China decides, at the "Two Sessions" Conference will undoubtedly have an impact on the entire world – in the medium-term (2025) as well as long-term (2035) – and beyond. China's socialism "with Chinese characteristics" will be an influence for peace, justice and equality, as well as for a multi-polar world.

China's thousands of years of cultural history and the ensuing Tao-philosophy of non-aggression and conflict avoidance, of a societal spirit of endless creation, as well as long-term thinking, contrasts radically with western conflict and instant-profit seeking.

The summit is addressing ambitious but attainable 2035 targets, including a 6%-plus growth in the foreseeable future; reduction of unemployment with urban focus; continued food self-sufficiency and environmental improvement targets, a gigantic 18% CO2 reduction, largely through a significant drop in energy consumption (13.5%) per unit of GDP – and this with a projected higher than 6% annual economic output. Environmental improvement and protection targets are way above any environmental objectives of western countries.

The conference also defines China's guiding role in a worldwide recovery from a covid-related devastated economy. China's economy has suffered, mainly during the first half of 2020, but her decisive actions have successfully overcome the pandemic's path of destruction. By the end of 2020, China's production and services were back to 100%. Thanks to this stellar efficiency, the west and Global South may continue relying on China's supply of such vital goods as medical equipment, medicines, electronics and more.

What China's 2025 Plan and 2035 / 2050 visions may include, is a strong emphasis on economic autonomy and defense.

Economy – Western China bashing with related sanctions, trade and currency wars, may continue also under the Biden Administration – because US / European policies on dealing with China – and Russia for that matter – are made well above the White House and Brussels.

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Rapid dedollarization may be an effective way to stem against the western "sanctions culture". China may soon roll out her new *digital Renminbi (RMB)* or yuan, internationally, as legal tender for inter-country payments and transfers, and as an international reserve currency.

Reduced demand for US-dollars may incite worldwide investments in the new digital RMB.

Detaching from western dependence, China is focusing trade development and cooperation on her ASEAN partners. In November 2020 China signed a free trade agreement with the ten ASEAN nations, plus Japan, South Korea, Australia and New Zealand, altogether 15 countries, including China.

The Regional Comprehensive Economic Partnership, or RCEP, covers some 2.2 billion people, commanding some 30% of the world's GDP. This agreement is a first in size, value and tenor - worldwide.

China, Russia, as well as the Central Asia Economic Union (CAEU) and the Shanghai Cooperation Organization (SCO), are likewise integrated into the eastern trade block.

RCEP's trade deals will be carried out in local currencies and in yuan – no US dollars. The RCEP is, therefore, also an instrument for dedollarizing, primarily in the Asia-Pacific Region, and gradually moving across the globe.

Defense - China provides the west's main supply chain, from medical goods to electronic equipment to almost every sector important to humanity. Yet, western political interference in China's internal affairs, like in Hong Kong, Taiwan, Xinjiang Uygur Autonomous Region and Tibet, are endless. Overcoming these aggressions and threats of armed conflicts, is part of China's forward-looking plan and defense strategy.

Mr. Wang Yi, China's Minister of Foreign Affairs, recently warned the White House to stop meddling in China's internal affairs; that reunification with Taiwan is a historic tendency and was the collective wish of the Chinese people. He added, this trend cannot be reversed.

As a forerunner to China's CPPCC Summit, in his address to the virtual World Economic Forum (WEF) on 25 January 2021, President Xi Jinping stated that China's agenda was to move forward in the World of Great Change, with her renewed policy of multilateralism, aiming for a multi-polar world, where nations would be treated as equals.

China will continue to vouch for strong macroeconomic growth with focus on internal development which, in turn, will stimulate and contribute to international trade and investments. – China pledges assistance for those that are suffering the most during this pandemic-induced crisis.

President Xi emphasized, there was no place in this world for large countries dominating smaller ones, or for economic threats and sanctions, nor for economic isolation. China is pursuing a global free trade economy. BUT – and this is important – when talking of "globalism" – respect for political and fiscal sovereignty of nations, is a MUST.

On a global scale, President Xi's Belt and Road Initiative (BRI) embraces currently more than 130 countries and over 30 international organizations, including 18 countries of the European Union. BRI offers the world participation – no coercion. The attraction and philosophy behind BRI, is shared benefits – the concept of *win-win*. BRI may be the road to socioeconomic recovery from covid-devastation and cross-border cooperation for participating countries.

China's achievements in her 71 years of revolution are unmatched by any nation in recent history. From a country largely ruined by western colonization and conflicts, China rose from the ashes, by not only lifting 800 million people out of poverty, becoming food, health and education self-sufficient, but to become the world's second largest economy today; or, if measured by purchasing power parity (PPP), since 2017 the world's largest econmy. China is poised to surpass the US by 2025 in absolute terms.

On 4 March, Robert F. Kennedy Jr. (Children's Health Defense), asked the pertinent question, *"Can We Forge a New Era of Humanity Before It's Too Late?"* – His answer is simple but lucid: *"Unless we move from a civilization based on wealth accumulation to a life-affirming, ecological civilization, we will continue accelerating towards global catastrophe."*

This understanding is also at the forefront of China's vision for the next 5 and 15 years – and beyond. A China-internal objective is an equitable development to well-being for all; and on a world-scale, a community with shared benefits for all.

Global Economy

Resilience in a New Shock-Prone World*

By KRISTALINA GEORGIEVA*

Joseph Joyce: Questions come up periodically about the need for a new Bretton Woods system. And maybe I should say very quickly, Bretton Woods is the name we use to refer to the agreement that was made in 1944 at Bretton Woods, New Hampshire, not too far from Wellesley, by the 44 representatives of the allied countries, looking forward to the post-war world. And they set up a new monetary system and also started the IMF, as well as the World Bank. So that's what Bretton Woods started with.

Joseph Joyce: And so, the question sometimes comes, is there a need for a new Bretton Woods? And as part of that, how can the Fund persuade countries to do what needs to be done, to do the changes, which you are very eloquently putting out need to be done? How much can the Fund induce countries to make those changes?

Kristalina Georgieva: I went to Bretton Woods for my birthday this last summer, because I felt I wanted to get into this history of how in the midst of a war, our founding fathers, they, by the way, were all fathers, 44 men, had the wisdom to establish institutions for post-war reconstruction. Now, we are in a similar kind of Bretton Woods moment. We have to reconstruct, we have to rebuild from the hit of COVID-19, and at the same time, we have to transform our economies to be greener, to be fairer, actually, to be digital everywhere so everybody has access to this digital transformation. So we do have a new Bretton Woods moment in that sense.

Kristalina Georgieva: Does it mean we have to create new institutions? Actually, not because I'm in one of them, this is not self-preservation, I see these institutions having evolved with time, doing what needs to be done today to protect the world economy from significant harm. If we didn't exist, if we didn't have the World Bank, the IMF and other institutions, the world would have been in recession that would have gotten deeper into depression. So we would have had yet another Great Depression.

Kristalina Georgieva: Why? Because we would have lacked these transmission lines of policy assessment, policy action. Swiftly, you realize that the world has poured $20 trillion to put the floor under the world economy. And monetary policy accommodation has allowed businesses to survive. Unemployment has gone up, but not to dramatic levels. So I would argue that that element of resilience for the world economy that comes with these institutions is precious. We have to value it and we have to continue to develop not only the Bretton Woods institutions, but also the other elements that keep the world connected and effectively coordinates action when it is necessary.

Kristalina Georgieva: If you look at the IMF today, we perform the heart of the global financial

safety net function very differently than we did it in '44, but we do perform this function. And I would be preoccupied and insistent on continuing to build these institutions for tomorrow, where we ... And this is probably the thing, the question that gives me most sleepless nights. The question is, how in a rapidly changing world, that is geopolitically very different, more fragmented than it used to be, how can we keep our membership together? How we can crystallize objectives that generate unity and also action on a scale that is necessary.

Kristalina Georgieva: So far, the fund has risen to the occasion, even if we would be a bit meandering, losing direction, especially at the moment of shock, the fund always would step up and then change so it can remain effective. And also, what I see is a tremendously important need for cooperation among the multiple institutions, one driven by purpose.

Kristalina Georgieva: If we have to say that the world today has three priorities, bring the health crisis to an end everywhere; transform, recover and transform the economy for the future, not replicate the economy of yesterday; and prevent divergence between rich and poor, rich and poor people, rich and poor countries. Each and every institution has to find its place, vis a vis these priorities, and deliver its utmost best to address them. And for me, that is our new Bretton Woods moment, to step up to what is expected from us in this crisis.

Joseph Joyce: Kristalina, you mentioned a little bit your own previous work, and of course, you grew up in Bulgaria when it was still a communist country, and you were there when the communist regime ended. And we're curious to know, how does that affect your perspective when you look at issues such as the ones we're talking about today?

Kristalina Georgieva: Well, the most important value of this personal experience for my job at the Fund is that I know firsthand the price people pay for bad policies and the benefits of good policies. My country basically went bankrupt as a result of bad management of our economy. We then got into an incredibly difficult couple of years in the early nineties, after the collapse of the centrally planned economy.

Kristalina Georgieva: In these days, I had to get up at four o'clock in the morning and queue to buy milk for my daughter. And I saw how my mother's lifelong saving melted to nothing because of hyper inflation. And then, the country took on board prudent policies. Up to this day, Bulgaria is immune against borrowing willy-nilly and squandering money into white elephant type of projects. During this crisis, we see Bulgaria being one of the countries that have handled the economic impact of the pandemic fairly well because of strong buffers and strong finances.

Kristalina Georgieva: So I bring this experience to the Fund and it is both an understanding that there is a pathway to sound macro economic framework, but also having the empathy for people that are for, very often, no fault of their own experiencing the negative consequences of bad policies, and how this transition to sound macro finances can be managed with attention to social needs. So you don't pull the plug on your education and health expenditures. You guarantee that as a result of adjustment, when this adjustment is necessary, the country is getting better off, but the most vulnerable, the poorest people are not left out. They actually are our center of attention.

Kristalina Georgieva: And if I may, we are now living through a very unique crisis, and to go back to your first question on the value of these institutions, if we needed to be vindicated for being a part of the global landscape, this crisis gave us a ample opportunity for that. The Fund assessed the crisis very quickly and came up with unorthodox policy advice. We basically said spend, keep the receipts, but spend. You don't hear an IMF managing director saying these words, spend, often. We did that because it was the right thing to do. Now, we are talking about calibration of support at this stage of the crisis.

Kristalina Georgieva: And then, we stepped up very, very rapidly, crisis finance directed to especially the most vulnerable countries. We have funded some countries, $5 billion since the beginning of the pandemic, benefiting 83 countries. 49 of these 83 countries are low income

countries. And this is where we made the biggest difference by significantly increasing our concessional lending capacity to provide lifelines where they're most needed. And I can say it was my upbringing, but even more so having served as a crisis commissioner and learning what it is to anticipate a shock, and when the shock comes, to act decisively.

Joseph Joyce: Well, speaking of that, not only does the IMF and you talk about the crisis, to do what we need to do now, which you've just outlined, but I know you also talked about the world after the crisis and how things will change. And in particular, you said that the crisis has triggered profound structural transformations of national economies. And you said that governments have to be ready to aid in the transformation of those economies. So I wonder if you could tell us which sectors of the economies may prosper, which economies may not, may actually contract, and what type of policies do you see governments with the backing of the fund enacting?

Kristalina Georgieva: Well, thank you for this question. What is very clear, just a year into this pandemic-induced crisis, is that digital, broadly speaking, tech, are big winners of the crisis. You and I have no problem to do our jobs and we are part of this privileged segment of the economy that can operate remotely. Digital services, overall, digital currencies, they're all taking off very rapidly. I used to say the future is digital. Well, the future has arrived. We are in it. Automation and manufacturing that is based on that automation, are big winners.

Kristalina Georgieva: Where are the losers? Contact dependent industries. We saw what has happened to restaurants and services of all kinds. Travel. There are some who say the conventional tourism is dead. I wouldn't go that far. I think it is going to eventually recover to a certain degree, but we sure are not going to go back to where we were in the pre-pandemic world. Low skilled workers, women, young people, these are the segments in societies, country after country, that are most severely impacted.

Kristalina Georgieva: And broadly, if I talk not about the sector, but about an issue, the issue that is going, already is hitting us and will hit us even more, is deepening inequalities. Because of this K shape that we see in countries and across countries. I am particularly concerned about the K shape across countries. After decades of progress in convergence between high income and low income countries, we are hitting the reverse gear. We're seeing now divergence that, if left unattended, would not only harm tremendously those affected, the countries that are affected, but it would harm security and stability in the world as a whole.

Kristalina Georgieva: So there is hugely important priority on recognizing this divergence, some doing very well, some doing very poorly. Rapidly and substantially revamping our tax policies, moving towards more re-distributional system of taxation, so those that are doing very well help the rest. Reshaping public spending policies so we think more about building resilience, not just to the pandemic, but resilience to shocks. And what it means is investing in resilient people that are educated, healthy, with sound social protection, when necessary. Resilient planet, we have now a climate crisis that was knocking on the door before, that has gone nowhere, that we have to deal with.

Kristalina Georgieva: And of course, continue to build the resilience of our financial system. As you know, Joe, we did some of it, actually, quite a lot of it after the global financial crisis. We built a more resilient banking system, but that is not enough. We have no banking institutions that have been left off the hook. And of course, we have this holistic view of resilience for a world that is going to be more shock-prone, because it is a faster changing world.

Joseph Joyce: So Kristalina, as you know, the Albright Institute is designed to take young women at Wellesley College and expose them to global issues. And for that reason, we ask global leaders such as you to come and address that. So Kristalina, thank you so very, very much for joining Wellesley College today.

Kristalina Georgieva:Thank you, Joe. It was wonderful to be with you. And to everybody who

was on the line, stay well and never never never aspire for less than the best you can be.

Joseph Joyce: I'm sure Madeleine Albright would second that one very quickly.

Kristalina Georgieva: Thank you.

Bruce Edwards: That was Wellesley College professor Joseph Joyce in conversation with IMF Managing Director Kristalina Georgieva at the Albright Institute for Global Affairs. You can watch the entire event on the Wellesley College YouTube channel, and go to IMF.org to find more conversations with Kristalina Georgieva, including her talk at the Center for Strategic Philanthropy at the University of Cambridge.

SDR Proposals Could Help Reset International Monetary System[*]

By WILLEM MIDDELKOOP AND DAVID MARSH[*]

The International Monetary Fund's special drawing right – the international reserve asset created in 1969 to prepare for a new dollar crisis – is undergoing a renaissance, with important worldwide repercussions. The announcement of by far the largest-ever increase in SDR allocations, which will greatly improve the liquidity of many developing nations, signals alignment between the US and China in a key area of global monetary power.

The immediate reason behind the decision on 19 March by the G7 group of industrial nations was to help low- and middle-income countries hit by the pandemic. UK Chancellor of the Exchequer Rishi Sunak, speaking after a finance ministers' meeting under the UK's G7 presidency, said the new capital injection ensured that 'no country is left behind'. Kristalina Georgieva, IMF managing director, said the planned SDR allocation – to be finalised next month – would accompany measures on 'debt vulnerabilities' and concessional finance.

The action has wider significance. The US now agrees with using the IMF's balance sheet to boost world liquidity. One side effect of the pandemic is that the IMF's accounting unit is advancing beyond its status as an arcane currency basket – and could become an essential part of a future monetary reset.

The G7 decision, already foreshadowed by agreement at G20 level, is likely to more than triple SDR allocations by at least $500bn. This reflects a change in US policy to back measures strongly advocated last year by China as well as leading European and African countries.

G7 countries will coordinate with the IMF to explore how countries could 'voluntarily recycle their SDR holdings to further support low-income countries'. This would open a new channel for rich nations with large reserves to distribute part of their plentiful SDR stocks to poor countries.

The massive increase in SDR reserves – which can be converted into its five constituents: the dollar (42%), euro (31%), renminbi (11%), yen (8%) and sterling (8%) – indirectly boosts the Chinese currency's international reserve role. As Geoffrey Yu of Bank of New York Mellon wrote in July 2020, 'China may have an additional interest in pushing for a general [SDR] issue, as it is a shortcut to a significant de jure nominal increase in the global level of renminbi reserves.'

Janet Yellen, US Treasury secretary, has been a key architect of President Joe Biden's emollient line on the SDR. In a letter to the G20 shortly after her appointment two months ago, she called for more SDR printing in a 'truly collective and multilateral response', urging G20 countries 'to continue to take significant fiscal and financial policy actions.'

The new allocation, the first since 2009, reversed the Trump administration's rejection last year of calls from European and African leaders for the IMF to create additional reserve assets to help emerging economies hit by the pandemic. German Chancellor Angela Merkel and French President Emmanuel Macron joined Ethiopian Prime Minister Abiy Ahmed and South African President Cyril Ramaphosa to urge an immediate decision on SDRs.

The IMF has been swamped by requests for financial assistance by dozens of countries, some

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of which face cumulative per capita income losses as high as 22% by 2022. With current IMF resources less than $1tn, extra liquidity supply is badly needed.

This latest action underlines changes in the world economy since 2011, the last time emergency SDR use was discussed, at the start of the euro debt crisis. The US administration proposed that the Bundesbank release excess stocks to aid Greece. The Bundesbank opposed this idea strongly. Merkel refused to put pressure on the central bank to change its mind, citing Bundesbank independence introduced under Anglo-American stabilisation measures for post-war Germany.

The SDR – brainchild of then French Finance Minister (and later President) Valéry Giscard d'Estaing – was conceived at a time when many countries, led by France, were converting surplus dollar holdings into gold. Under the Bretton Woods system, which broke down in 1971-73, the dollar would always be 'as good as gold'. However the IMF's unit has taken a long time to gain ground.

In 2009, the United Nations suggested a new SDR-based 'global reserve system' – 'feasible, non-inflationary, and … easily implemented, including in ways which mitigate the difficulties caused by asymmetric adjustment between surplus and deficit countries.' That same year, Zhou Xiaochuan, governor of the People's Bank of China, proposed that the SDR could become the pivotal international reserve currency, disconnected from individual nations, as 'the light in the tunnel for the reform of the international monetary system'.

Now, as a result of Covid-19, the world's monetary system based on national fiat currencies may be approaching a turning point. With the SDR revival, Zhou's 'light in the tunnel' is shining a little brighter.

China

How Will the New U.S. Government Affect Yuan's Appreciation Trend?[*]

By GUAN TAO[*]

The appreciation of the Chinese yuan against the U.S. dollar has entered the eighth month. The widening gap between China and U.S. interest rates, the weakening of the U.S. dollar index, and the market expectation for the improvement of China-U.S. relations are important external factors that support the recent continuous strengthening of the RMB. As Joe Biden officially takes office, the United States will enter the Biden era. So what are the implications for yuan's exchange rate?

First, we should examine China-U.S. relations. In the last three years, the Trump administration changed its China policy frequently, economic and trade disputes continued to escalate, and the yuan's exchange rate was under pressure. Biden said his new government will reshape the competitive and cooperative relationship between the two countries. It is expected that China and the United States will strengthen cooperation on issues such as vaccines, climate, and arms control.

But the overall situation of competition may not be fundamentally changed, though the direction or method may be adjusted, from trade issues to structural issues, from bilateral conflicts to multilateralism, from tariff frictions to competition of rules, and from economic and trade fields to other fields. The long-term and complex nature of the relationship between the two big powers will have an event-driven impact on the RMB exchange rate, that is, when good news comes out, the RMB will gain momentum, and vice versa.

The second factor is the China-U.S. interest rate differential. Controlling the spread of the COVID-19 pandemic and restarting the U.S. economy will be the top priorities of the new U.S. government. A few days ago, the Biden administration has announced a $1.9 trillion fiscal stimulus plan, which is mainly used for pandemic control and expected to salvage the U.S. economy. If the pandemic is under control and the economy rebounds, although the Fed may not raise interest rates, the weakening of the monetary easing margin and the rise of inflation expectations may still push up U.S. bond yields and narrow the interest rate differential between the U.S. and China. It is precisely under the influence of this market expectation that at the beginning of the new year, the yield on the ten-year U.S. Treasury rose rapidly to around 1.1 percent, and the China-U.S. interest rate gap dropped by about 50 basis points from the high point.

However, if the vaccination progress is slow or even fails, and the restart of the U.S. economy is hindered, the Fed may further increase asset purchases or even introduce negative interest rates. Under this circumstance, if China's monetary policy remains unchanged, the China-U.S. interest

rate spread will widen, which will boost the yuan. If China's monetary policy is relaxed, the China-U.S. interest rate differential is expected to narrow, which will drag the yuan. Another scenario is that if global inflation rises, it depends on how the central banks of the two countries would respond. If both have a certain tolerance for inflation, the China-U.S. interest rate differential will remain unchanged and have a neutral impact on the yuan. If the Fed responds stronger, the China-U.S. interest rate differential will shrink, which will weaken the yuan. It should be pointed out that the spread between Chinese yuan and foreign currencies is not only affected by nominal levels, but also by actual interest rates and risk factors.

The third is the dollar index. So far, the U.S. dollar index has fallen by more than 10 percent from its high at the end of March last year. Under the benchmark scenario, if the global pandemic is under control, the economy restarts, and market risk appetite improves, the U.S. dollar index is expected to weaken further, which will support the yuan. However, the duration and depth of the fall in the U.S. index depends on the speed of economic recovery in major economies after the pandemic. After the outbreak of the financial crisis in 2008, the Fed's quantitative easing did not lead to a significant depreciation of the U.S. dollar, mainly because the U.S. economy entered the longest post-war economic boom, while the European and Japanese economies fell into a long-term stagnation. Before the outbreak, the fundamentals of the U.S. economy were better than those of other major economies. In fact, benefiting from rising U.S. bond yields, the U.S. dollar index stopped falling and rebounded in the second week of the new year.

Moreover, under the background that major economies have adopted unprecedented fiscal and monetary stimulus measures, the new U.S. government's return to globalism and multilateral frameworks will help delay the decline of the dollar's international status and then boost it. Of course, there is still the pandemic fallout into a major economic crisis and financial turmoil, and the rebound in risk aversion in the market will push up the dollar again, which will be negative for the Chinese yuan.

From the policy perspective, China will continue to deepen the market reform of exchange rate this year, maintain the basic stability of the RMB exchange rate at a reasonable and equilibrium level, and further strengthen the exchange rate's role as an automatic stabilizer of macroeconomics and international payments.

From the perspective of the market, the rise and fall of the yuan's exchange rate will become the new normal. The continuous appreciation of the yuan in the early stage is the result of multiple favorable conditions. The next step is to pay attention to the market's possible exhaustion to the favorable factors and renewed sensitivity to negative factors, which could result in wide fluctuation of the exchange rates. The Chinese companies should stay on alert to such financial risks.

Pains, Difficulties, Bright Spots, and New Growth

Opportunities for the Hong Kong Economy in 2021

By E ZHIHUAN[*]

At the beginning of 2021, the Hong Kong economy has once again come to a crossroad. External and internal factors such as the fermentation of the coronavirus, US-China geopolitical tensions, and local protest events have caused the Hong Kong economy to face downward pains. The largest economic recession on record has made the existing structural problems for Hong Kong in the medium-to-long term to become apparent again. At the same time, the K-shaped recovery of the global economy and the fact that the Mainland has become the only major economy in the world that has achieved positive growth for two consecutive years will bring rare bright spots and new growth opportunities for the Hong Kong economy.

1. The triple shocks have caused Hong Kong to endure the worst economic downturn on record

Since 2020, the outbreak and persistence of the coronavirus pandemic has cut off personnel exchanges between Hong Kong and the rest of the world. Inbound tourism, which accounts for 3.6% of Hong Kong's GDP, has stalled. In order to control the pandemic, Hong Kong has implemented strict social distancing measures for many months, which has brought huge pressure to the retail, catering, entertainment, personal services and transportation industries, causing the real economy to deteriorate. Not long ago, the Hong Kong economy was hit successively by US-China frictions and local protest events. The United States imposed huge tariffs on China's exports, and subsequently revoked Hong Kong's status as an independent customs territory, sanctioned mainland and Hong Kong's officials, and discouraged international investors from treating Hong Kong as an international business and financial centre. In 2019, there were protest events in Hong Kong that restrained normal economic activities and tourism, leading the Hong Kong economy into recession. Political disputes over a long time in the past have hindered the long-term infrastructure and investment projects of the SAR government. The Hong Kong economy has lost important support during the downward cycle, and fell into a deep recession in 2020.

According to quarterly data, Hong Kong's real GDP contracted by an average of about 7.2% in the first three quarters of 2020, and the decline in real GDP in the third quarter narrowed to 3.5%. In the fourth quarter, the Hong Kong economy was once again hit by strict social distancing measures in response to the fourth wave of the local pandemic. For the whole year of 2020, the economy may shrink by about 5.9%, which is the same as the 5.9% decline recorded in 1998. Judging from quarterly figures, there may be economic contractions for six consecutive quarters, which will exceed the historical record of five consecutive quarters of contractions from the first quarter of 1998 to the first quarter of 1999. It will also be the first economic recession that would last for two consecutive years since record. Obviously, the current economic downturn in Hong Kong has caused practitioners in various industries to feel the deep pain, and people are eagerly looking forward for the economy coming out of the shadow of recession.

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2. Economic downturn has intensified the difficulty of solving Hong Kong's long-term structural problems

In the first half of 2021, the coronavirus will continue to ravage the world, and there is still a certain degree of uncertainty about whether the research, development and production of the vaccine can contain the pandemic. Countries around the world have generally strengthened disease prevention measures in response to changes in the pandemic. Cross-border exchanges continue to be restrained, thus it is difficult for the economy to recover significantly. Industries such as tourism, aviation, hotels, and catering are still facing tremendous downward pressure.

Facing a long-term economic downturn, the Hong Kong economy's structural problems, such as small, open and service-oriented, have been further exposed. For many years, Hong Kong's industrial structure has relied heavily on the service sector. Its four key industries - trading and logistics, financial services, tourism, professional services and other - accounted for 57% of Hong Kong's GDP. Among them, the percentages of finance, tourism and professional and business services have continued to expand, while the percentage of trading and logistics has declined. The scale and the economic contribution of advantageous industries such as culture and creativity, medical care, education, innovative technology, testing and certification, and environmental protection were limited. The downturn in the real economy has made it difficult for large companies such as the Cathay Pacific Airways and the Ocean Park to operate. These companies needed government capital injections to maintain their operations. Small and medium-sized enterprises and industries being directly affected by the pandemic faced even more difficulties to sustain.

The excessive uniformity of Hong Kong's industrial structure has also increased the vulnerability in the labour market. The overall unemployment rate in Hong Kong has risen rapidly from 2.8% in mid-2019 to 6.6% in October - December 2020, which is higher than the 5.5% recorded during the global financial crisis in 2008, hitting a 16-year high. Under the impact from the fourth wave of the pandemic and the completion of the Employment Support Scheme, the unemployment rate will deteriorate further. The unemployment rates in retail, accommodation and food services, and construction are among the highest, reaching 10.6% and 10.7% respectively. If the Hong Kong economy continues to be plagued by the pandemic in 2021 and fails to recover, it's possible for the unemployment rate to shoot further above the record high of 8.5% during the 2003 SARS period.

The rising unemployment rate brought by the long-term economic downturn affected citizens' confidence in the property market. The market is worried that once property prices are adjusted sharply, financial risks may arise. Historically, the period of economic downturn is often a period of risk exposure for the Hong Kong's property market. The real estate cycle in Hong Kong has rebounded rapidly after the SARS period in 2003, and has been in an upward cycle for more than 17 years. Private residential property prices in December 2020 have risen 5.5 times compared with the lowest level recorded during the 2003 SAS period, and is 1.2 times higher than the peak of the real estate bubble in 1997. The growth rate in property prices far exceeded the growth rate of household income during the same period. In 2021, as global major interest rates remain low and Hong Kong's housing supply is limited, it is not easy for property prices to undergo substantial adjustments. However, standing around the historical high, property prices could also be concerned by their own height.

3. Bright spots of the Hong Kong economy in 2021 and new growth opportunities for getting out of the downward cycle

If vaccines could be adopted globally, the pandemic may become under control and the economy may restart in the second half of 2021. Major economies will show signs of rebound, driving the

recovery of tourism, aviation, hotels and catering industries, bringing external support for the small open economy in Hong Kong. Foreign trade may become the first bright spot for the Hong Kong economy. In the second half of 2020, Hong Kong's exports of goods increased 3.3%, which was an improvement from the 6.9% contraction in the first half of the year.

In 2020, Hong Kong's financial market has operated normally and demonstrated resilience. The main reasons are not only that Hong Kong has a good business environment, a simple and low tax system, a free port of funds, a judicial system in line with the West, efficient financial supervision and the freest economy, but its economic and trade links with the Mainland and the interconnection of financial markets also provided Hong Kong with an internal stabilizer to deal with external shocks. In recent years, with the internationalization of the RMB, the Mainland has successively introduced Shanghai-Hong Kong Stock Connect, Shenzhen-Hong Kong Stock Connect, Bond Connect and Mainland Hong Kong Mutual Recognition of Funds and other schemes to promote system integration and policy coordination. These schemes provided Hong Kong's financial and professional services companies with greater room for development. They also helped Hong Kong to withstand external shocks and maintain market stability. In 2020, the net fund inflow to Hong Kong's stock market through Shanghai-Shenzhen-Hong Kong Stock Connect was HK$672.1 billion. Since 2021, the amount of fund inflow has reached 40% of the inflow in the whole year of 2020. In addition, benefiting from the return of China concept stocks and the prolonged low-interest environment, Hong Kong's financial activities maintained good performance in 2020. Since April 2020, a total fund inflow of approximately HK$383.5 billion has been recorded, and the banking system's Aggregate Balance has risen to HK$457.5 billion, above the historical high of HK$426.3 billion in November 2015. The United States continues to tighten the requirements for mainland companies to list on American exchanges and restricts US investors from investing in mainland companies, which has prompted more mainland companies to return to Hong Kong for listing and conducting more investment and financing activities, promoting Hong Kong's IPO fundraising amount to the second largest in the world again. It is expected that Hong Kong's financial industry will remain active in 2021, bringing a rare bright spot to the Hong Kong economy.

In 2021, the Mainland will become the only major economy in the world to achieve positive growth for two consecutive years, maintaining its role as an important driving force of the global economic growth. From the second to fourth quarter of 2020, the Mainland's GDP grew by 3.2%, 4.9% and 6.5% in real terms respectively, and grew by 2.3% for the whole of 2020. It is expected that the economic growth of the Mainland in the first quarter of 2021 will further accelerate. In response to the changes in the international environment, the Central Authorities have proposed to accelerate the formation of a new development pattern in which the domestic and international circulation could promote each other. The initiation of a new dual-circulation economic development pattern relying on huge domestic demand, market, and further opening-up, can provide Hong Kong with new opportunities to integrate its economic development into the overall national development. And this will also become a new growth point for Hong Kong to walk out from the long-term economic downturn.

Hong Kong should seize the new opportunities from the Mainland's dual-circulation development pattern, give full play to the particularity of its key nodes in the dual circulation of domestic and external economies, enhance the overall expression of its economic value to the Mainland, and expand its own development space in the process of helping the Mainland economy reshape new advantages in international cooperation and competition.

First, to encourage more Hong Kong companies to participate in the great economic circulation in the Mainland. The mainland economy will shift from being driven by investment and exports to driven by domestic demand with consumption as the mainstay, by increasing residents'

disposable income, further improving the rationality of income distribution, orderly expanding the middle-income group, and narrowing the income distribution gap. Hong Kong should proactively seize the new opportunities from the high-quality development of the mainland economy and actively participate in the Mainland's new economic development driven by domestic demand. Over the years, Hong Kong has invested heavily in the Mainland and has become the preferred channel for thousands of international investors and multinational companies from major countries/regions to invest in the mainland market. While continuing to maintain and improve its own business environment, Hong Kong should give full play to its expertise in market philosophy and related institutional design to encourage more companies to participate in the great economic circulation in the Mainland.

Second, to promote the diversification of the Hong Kong economy and improve the quality of its economic development. In 2021, industries such as the digital economy, life and health will achieve rapid growth. The Internet and artificial intelligence will help realize seamless connections of people, property and assets, and help accelerate the process of decentralization. The Mainland accelerates to push forward the independent innovation of core technologies, promotes the development of strategic emerging industries such as the digital economy, life and health and new materials, accelerates the replacement and circulation of the technological ecosystem, regards technological innovation as a key element to promote the high-quality development of the real economy, so as to realize the transformation and upgrading of its industrial structure, to promote the industrial chains and supply chains to shift from international division of labour to domestic division of labour, and to reduce the reliance on foreign markets. Hong Kong has solid foundations and capabilities in basic scientific research and innovation, and has global leading research capabilities in the fields of biomedicine, neuroscience, genomics, vaccine technology, and stem cell technology. Hong Kong's scientific and technological innovation support system is relatively complete. It has established a highly open and international scientific research system. The protection of intellectual property rights has reached a relatively high level in the world. It has attracted a large number of high-quality innovative talents and established an internationally leading higher education discipline system. Hong Kong can give full play to its institutional advantages and first-mover advantages mentioned above, deepen cooperation with mainland innovative enterprises, advanced manufacturing, high-end manufacturing and other industries, to promote the accelerated transformation of scientific research results into products and services that meet market needs, and jointly develop the mainland market to serve the development of innovation and technology industry. In addition, technological innovative enterprises with advantages and attractiveness should be encouraged to choose the Hong Kong market, in order to provide new growth drivers for the Hong Kong economy, to promote Hong Kong's economic transformation, and to help resolve the deep-seated contradictions and risks faced by Hong Kong.

Third, to use the offshore RMB business as a starting point, continue to enhance the influence of Hong Kong as an international financial centre. The high-quality development of the mainland economy accelerates to promote a new round of financial market opening and further improve the renminbi's status as an international reserve currency. In 2020, the RMB exchange rate rose by 6.7%. Entering 2021, the RMB exchange rate continued to strengthen, hitting the highest level since June 2018. At present, the renminbi maintains a positive interest rate differential relative to other currencies, and mainland financial assets have been included in more global financial indexes. This enhances the attractiveness of the renminbi assets to global investors and will support the RMB exchange rate to maintain a good momentum of steady appreciation. Hong Kong should continue to leverage its first-mover advantages and scale advantages on the offshore RMB hub, continue to promote the development of offshore RMB business, and boost the use of RMB in trade and investment in "Belt and Road" countries, and increase the influence of Hong Kong's

financial institutions in the RMB business sector. At the same time, Hong Kong can assist the Mainland to optimize the construction of free trade zone and free trade port system, accelerate the establishment of intermediary nodes for Chinese enterprises' "going abroad" plans, attract the influential industrial leading enterprises in the Mainland to go out and invest in Hong Kong, establish overseas or regional headquarters to improve the efficiency of "going abroad". Hong Kong should seize the new opportunities of the mainland's new round of financial market opening to enhance its competitiveness as an international financial centre.

China Must Create Shared Global Wealth[*]

By ANDREW SHENG AND XIAO GENG[*]

China has become vastly more prosperous in the last two decades, but with greater wealth comes greater social responsibility. Instead of quarreling, the United States and China need to start solving global problems together.

The OECD is projecting an uneven K-shaped economic recovery from the pandemic in 2021. Richer countries with more extensive vaccine rollouts that can afford to reopen and reflate their economies will do so. Poorer economies will struggle to stay healthy and avoid debt crises. But the mantra that "no one is safe until everyone is" highlights the need to spread health, wealth, and self-respect to all. An increasingly prosperous China can and should play a central role in this effort.

Whereas the World Bank estimates that the pandemic may drive up to 150 million additional people globally below the poverty line of $1.90 per day, billionaires everywhere have become richer during the crisis. A 2020 report by UBS and PwC indicated that the global number of billionaires had increased to 2,189, with their combined wealth rising to $10.2 trillion, mainly owing to higher returns on technology stocks.

Meanwhile, Credit Suisse estimates that global household wealth stood at $400 trillion in June 2020, a more than threefold increase from $117.9 trillion at the end of 2000. Chinese household wealth rose remarkably fast, from 3.2% of the global total in 2000 to 17.7% by mid-2020. Over the same period, the United States' share dropped from 36.2% to 29.4%, and Europe's from 29.3% to 25.2%, while India's rose from 1.1% to 3.5%. But the benefits of rising wealth have not been equally shared, as almost all countries' Gini coefficient – which measures inequality – has worsened.

Yet, while the number of Chinese billionaires has risen sharply due to property and tech booms, the gap between Chinese and US median wealth levels is narrowing. In 2000, the median wealth per Chinese adult was $2,193, or 4.8% of the US level, according to Credit Suisse. By mid-2019, it had risen 9.5 times, to $20,942, or 31.8% of the American median of $65,904.

Moreover, although Chinese per capita debt rose over those two decades, it was equal to only 21% of median wealth in mid-2019. In the US, by contrast, per capita debt amounted to 95% of Americans' median wealth in mid-2019, up from 76% in mid-2000. This faster debt increase slowed the rise in median Americans' net wealth. These numbers confirm the findings of Angus Deaton and Anne Case that the lives of working-class Americans have deteriorated dramatically, relative not only to the top 1% of the US population but also to their Chinese counterparts.

At the macroeconomic level, data from the Chinese Academy of Social Sciences indicate that China is closing the gap with the US in terms of net national wealth even faster than in terms of GDP. After noting differences in the valuation of assets such as real estate, China's GDP (at market exchange rates) and net national wealth were both around 12% of US levels in 2000. By 2018, China's GDP (at $13.4 trillion, or around $10,000 per capita) had reached 65% of the US level, while its net national wealth of $88.6 trillion was 80% of the US level of $110 trillion. China's

2018 net-wealth-to-GDP ratio of 6.6 was similar to that of France and higher than the US ratio of 5.3, and only slightly lower than Australia's ratio of 6.8.

China's net national wealth soared by 28%, 25.3%, and 11.5%, respectively, during the during the last three Five-Year Plans, driven by sustained high savings and investment rates of 40-50% of GDP. China's domestic asset prices benefited from the government's policy of moving toward market-determined prices, interest rates, and exchange rates.

Strikingly, the Chinese state owned CN¥162.8 trillion ($25 trillion), or 24.6%, of the country's net national wealth at the end of 2019. The household sector held 77.4%, or CN¥512.6 trillion, with China having net claims on the rest of the world equal to 2% of net national wealth. In contrast, the US household sector held $117.3 trillion, or 111.7%, of US net national wealth at the end of 2019, with the balance being net debt of $10.6 trillion owed mostly by the federal government to foreign creditors.

The Chinese state increased its share of net national wealth through rapid improvements in public infrastructure that benefited ordinary people rather than just elites. High levels of state-owned assets should enable the government, in the new 14th Five-Year Plan, to recapitalize the pension and social-security sector, effectively transferring wealth to low-income workers.

Moreover, with 90% of households now owning homes, and real wages having increased by about 3% per year for a decade, China can now rely on consumption as its main growth engine. This explains why Chinese policymakers are less afraid of economic decoupling from the US than American policymakers may assume. At the same time, China benefits from globalization, so it has little interest in attacking the global order (or the US).

Those who argue that rising gross debt levels pose a danger to China should note that its debt (like Japan's) is mostly domestic, while the country is a net lender to the world. This contrasts with the US net liability to the world of 11.7% of its net wealth, or over one-half of its GDP and rising. A high level of debt matters only if there are no assets to back it. Through decisive actions to control firms' debt, the Chinese corporate leverage ratio declined from 160.4% in the first quarter of 2017 to 151% by the end of 2019.

With an aging population but growing wealth, China must address the common global challenges of social inequality and climate change. Shared prosperity is shared peace. No one is truly prosperous if prosperity is insufficiently shared. China thus has every reason to be a responsible global actor by tackling its own social and climate problems, instead of diverting resources to stoke a rivalry with the US.

With greater wealth comes greater social responsibility. In 2019, the combined net wealth of the US and China reached 227% of global GDP. These two superpowers need to stop quarreling and start solving global problems together.

Monetary Policy

Monetary Policy, Technology and Inequality*

By Luiz Awazu Pereira da Silva*

Introduction

Post-Global Financial Crisis, a typical question triggered by the wealth effect of unconventional monetary policies has been whether monetary policy has contributed to rising income and wealth inequality (Domanski et al (2016)). The indications are that it has not been among the main drivers of income inequality[1]. For instance, as to what regards monetary frameworks, income inequality has risen in inflation targeting countries and in non-inflation targeting countries alike, and in countries with or without unconventional monetary policies. Monetary policy stabilises the business cycle and inflation, and thus the more cyclical components of inequality. The conventional view is that monetary policy can limit the volatility of inflation, which penalises first and foremost the poorest households, whose assets, such as cash and bank accounts, are not protected against inflation. More recently, however, inflation has become a lower risk, at least in most OECD countries. Hence the debate on monetary policy and inequality has turned to employment, or rather unemployment risk. Indeed, cyclical increases in unemployment are much more likely to lower the income of workers with fewer marketable skills. When national unemployment rises, the increase is much larger in the poorest neighbourhoods and among ethnic minorities.

Hence the recent debate on monetary policy and inequality, as exemplified by the Federal Reserve's review of its monetary policy strategy in August 2020 emphasised countering inequality by ensuring that recessions remain mild and short-lived. This finds roots in the notion that unemployment and the associated loss in income are the main drivers of income inequality, which in turn cumulates into wealth inequality. Thus, properly run monetary policy works as a safeguard against rising inequality (Romer and Romer (1999)). On top of dampening cyclical fluctuations, price stability will also facilitate longer-run income stability and growth. So, in a world where the "divine coincidence" holds, central banks would only have to focus on their traditional mandates. In particular, inequality would also be addressed by protecting the purchasing power of the poor's main assets, typically deposits and cash. This makes, in theory, central bankers' job quite straightforward, and leaves structural issues that affect inequality to be dealt with in other policy spheres in particular fiscal and structural reform policies.

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*This speech was given at Peterson Institute for International Economics roundtable: "Central banking and inequality: Covid-19 and beyond" on December 11, 2020.
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[1]Inequality seems to have risen mainly because of secular trends beyond central bankers' reach: technological progress, globalisation and the associated erosion in workers' bargaining power. Technological progress and globalisation have been the most important drivers of income and wealth gaps (eg Jaumotte et al (2013)) and what role these play in growth (Berg et al (2018)).

However, central banks are fully aware that in the real world, things are more intertwined. Income inequality has been rising steadily since the Great Moderation – against the backdrop of lower unemployment and inflation volatility. Irrespective of its causes, inequality has surged to a degree that influences the mechanics of the business cycle, particularly as households' propensity to spend depends crucially on their income. In addition, low-income households save less than wealthier ones. Rising inequality can therefore change the transmission of monetary policy, a hypothesis that central banks are re-assessing carefully. And indeed the issue is rising on central banks' policy agendas.

Inequality raises the issue of policy effectiveness as it may affect, for example, the transmission of central banks' actions to fulfill their mandates of price and financial stability. By taking predominantly a convenient view in which agents are homogeneous, we can neglect other important transmission channels.

During the Covid-19 pandemic and the associated recession, the increase in wealth and income disparities has come further into the limelight (Ahmed et al (2020)). Central banks reacted quickly to support aggregate demand, in an unprecedented coordinated effort with treasuries that in many instances designed new policies to target specific segments that were severely hit by the pandemic (BIS (2020)). However, as we look now early 2021 toward the rollout of a vaccine and the pace of the recovery, what the post-pandemic world will look like in terms of the sectoral composition of output and the level of employment remains highly uncertain. This brings us back to the issue of policy effectiveness, and notably whether the currently elevated rate of savings will persist. We have also learned that financial technology can play an inclusive role, enhance the speed and transmission of payments, and reduce the cost of access to credit. When it comes to inequality, among many questions, will digital technologies be part of the solution, and can central banks use the lever of new technologies in the pursuit of their policy mandates to increase their effectiveness?

These remarks address the role of technology in central banks' thinking on inequality. They start by discussing inequality in light of a core function of central banks: monetary policy. We will show that inequality hinders monetary policy transmission and job creation. We then ask: can technology help? There are a number technology infrastructures that can help to improve inclusion, and we see concrete evidence of this already. But we will also discuss a number of challenges. These include new forms of segmentation in credit markets and new forms of income and wealth concentration around big techs. We conclude with some thoughts on what public policy can do to harness the power of digital technologies to promote efficiency and equity.

Monetary policy and inequality: why bother?

Monetary policy affects household income mostly through employment. Second, it affects spendable income through the interest bill on mortgages and the income accrued from savings. Third, tighter labour markets due to loose monetary policy may also bring higher wages as firms struggle to attract more skilled workers.[2] For households, variation in terms of type of employment and skills and, to a lesser extent, assets and liabilities can lead to very different effects of changes in the monetary policy stance. For example, low rates benefit borrowers (mostly middle class and young or middle-aged) at the expense of savers (mostly elderly middle class or wealthy). Yet some poorer households may be prevented from borrowing due to their lack of collateral, and so will not benefit from lower rates. Low rates are also likely to boost asset prices, which are held only by pensioners and the small fraction of households, typically among the 5% richest in most OECD countries, which hold stocks. Under such circumstances, determining the final effect of monetary policy on inequality is mostly an empirical question whose answer depends on the scale

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[2]The relevance of this effect along the intensive margin depends on the bargaining power of workers, which has been eroding over time; see Lombardi et al (2020).

of heterogeneity among households. As one would expect, most empirical studies (eg Kharroubi et al (2021)) actually find that more accommodative monetary policy reduces income inequality. This is because lower unemployment increases income among poorer households. Changes in interest income for savers and payments for borrowers remain small in comparison with the effects of unemployment.

The effects are opposite for wealth inequality: households at the bottom of the distribution are renters, the middle class owns mainly real estate and bank deposits, and those at the top own more sophisticated (and higher-yielding) financial assets, equities in particular.

In light of these developments, the issues of transmission across different groups and, implicitly, inequality have featured more prominently in major central banks' current review of monetary policy(Powell (2020)). In practical terms, some central banks are extending their description of the monetary transmission channel to heterogeneous agents New Keynesian models (see Kaplan et al (2020), and Feiveson et al (2020) for a background paper for the strategy review of the Federal Reserve).

For example, it is clear that income inequality has increased across the US states, as reported for instance by the Sommeiller and Price (2018) data set (Graph 1, left-hand panel). This shows the growing income share of the top decile of the distribution. Why does this matter? For one thing, Kharroubi et al(2021) show that more inequality is associated with steeper declines in private consumption during recessions (right-hand panel), precisely at the time when it matters most. This can also be clearly seen using more granular data from US states. For example, during the 2007–09 GFC, private consumption fell by significantly more in US states that had higher pre-crisis concentrations of incomes. So, despite the role of macro policies to smooth downturn across all states, inequality has a higher contraction cost in more unequal states.

A cost of rising inequality in the US: deeper recessions due to the GFC   Graph 1

Income inequality across US states

GFC: more unequal US states had steeper declines in consumption[1]

- Median
- Maximum value
- 25th–75th percentiles
- 5th–95th percentiles

[1] Aggregate private consumption growth between 2007 and 2009 as a function of the income share of the top 5% earners in the respective state.

Sources: Kharroubi et al (2021); Sommeiller et al (2018).

That higher levels of income inequality are associated with steeper declines in private consumption during recessions applies more generally across space and time. By analysing data from a large sample of advanced economies, in Kharroubi et al (2021) we further show that more inequality implies steeper recessions (Graph 2, left-hand panel). And the difference is material:

during a recession a country at the 90th percentile of income inequality experiences a drop in consumption that is 3 percentage points larger than that experienced by a country at the 10th percentile of income inequality. Why? A plausible explanation is that higher concentration of income goes hand in hand with more cyclical unemployment rates and more cyclical income of the middle class. As the propensity to consume income is higher for poorer households, a more cyclical income is compounded into a steeper response of consumption.

What is more, inequality reduces the effectiveness of monetary policy transmission (Kharroubi etal (2021)). High income concentration can indeed affect the transmission of monetary policy through the different effects easy monetary conditions have across heterogeneous households. Wealthier households have a much lower propensity to consume; hence their consumption may be less reactive to monetary stimulus. In turn, poorer households may not benefit from easier credit conditions because they lack collateral or adequate credit scores and are hence unable to borrow.

To show this, we report estimates[3] of how income inequality interacts with the transmission of monetary policy to real private consumption growth in advanced economies (Graph 2, right-hand panel). The dots represent the central estimates of cumulative real private consumption growth (in per cent) per100 basis points of an expansionary monetary policy shock by quantile of income concentration. We can see that in countries with higher inequality (darker dots), the effect of monetary policy easing on growth is limited in year 1 and much lower later than in more equal countries (lighter dots, in each column, at the top). An expansionary monetary policy shock (ie an interest rate surprise), leads to a significant increase in real private consumption growth in the same year and in the following two years. However, more concentrated income (ie a higher share of post-tax income accruing to the top decile) tends to significantly attenuate this expansionary effect.

There is corroborating evidence from other studies. For instance, Doerr et al (2020) find that rising top income shares may be associated with less credit to small businesses and less job creation. This is because high-income households save relatively less in the form of bank deposits, and small firms are bank-dependent. The authors of this study find that a 10 percentage point rise in the income share of the top 10% reduces the net job creation rate of small firms by 2 percentage points relative to large firms. This could choke off the type of lending that central banks have in many cases been trying to encourage, particularly during the Covid-19 pandemic. The bottom line is: concentration of income can affect the transmission of monetary policy.

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[3]In Kharroubi et al (2021), a two-step empirical exercise is conducted with a standard panel vector autoregression (PVAR) using quarterly data from 1999 to 2019 and 30 advanced economies, with country and time fixed effects.

Inequality reduces the effectiveness of the transmission of monetary policy

Graph 2

Recessions in more unequal countries are steeper[1]

% income share of top decile of distribution

Estimates of cumulative consumption growth (in %)[2]

Inequality at: 10th percentile / 50th percentile / 90th percentile / 90% confidence interval

Percentiles of income inequality distribution across 20 AEs: 10th (low inequality) / 25th / 50th / 75th / 90th (high inequality)

[1] Estimated fall in per capita consumption during recessions at each percentile of inequality in the income distribution. Recessions are defined as a year of negative growth, and the share of income of the top 10% is taken as the indicator of inequality. Based on estimated coefficients of a cross-country panel with fixed effects. The specification regresses consumption growth on its lag, on an indicator of a recession, on the share of income held by the top 10% and on the interaction between the latter two variables. The sample period is 1972 to 2019. The "all countries" sample is based on 129 countries. [2] Results of the central estimates of cumulative consumption growth (in %) per 100 basis points of an expansionary monetary policy shock using a standard panel vector autoregression (PVAR) with quarterly data from 1999 to 2019 for 20 advanced economies.

Source: Kharroubi et al (2021).

Can digital technologies reduce inequality?

Naturally, income and wealth inequality can be mitigated by many other policy instruments that are associated with structural reforms in our economies. But in the realm of the financial sector, central banks and regulators, one question is, can digital technologies help? Can innovations promote greater equity and efficiency, and boost the transmission of monetary stimulus? The good news is that we do have some encouraging evidence from countries around the world.

One technology is digital identity (ID) infrastructure, like India's Aadhaar. "Aadhaar" is Hindi for "base" or "foundation". In India, the introduction of government digital ID has drastically reduced the costs of on boarding – by one estimate from 15 US dollars per new account to 7 cents. This has allowed a dramatic increase in the share of adults with a bank account – from 10% in 2008 to over 80% just 10 years later(Graph 3, left-hand panel). This increase would have taken 47 years relying on normal economic growth processes alone (D'Silva et al (2019)).

India is certainly an important case, but it is not entirely unique. Graph 3 (right-hand panel) shows progress in account access across regions, from the World Bank. South Asia, shown in black, sticks out, driven in large part by India. But you can see that in sub-Saharan Africa, there has also been a strong increase – a doubling in account access between 2011 and 2017. This was driven in particular by mobile money innovations. Mobile money is also an important driver of inclusion in the Middle East and North Africa and in Latin America and the Caribbean.

Technology has helped to support dramatic improvements in account access

Graph 3

Progress with account access after India's Aadhaar digital ID[1]

Progress with account access across regions, especially South Asia

Per cent

- North America
- Sub-Saharan Africa
- Europe & Central Asia
- Latin America & Caribbean
- South Asia
- East Asia & Pacific
- Middle East & North Africa
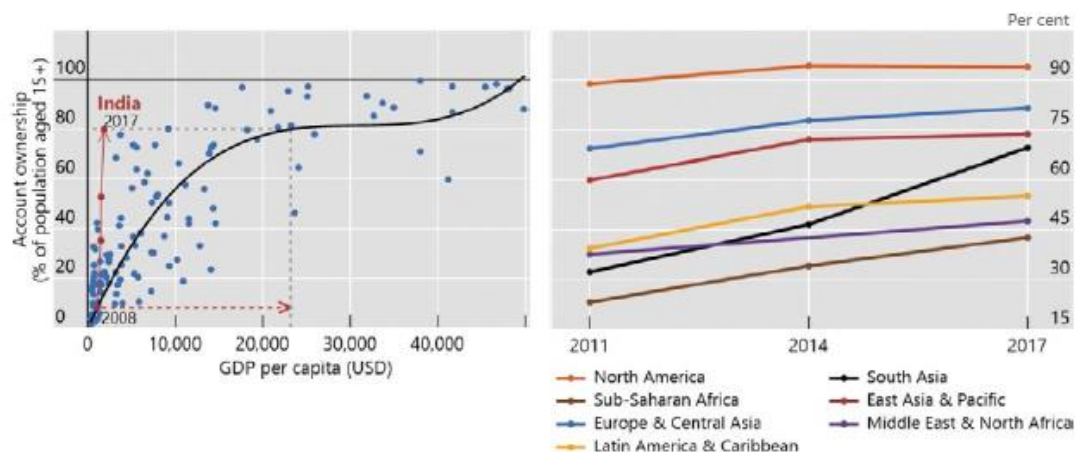
[1] Data for 2011; for India, 2008 (estimate), 2011, 2014 and 2017.

Sources: BIS (2020); D'Silva et al (2019); World Bank.

Technology is allowing faster, cheaper payments at home and abroad

Graph 4

Diffusion of fast retail payment systems in the world[1]

Number of countries

Payment innovations are reducing remittance costs

Per cent

- RTGS systems
- Fast payment systems

Average cost of sending an amount equivalent to 200 USD:
- Bank
- Joint ventures[2]
- Money transfer operators
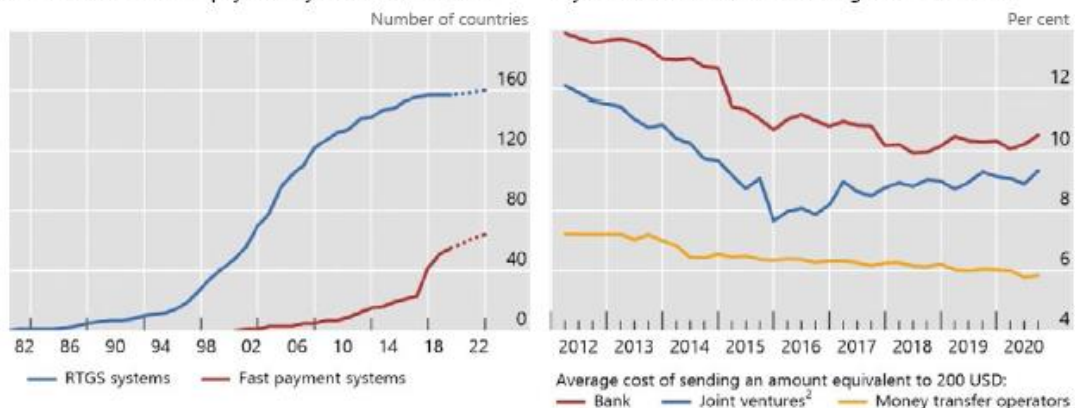
[1] The dotted part of the lines corresponds to projected implementation. [2] Partnerships between non-bank firms and financial institutions.

Sources: World Bank (2020); BIS (2020); authors' calculations.

Technology has also been a key driver of the costs of migrants' remittances. Currently, migrants pay an average of 7% fees to send a remittance of $200 home (World Bank (2020)). These costs have fallen over time, and technology has been an important driver. Indeed, non-bank money transfer operators charge consistently less for remittance services than banks and joint ventures (Graph 4, right-hand panel). Competition from these non-bank providers may also be an important reason for the decline in remittance costs for banks. It is notable that during the Covid-19 pandemic, the costs for banks and joint ventures have actually ticked up slightly, while those for money transfer operators have not.

Fintech allows credit to reach individuals and firms that are typically unbanked. This should increase the effectiveness of monetary policy transmission. For instance, most small and medium-sized enterprises (SMEs) in China, India and Latin America do not meet the minimum requirements for a bank loan application, especially since they cannot provide audited financial statements or other formal documentation (Gambacorta et al (2019, 2020)). This does not allow them to be rated by a credit bureau. Big tech firms are able to overcome these limitations by exploiting the information provided by their core businesses, such as e-commerce or social media, with no need for additional documentation from merchants.

Evidence from BIS researchers (Frost et al (2019)) shows that the internal ratings of big techs, which use big data and machine learning, are better able to predict losses. Graph 5 (left-hand panel) shows the loss rate, ie the volume of loans more than 30 days past due relative to the origination volume for the case of Mercado Libre in Argentina. While both the internal rating and the credit bureau rating are continuous variables (between 0 and 1,000), they can be segmented into five different risk groups (A through E) versus three clusters identified by the credit bureau.

For a given bureau rating (eg low-risk), the expected loss rate is strictly monotonic with the internal rating (ie the patterns of the dots show that the internal rating orders expected loss). Conversely, given an internal rating (eg C, D or E), the loss rate is not strictly monotonic with the bank bureau risk. For example, the dot associated with internal rating D in the low-risk bureau category indicates a higher risk than the internal rating D in the medium-risk bureau category. Moreover, the internal rating has a broader range, covering losses from 0.0 to 10.2%; the bureau rating ranges from 0.7 to 2.8%.

Most importantly, by using its proprietary scoring model, Mercado Libre is able to serve the profiles assessed as high-risk by the bureau. The size of the dots is proportional to the share of the firms in rating distribution. Thirty per cent of the portfolio originated by Mercado Libre would fall into the high-risk cluster. Banks use a mix of credit bureau information and soft information from loan officers, but in general would not lend to these borrowers in Argentina. These simple statistics indicate that the internal rating system of Mercado Libre is more granular than a traditional credit bureau, and allows the firm to serve vendors that would be otherwise be excluded from the provision of credit. It remains to be verified if an internal rating system based on machine learning and big data from the e-commerce platform can outperform (ex post) the more traditional models in predicting defaults over a full business and financial cycle.

There is also more formal evidence on the predictive power of machine learning-based credit scores. Graph 5 (right-hand panel) reports the area under the receiver operating characteristics (ROC) curve for different models in Argentina. The ROC curve is created by plotting the true positive rate against the false positive rate at various threshold settings. The area under the ROC curve ranges from 50% (purely random prediction) to 100% (perfect prediction). The 45 degree line corresponds to tossing a coin. We consider three models. The red line is a logistic model with only the bureau score. The yellow line is a logistic model with the bureau score and borrower specific characteristics. The blue line is the machine learning and big data model of Mercado Libre. The predictive power rises substantially for the model that use a machine learning technique applied to the data from the e-commerce platform.

Technology and big data can help enhance credit access for small firms   Graph 5

Loss rates by big tech internal ratings vs the credit bureau in Argentina[1]
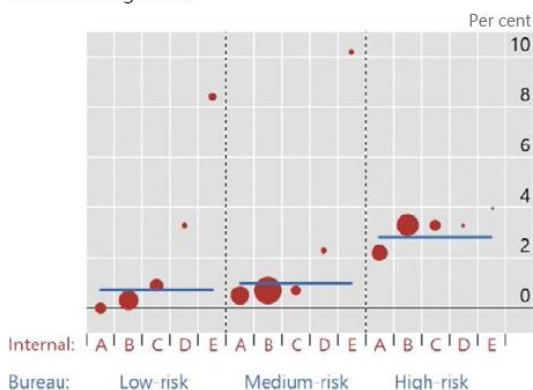
Better prediction of default using ML big data as seen by ROC curves for the different credit score models[2]

Internal: A B C D E   A B C D E   A B C D E

Bureau: Low-risk   Medium-risk   High-risk

Model:
— I – Logistic, only bureau score
— II – Logistic, bureau score and borrower characteristics
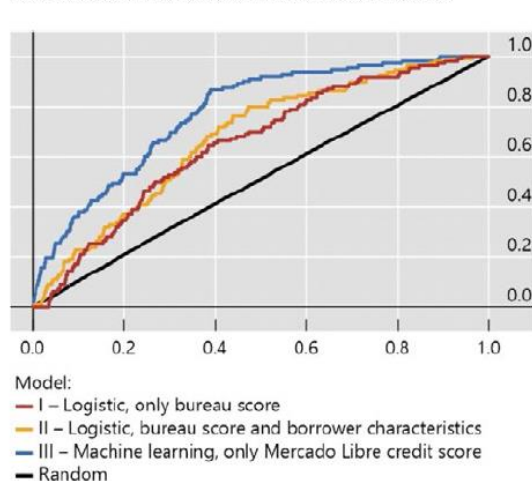— III – Machine learning, only Mercado Libre credit score
— Random

[1] The loss rate is the volume of loans more than 30 days past due relative to the origination volume. In its use to date, the internal rating of Mercado Libre is better able to predict such losses. It segments the originations into five different risk groups, versus the three clusters identified by the credit bureau. The size of the dots is proportional to the share of the firms in the rating distribution. The horizontal blue lines indicate the average loss rates for each credit bureau cluster.   [2] True positive rates versus false positive rates for borrowers at different thresholds for a logistic model with only the credit bureau score (I), a logistic model with the bureau score and borrowers' characteristics (II), and a machine learning model with the Mercado Libre credit score (III). A random model is included for comparison purposes. The ROC curve shows that the machine learning (ML) model has superior predictive power to both the credit bureau score only and the credit bureau score with borrower characteristics.

Source: Frost et al (2019).

Some important challenges: can digital technology offset exclusion?

Overall, technology holds great promise to enhance inclusion – but there are also important challenges. Could financial technology be sophisticated and significantly improve risk assessment, but not be sufficient to offset discrimination and exclusion?

As one example, a study by Fuster et al (2020) looks at machine learning-based credit scoring in US mortgage markets. They find that white and Asian Americans benefit disproportionately from the new machine learning models. Black and Hispanic borrowers benefit less. Graph 6 shows the cumulative share of borrowers for each change in the predicted probability of default. For white and Asian borrowers, about 65% are better off with the machine learning model. This is only 50% for Black and Hispanic borrowers.

Another challenge is to increase the dissemination of technology, since currently it is adopted primarily by the wealthy. Frost et al (2020) have shown evidence of the Matthew Effect – the tendency for the rich to get richer. The name comes from the New Testament Book of Matthew, which states: "For unto every one that hath shall be given". This tendency is explored in many areas in the social sciences. In Italy, the researchers show that higher-wealth households have achieved consistently higher returns than lower wealth households (Graph7, left-hand panel). They also find that especially higher-wealth households were able to benefit from remote banking access – an early form of fintech (right-hand panel). Another study finds comparable evidence for the United States, where gains from financial technology have accrued disproportionately to high-wealth investors since the early 2000s (Mihet (2020)).

Credit innovations may benefit different ethnic groups differently

Cumulative share of borrowers   Graph 6
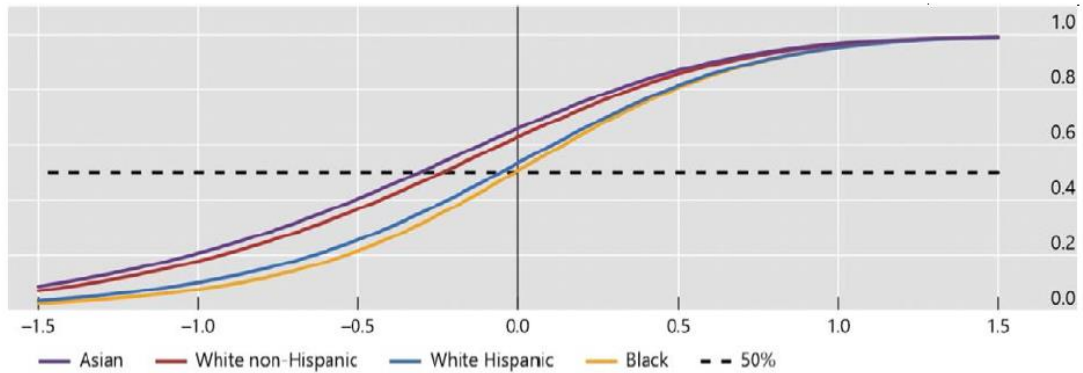
The horizontal axis reports the change in the log predicted default probability as lenders move from traditional predictive technology (a "Logit" classifier) to machine learning technology (a "Random Forest" classifier). The vertical axis reports the cumulative share of borrowers from each racial group that experience a given level of change.

Sources: Fuster et al (2020); Gambacorta et al (2019).

An implication of these findings is that other accompanying policies are needed to address these challenges. Technology may be helpful – in this case to achieve higher returns – but if it is adopted primarily by those who are already well off, it may enhance inequality. We often hear of the "digital divide". The good news is that in Italy, this tendency has declined over time, as remote banking has become more widely diffused (Frost et al (2019)). That is, technology does not produce disparities when it is for everyone.

The Matthew Effect: inequality in returns to wealth   Graph 7

Rate of financial returns of Italian households by net wealth quartile[1]

Effect of remote banking access on financial returns[2]
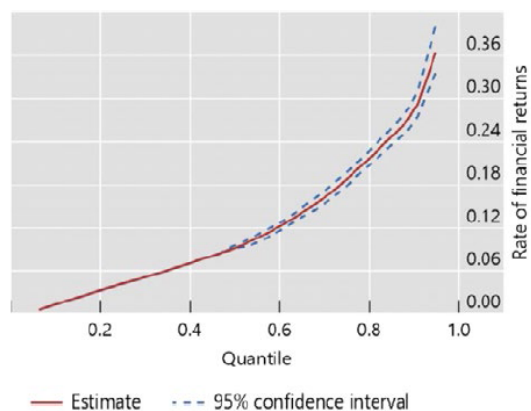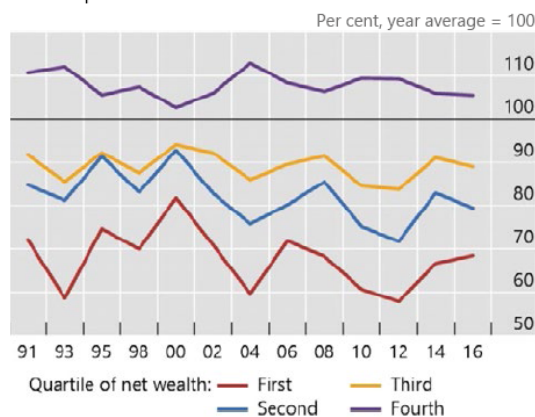
[1] The graph indicates that households with wealth in the top quartiles of the distribution have consistently received higher returns on their investments than other wealth quartiles.   [2] The graph indicates that remote banking access has a positive impact on the returns to household financial wealth. This increases starkly moving towards the top of the wealth distribution.

Source: Frost et al (2020).

Big techs have a rising share in overall market cap and higher profitability, and
the "tech premium" in labour markets is rising

Graph 8

Share of big techs[1] in overall stock index[2] and profit
margins

Average salary in the US by industry[3]

Lhs: —— Big techs' share in world market capitalisation

Profit margin (rhs): —— MSCI All Country Global Index   —— Big techs[3]

—— Technology[4]   —— Finance and insurance   —— Other

[1] The sample includes Alibaba, Amazon, Apple, Baidu, eBay, Facebook, Google, Kakao Corp, Line, Microsoft, NTT Docomo, Rakuten, Samsung and Tencent.   [2] MSCI All Country Global Index.   [3] Average profit margin.   [4] Average of publishing industries (includes software) and information and data processing services. The graph shows that in the last decade the average salary for employees in the technology sector has increased approximately 50% more than the wages in the financial sector.

Sources: Bureau of Economic Analysis; Bloomberg; authors' calculations.

In recent quarters – and particularly during the Covid-19 pandemic – we see another striking trend. Big tech companies, which make widespread use of digital technologies, have been highly profitable(Graph 8, left-hand panel). You can see the yellow line is consistently higher than the blue line, which represents profitability for all companies in the MSCI All Country Index. As a result of this, the share of big techs in global market cap has risen, from less than 10% in 20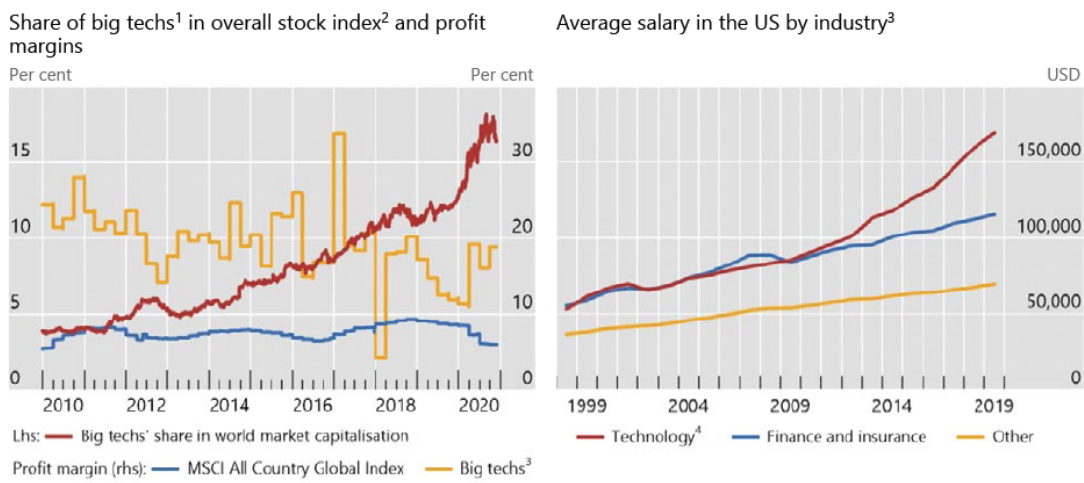11 to over 30% today. Indeed, e-commerce platforms like Amazon or Mercado Libre have done very well during the pandemic, seeing a big increase in demand for their services. That helps to explain the steepening of the red curve in early 2020.

This divergence between tech firms and the rest is also apparent in labour markets. Before and after the GFC, there was a debate about wages in the financial sector, and how abnormally high wages may pull the best and the brightest away from other sectors in the "real economy" (Philippon and Reshef (2012)).You can see that divergence in Graph 8 (right-hand panel) – finance and insurance do indeed pay higher wages than other sectors, though the gap narrowed a bit after the crisis. What is striking is that the technology industry – software, IT and data processing – is now paying wages that are more than twice as high as those of other sectors, and much higher than in the financial sector (Pereira et al (2019)). This so called"tech premium" has continued rising, and it is even possible that this, too, has increased in the pandemic.

A final challenge is that technology on its own may not close the gender gap in access to financial services. Indeed, a new study by Chen et al (2020) looks into the fintech gender gap – the difference in the use of fintech products and services by gender. The authors find that in nearly every country surveyed, women are less likely to use fintech than men (Graph 9). India and Peru are the two exceptions. The authors also find that women are less willing to share their data in exchange for better offers on financial services, that they worry more about their security when dealing with companies online, and that they are less willing to use fintechs for innovative services. Overall, for a variety of potential reasons, it seems that fintech providers are not yet adequately

catering to women. If fintech is to help make our financial system more inclusive, then additional policy efforts – around digital ID, data protection regulation and digital and financial literacy – may be needed. In these areas, central banks and regulators may have to cooperate with other public authorities.

Use of fintech products and services by country and gender

Graph 9

Uses fintech, in per cent

• Female   ◆ Male
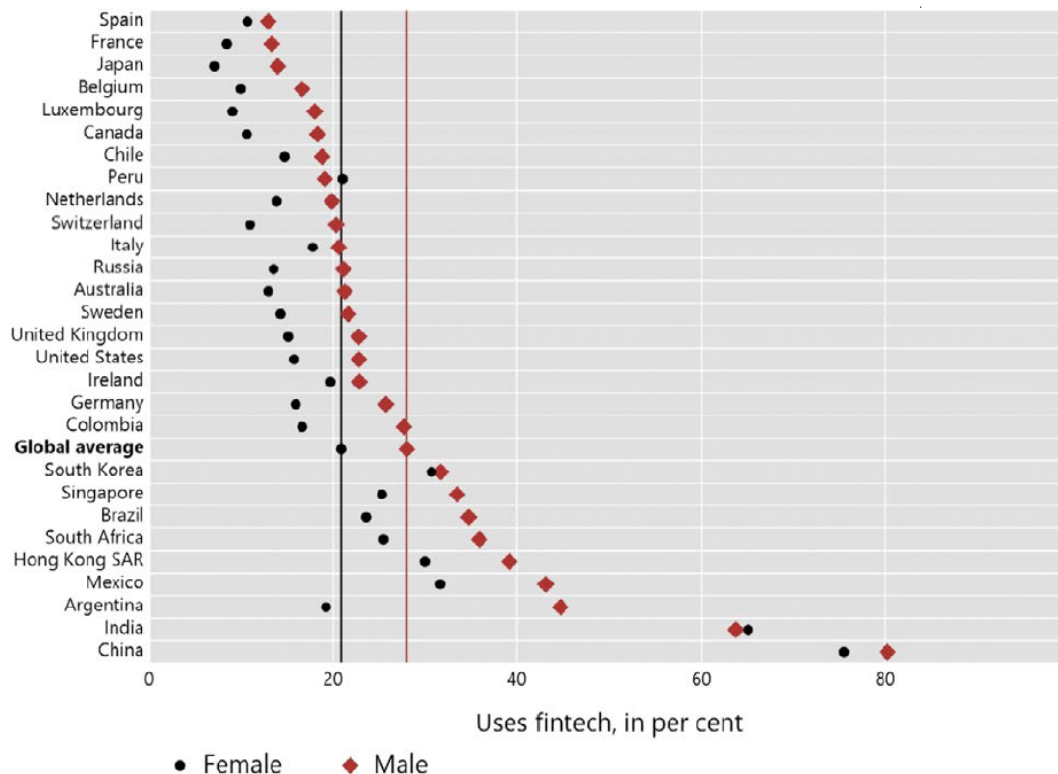
Source: Chen et al (2020).

Conclusion

Monetary policy has become more concerned with inequality, mostly because inequality is likely to impact its transmission and its effectiveness. This has been backed by growing empirical evidence for advanced economies, including some of my current research (Kharroubi et al (2021)). This new body of evidence resonates with ongoing reviews of monetary policy frameworks, most prominently that of the Federal Reserve. While inequality influences monetary policy transmission and job creation, it should be particularly relevant at the current juncture since the Covid-19 pandemic has worsened poverty, especially of workers in the most heavily customer-facing sectors, and inequality has increased even more than in previous recessions.

Can technology help? New financial technology can certainly increase financial inclusion and thus enhance policy effectiveness. Yet by itself, without the support of other policies, it can also be insufficient to fully offset discrimination. Overall, we see that technology holds enormous promise to enhance financial inclusion and thus reduce inequality – and we see concrete evidence of this already. But there are several challenges, and ways in which digital technologies could need to be combined with other policies in order to avoid new forms of exclusion.

For technology to contribute even more to inclusion, we need to promote its quality as a "public good" – its availability to all with a wide diffusion. That could entail looking at fostering public platforms and competition and preventing innovation from being captured and managed by the few.

Hence, public policy interventions have to aim at promoting both efficiency and equity. This can include building public infrastructures like digital ID or fast retail payment systems. It could also include a balanced regulatory approach, incentivising innovation and avoiding rent-seeking. That requires concrete progress on inclusion metrics from both incumbent financial institutions and new fintech and big tech challengers. It also implies adapting regulation and supervision and continuing research on the effects of our digital transformation.

Overall, technology is obviously unlikely to solve the problems of inequality on its own. An array of structural policies is needed, as is well known (eg Milanovic (2019), Atkinson (2015) and Bourguignon (2015)). One promising lead is that new digital technologies may also make other policies more efficient. For instance, fiscal policy may use better digital ID tools to target specific households benefiting from conditional cash transfer (CCT) programmes, or the speed of settlements and transfers might allow poor households to be reached much faster. Moreover, if technology enhances policy coordination, it can increase the overall efficiency of public policies in general. In the domain of the financial sector, if central banks and regulators want technology to be a force for both efficiency and equity, we have to promote wide diffusion and support for important public policy goals. It is up to policy makers in all areas to contribute to these goals and thus to a more equal, more efficient and more inclusive economy.

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Beware Rising Neutral Rates*

By JAMES SWEENEY*

The US military has traditionally attempted to stand prepared to fight two major wars at once. In that spirit, economic policy-makers should consider challenging scenarios in the pandemic recovery, even ones that are not supposed to happen according to certain models.

One scenario worth attention is a rising neutral rate of interest (r*) amid public unrest, political turmoil and disappointing economic activity. Neutral rates are most likely to rise in a strong economy with soaring business and government revenues. However, there are other plausible situations.

What if full employment is reached during higher-than-expected inflation but, meanwhile, economic rebalancing has heightened distributional tensions and led to strong public criticism of any potential fiscal or monetary policy tightening? And suppose that once monetary policy tightening begins it quickly becomes clear that short rates will need to rise far more than expected to keep inflation on target. Would central banks tighten sufficiently, even if it meant increasing rates to levels that were seen as implausible a few years earlier?

A sharp rise in apparent neutral rates, similar to this scenario, happened in the US in the late 1960s. R* estimates from the Laubach-Williams model, based on backward-looking information, rose by about 1.5% in that period. However, this was the increase in the real rate needed to stop inflation from rising (at full employment), not what was needed to keep it at the initial mid-decade level.

If something similar happens in the next few years, from a starting point of below neutral real rates and amid rising inflation, then the implied necessary nominal rate change could be surprisingly large. Circumstances in the 60s were different in many ways from now, but our knowledge of the future rates needed for stable inflation might be less than is implied from a parade of commentaries about how low interest rates will persist.

Many central banks are confident that they could stop inflation. They worry more about a limited toolset at the effective lower bound. History suggests, however, that inflation often emerges during political interference when central banks tighten insufficiently because of miscalculated output gaps or poorly understood lags between churning economic dynamics and later inflation.

Rising long-term market interest rates would occur if central banks stopped buying bonds amid a rising neutral short rate. This would increase government debt service costs, but it would take years for such a change to meaningfully drive budget deficits.

Two important unknowns are, first, how sensitive economic activity will be to future interest rate increases and, second, how sensitive inflation dynamics will be to the profound recent changes in the composition of government liabilities and bank assets, one-fifth of which might soon be interest baring Fed reserve balances, matched by rising bank deposits.

Future rate hikes might be an exceptionally unpopular option. The expectation of persistently low neutral rates is now embedded in the strategies of many businesses, financial firms and governments. This confidence is useful now, depressing long-term interest rates. But if investors and policy-makers are disabused of this idea at the same time, great turbulence will ensue.

Of course, an overshoot in inflation might be worth tolerating compared to other problems. But it is precisely this that compels us to think about this scenario now. Although it is hardly an existential risk (like two wars at the same time), from a financial stability perspective it could well lead to great volatility.

If central banks do not respond to rising neutral rates with sufficient hikes, then inflation, asset price bubbles or disruptive late tightening would follow. It is possible that the economy's interest sensitivity has increased so that even a few hundred basis points of interest rate hikes could lead to a sharp slowdown or falling asset prices.

This dark scenario is no one's base case and the most sensible objection to it is that yields and neutral rates won't rise sustainably without strong growth. But the 'wars on two fronts' idea reminds us that this objection is not a universal law.

Financial Regulation

My Perspective on Bank Regulation and Supervision*

By MICHELLE W. BOWMAN[*]

I want to thank the American Bankers Association for inviting me to speak to you today. Two years ago, I gave my first speech as a Federal Reserve governor at this conference in San Diego, and it is always great to be with you-even if remotely from our recording studio at the Board.

It's fair to say that a lot has happened over the past two years. It is an understatement to say that the COVID-19 pandemic has created significant challenges inside and outside the banking sector. Bankers significantly adapted operations to continue serving their communities and customers. You overcame staffing challenges and other hurdles, kept the virtual doors open, worked with your customers, and provided assistance to workers and businesses through the Paycheck Protection Program. Those efforts have made, and continue to make, a huge difference in the lives of many people affected by the pandemic, and I thank you.

Since becoming a member of the Federal Reserve Board, I have made it a priority to enhance the Federal Reserve's dialogue with community bankers. I have embarked on an effort to meet with the leaders of every community bank and regional bank supervised by the Federal Reserve. This valuable interaction helps build an understanding of issues affecting small and regional banks, support supervisory decision-making, and shape some of my perspective. It has also helped the Federal Reserve identify initiatives to support the vital role of community banks in serving the financial needs of communities.

Today, I would like to share my approach to supervision and regulation, which has helped guide the Fed's efforts to improve oversight of community banks over the past few years and shaped our priorities for 2021 and beyond. In most cases, my points about banking regulation also apply to supervision. I will then focus on several Federal Reserve initiatives that are underway to support community banks during the pandemic and into the future.

The first principle is fundamental to regulation but sometimes bears repeating-regulation should always strike the right balance. For banking regulation, that means a balance between actions that promote safety and soundness and actions that promote an acceptable and manageable level of risk-taking. The challenge is doing neither too little to be effective to achieve the public benefit of government oversight, nor too much to prevent the regulated businesses from meeting their customers' needs. Some regulation is appropriate and necessary but striking the right balance means that at some point regulation can go too far and end up reducing the public's welfare. In recent years, the Federal Reserve and other agencies have made oversight more effective by better differentiating prudential regulation and supervision based on the asset size of banks, the complexity of their activities, and the related risks they pose to the financial system. This is

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especially important for community banks, most of which managed risks well before and during the 2008 financial crisis and have managed their risks well since. Achieving these principles also requires following consumer protection laws and regulations, including fair lending laws, to ensure fairness and broad access to credit and financial services that enable economic opportunity for individuals and communities.

The second principle is that the regulatory framework should be effective, but also efficient, and that means assessing the impact of the requirements. For the Federal Reserve, it means that we consider both a rule's benefit to safety and soundness and any potential negative effect, including limiting the availability of credit and services to the public, and the implications of compliance costs on banks. The wisdom in this approach is evident when considering the effect of a regulation on community banks and their role in providing financial services to their communities. Community banks have often been one of the few or only sources of credit and financial services to their customers. Their smaller operational scale relies on fewer staff to reach a more disbursed customer base with limited resources for compliance activities. Regulations should consider the potential impact on the availability of services in a community, as well as the costs to the bank of implementing a rule, particularly in more rural locations. It is necessary that a full and careful practical analysis of costs and benefits be a part of every rulemaking.

The third principle is that regulation and supervision should be consistent, transparent, and fair. Regulators are obligated by law to act in this manner, and it also makes good practical sense. These principles enhance safety and soundness and consumer compliance by making sure supervisory expectations are clear and that banks understand and respect the regulatory requirements. Supervisors should not and cannot be everywhere at every moment. But they should be available to provide clarification or answer questions when needed. A clear understanding of the rules and our expectations and a respect for the reasonable application of them is an effective approach to ensure effective compliance. By promoting respect and trust between regulators and the supervised institution, banks are more likely to communicate throughout the examination cycle to inform supervisors of changes they may be considering or challenges they may be facing and how best to resolve or approach them from a regulatory perspective.

A final principle that flows from consistency, transparency, and fairness is that rules and supervisory judgments must have a legitimate prudential purpose, and in the majority of cases must not be solely punitive. The goal should be to encourage sound business practices and activities by supervised institutions. By clearly communicating our objectives, we build respect for the rules and make it more likely that any remedial actions against an institution will not be necessary because we encourage compliance through our supervisory approach. When a supervisory action or formal enforcement action is required to address violations at an institution, those actions should be framed in a way that seeks to promote safe, sound, and fair practices and not simply as punishment.

These principles that guide my approach to regulation and supervision are consistent with many of the major steps that the Federal Reserve has taken to improve community bank oversight since the implementation of the rules following the 2008 financial crisis. Some predate my arrival at the Fed, and some I have played a significant role in achieving. Most of these actions involve tailoring rules that treated community banks in the same way as larger, more complex institutions. For example, the Volcker rule was aimed at curbing proprietary trading by large banks, but it ended up creating significant compliance costs for community banks, which are not involved in this type of trading.

Many of the most important improvements to the Federal Reserve's regulatory framework involve tailoring rules to fit to the size, business model, and risk profiles of community banks. For example, we raised the asset threshold for small banks to qualify for an 18-month exam cycle and

similarly raised the threshold for small bank holding companies to be exempted from consolidated risk-based capital rules. The concept of tailoring is also expressed in our community bank supervisory framework, which has been updated to implement the Bank Exams Tailored to Risk (BETR) program. The BETR program allows examiners to identify higher and lower risk activities and, in turn, streamline the examination process for lower risk community banks, thereby reducing burden. In fact, Federal Reserve examiners have tailored examinations by spending approximately 65 percent less time on low/moderate risk state member bank exams than they do on high-risk exams. We also implemented the community bank leverage ratio that allows institutions to opt out of risk-based capital requirements. The Federal Reserve and the other agencies also raised the threshold for when an appraisal is required for residential real estate loans and tailored safety-and-soundness examinations of community and regional state member banks to reflect the levels of risk present and minimize regulatory burden for banks.

These improvements in regulation and supervision have helped right the balance I spoke of earlier between safety and soundness and consumer protection, on the one hand, and the ability to provide financial services and best meet the needs of their customers. We have also considered the impact of our actions, seeking to revise rules that impose significant costs to community banks but provide limited benefit to safety and soundness, consumer protection, or financial stability.

As a part of this approach, I have also prioritized efforts to improve the consistency, transparency, and reasonableness of regulation and supervision. One of those efforts is promoting greater consistency in supervisory practices across the Federal Reserve System. For example, we are actively working to improve the timeliness of providing banks with consumer compliance exam findings. Further, we are exploring ways to strengthen our ability to understand, monitor, and analyze the risks that are affecting community banks. A key aspect of consistency is ensuring the same supervisory approach and outcomes for similarly situated institutions, with the goal of ensuring, for example, that a "one" composite or component rating in a particular region would be the same for an institution with similar activities and practices in another region. This applies to all areas of our supervisory responsibility, whether safety and soundness, consumer compliance, or analyses of financial stability risk.

I'd like to expand on one important area of focus, which is essential to the future success of the community banking sector: accessible innovation and technology integration. This subject is one that I speak about frequently with stakeholders and our staff at the Board. We are committed to developing a range of tools that will create pathways for banks to develop and pursue potential partnerships with fintech companies. This includes clearer guidance on third-party risk management, a guide on sound due diligence practices, and a paper on fintech-community bank partnerships and related considerations. These tools will serve as a resource for banks looking to innovate through fintech partnerships.

Technological developments and financial market evolution are quickly escalating competition in the banking industry, and our approach to analyzing the competitive effects of mergers and acquisitions needs to keep pace. The Board's framework for banking antitrust analysis hasn't changed substantially over the past couple of decades. I believe we should consider revisions to that framework that would better reflect the competition that smaller banks face in an industry quickly being transformed by technology and non-bank financial companies. As part of this effort, we have engaged in conversations and received feedback from community banks about the Board's competitive analysis framework and its impact on their business strategies and long-term growth plans. We are in the process of reviewing our approach, and we are specifically considering the unique market dynamics faced by small community banks in rural and underserved areas.

Soon after the pandemic began early last year, the Federal Reserve took several actions to support community banks and their ability to help affected customers. We paused examinations

and issued supervisory guidance that made it clear that we would not criticize or take public enforcement actions against a bank that was taking prudent steps to help customers and making good faith efforts to comply with regulations. This certainty of regulatory treatment created an environment that built trust between regulators and bankers. It enabled banks to continue to meet the needs of their customers who were struggling with circumstances through no fault of their own.

Let me conclude by again commending the important role that community banks have played in providing financial services during these challenging times. You responded quickly to the needs of your customers and communities to provide financial services with limited, if any, interruption. You persevered to implement the largest proportion of Paycheck Protection Program funds to small businesses, whether they were your existing customers or new customers. These relationships are the hallmark of community banking, and as we look toward the future, community banks will continue to play an essential role in supporting customers, delivering financial services, and providing resources to their communities and customers.

Let me stop here and thank the organizers for another opportunity to speak to you at this important conference.

BaFin Reforms Must Go Further*

By IGNAZIO ANGELONI*

In the aftermath of the Wirecard scandal, Germany has an opportunity to reform BaFin, its financial supervisory authority, and help boost regulation and governance across the European Union. The Bundestag is considering a bill that would reform corporate auditing processes, eliminate the role of the financial reporting enforcement panel and strengthen the supervisor's investigatory powers. BaFin will also get new senior management after its chief, Felix Hufeld, and his deputy, Elisabeth Roegele, resigned at the end of January.

Is there room for hope? Could one of Germany's biggest financial scandals act as a turning point, forcing a move toward better financial governance? If so, the timing is apt, as Brexit is putting more responsibility on the shoulders of continental financial regulators.

The potential for a capital markets union also strengthens the need for reform in Germany. A European market supervisor – be it an expanded European Securities and Markets Authority or a new institution entirely – needs a strong and reputable German agency as part of its membership. Reforming BaFin is an important prerequisite to the broader European project.

The reform bill now on the table in Germany, with its narrow focus on accounting, auditing and the powers of an otherwise unchanged BaFin, falls significantly short of what is needed. The opportunity to learn from all the lessons of the Wirecard affair may be missed.

In spite of its complexities and the time it took to uncover, the crux of the scandal and its implications for supervision are disarmingly simple. For years, market rumours and articles in the Financial Times advanced the suspicion that Wirecard, a payment fintech and once one of Germany's most important listed companies, was manipulating its accounts.

No supervisor should act on rumours. But they may prompt action on two fronts. First, to protect market integrity from unproven and potentially disruptive hearsay. Second, to clarify whether those rumours had any substance. If its investigatory powers are insufficient, a competent supervisor should alert other relevant authorities.

From what has emerged so far, BaFin moved only on the first front. It even went so far as to undermine the second by taking legal action against the Financial Times, potentially stopping other investigations. It is hard to explain why without allowing for bias, perhaps rooted in the culture of the organisation.

As the scale of the problem was becoming apparent, another disturbing development occurred. A number of German banks, large and small, came to the rescue of the accused. Wirecard was given sizeable unsecured lines of credit and the banks offered favourable stock market advice, which attributed the rumours to false information spread by speculators. The reputation of the banking establishment and stability of those banks, some already facing other problems that had weakened them, were put at risk.

The problem is that BaFin supervises both the stability of the banks and the integrity of the financial market. This is rare. In the euro area, only in a few, small countries are those responsibilities combined (as one can see by comparing the membership of the European Central Bank's supervisory board and that of ESMA's board of supervisors). In Germany, banks have sizeable stakes in the corporate sector. No sufficient firewalls exist to alleviate risks caused by the

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potentially diverging goals this creates, such as banks undermining their own financial stability to prop up zombie firms they are exposed to. Consequently, the amalgamated responsibilities of the supervisor give rise to a conflict of interest between maintaining market integrity and bank stability.

BaFin's defence had been that Wirecard was a fintech, a business it has no supervisory responsibility for, and that its banking subsidiary, Wirecard Bank, was prudentially sound and too small to justify supervision of the entire group as a financial conglomerate.

But this is beside the point for two reasons. First, BaFin is also a market supervisor, with responsibility over listed companies. Second, the broader ramifications of the affair on the stability of the entire German and, indeed, European financial establishment were greatly underappreciated.

Such responsibility in Germany cannot belong to any authority other than BaFin, given the breadth of its mandate. That responsibility also means that BaFin cannot interpret its mandate narrowly or disregard what happens just beyond the perimeter of its authority. Admittedly, supervisory fragmentation and boundary problems among supervisors are not unique to Germany. They are typical of regulatory architectures worldwide. A legalistic, risk-averse mindset exacerbates the problem, making authorities reluctant to intervene unless their obligation to do so is absolutely certain. In Germany and elsewhere, supervisory mandates can and should endeavour to correct such inaction bias.

The combination of these three pitfalls provides clues to how the lessons of Wirecard need to be read and what reforms are necessary. The cultural problem can be addressed by a combination of clarity in the supervisor's mandate, formal statutory independence and hiring people with an appropriate professional background, with a special emphasis on transparency and integrity at all levels. The chance to appoint a new chair is an obvious opportunity to start doing this.

The risk of conflict of interest between banking stability and market integrity can only be corrected by clearly demarcating the two responsibilities; preferably, by investing them in separate authorities.

After the 2008 financial crisis, central banks began playing a much more important regulatory role, with monetary policy authorities assuming full or partial supervisory powers. The ECB does not just manage the money supply. It is a banking supervisor as well. Concerns that there would be conflicts between these roles have, so far, not been born out.

The risks of increasing the Bundesbank's role are smaller than those of maintaining a blurred distinction between the banking and market supervisor. Be that as it may, the mandates, accountability provisions and co-operation among authorities need to be redesigned to ensure that never again does the supervisor fail to see the bigger picture.

Digital Economy

How Democracy can Evolve and Flourish in the Digital Era*

By LIU JUN*

What has happened to democracy, or at least the democracy that Western countries advocated and fought so hard for? After the recent political chaos that swept Washington, law and order has returned but the conviction for democracy appears to have faltered.

Theoretically, much like music and other art forms, democracy is bound to progress with social advancement. Long before Donald Trump became US president in 2016, society was undergoing a paradigm shift driven by technology and innovation. Online business and the internet in general spurred a big leap forward into the second millennium.

Digitalisation brought about by big data, the internet of things and artificial intelligence has been an even bigger leap. Human behaviour and society are constantly being reshaped by tech-driven productivity improvements, and so is democracy, a central construct of many political regimes.

During the first Industrial Revolution, people were tied to physical premises such as farms, factories, houses and offices. Information did not flow freely and was often limited for ordinary people, making it difficult for them to make important decisions. The realistic choice then was for a well-informed elite to represent the masses and make those decisions on their behalf.

Electoral democracy became a natural choice and consequently, when a government was needed and came to be formed, it relied heavily on this elite minority to function, represent and serve the people.

With representation built from the bottom up, the electoral system rightfully reflected the social and political hierarchy in general. The higher up the pyramid, the more resourceful people were.

Although the inherent principal-agent problem (the conflict in priorities between a group and the representative who acts on their behalf) hinders information symmetry and the quality of representation, the system by and large worked to give voice to ordinary people by allowing them to elect their representatives.

The basic assumption of this classical form of democracy was that ordinary people cannot afford the costs of information gathering and decision making, so their scope for expression of opinion is reduced, along with their direct political involvement.

This democratic architecture was fair at that stage, taking into account the barriers to information and lack of connectivity among people and the issues they care about. Accordingly, the formation of government has been based on geography and physical aspects, and governance beyond national borders has been largely unachievable.

But the digital age has transformed society and removed these bottlenecks. With the explosion of social media, anybody can easily set up a personal channel or platform and broadcast to an audience, not just CNN or the BBC.

Information now travels at the speed of light and can be integrated and manufactured efficiently and systematically. Citizens are netizens too; virtual social groups are replacing physical ones and statehood is mirrored in the virtual world – although the virtual world is better at breaking down the walls of nationality and ethnicity.

The rise of "virtual supremacies" such as Facebook, Twitter and Amazon has created virtual states that might to a certain extent be more powerful than nation states. In the virtual world, society has been re-engineered into a large variety of groups which align with various interests and preferences. The effects of the information cocoon or data silo are reinforced by algorithms – and the people behind them.

This atomised society is regrouped along lines labelled as values or principles, and assembled back on the platforms designed by Big Tech. Opinion leaders, rather than politicians or officials, are the ones who come out strongly to represent the people within the groups, and this representation is borderless and deemed democratic by their own members.

Once politicians lose touch with their virtual communities, their power of representation is gone for certain. Nowadays, the scariest thing for an elected political leader is not being thrown out of the official circle but, rather, being banned from social media, which is what has been happening in Washington in real time.

The obstructions to free speech erected by these virtual states, and the standards applied by those behind them may hamper the careers of some politicians, but within these own virtual republics, it is deemed to be democratic representation per se.

If we are now in a new digital era, then it is time for democracy to change; to march towards a digital democracy and leave behind the industrial-era democracy. It is necessary to keep the time-tested principles, but also elevate them by embracing transparent and just rules that are adaptable to the new era. In this way, the spirit of democracy can live on.

The traditional idea of democracy is that it is linear in nature with a top-down execution path. But if democracy can be reincarnated as a result of profound introspection and prudent practice, it can become dramatically non-linear with a multidimensional path of execution. With new technologies at hand, humankind can undoubtedly handle this new system properly and wisely, leading once again to a great renaissance.

Beyond Bitcoin, It's Time for Cryptocurrency Boards*

By STEVE H. HANKE AND ROBERT J. SIMON*

In 1999, Milton Friedman, the world's foremost monetary luminary, foretold the rise of cryptocurrencies. Here's what he had to say:

I think that the Internet is going to be one of the major forces for reducing the role of government. The one thing that's missing, but that will soon be developed, is a reliable e-cash method whereby on the Internet you can transfer funds from A to B without A knowing B or B knowing A. The way I can take a $20 bill, hand it over to you, and then there's no record of where it came from. You may get that without knowing who I am. That kind of thing will develop on the Internet and that will make it even easier for people using the Internet. Of course, it has its negative side. It means the gangsters, the people who are engaged in illegal transactions, will also have an easier way to carry on their business.

More than 20 years after Friedman's prediction, the speculative mania surrounding cryptocurrencies is breathtaking. Just consider that Bitcoin's price has skyrocketed 1,030 percent in the past twelve months and that its market capitalization has soared to $1.1 trillion, which makes it the world's sixth-most valuable asset.

With Elon Musk's announcement that Tesla would purchase $1.5 billion worth of Bitcoin in order to start "accepting bitcoin as a form of payment for [its] products in the near future," the frequency of Bitcoin's mentions on Google and its trading volume have risen sharply and in lockstep in 2021.

Putting aside Bitcoin's meteoric ascent in price, which has been punctuated by dramatic booms and busts, it is important to note that its designation as a "cryptocurrency" is a misnomer. A currency is characterized by four fundamental features. To qualify, it must be unit of account, a standard for deferred payment, a store of value, and serve as a medium of exchange.

Just how does Bitcoin stack up when it comes to these currency criteria? Bitcoin's volatility turns out to be its Achilles' heel. In 2020, Bitcoin's annualized daily volatility was an astonishing 67 percent. If we look at the most important price in the world, the USD–euro exchange rate, and the world's international currency, the U.S. dollar, the dollar's annualized daily volatility in 2020 was only 7.8 percent. Since Bitcoin's source code predetermines that Bitcoin's supply will ultimately be fixed and totally inelastic, all market adjustments can take place only via price changes, not quantity changes. As a result, it is destined to be inherently subject to extreme price volatility. This means that Bitcoin will never serve as a reliable unit of account. You will rarely see items with Bitcoin price tags attached. You will also never see deferred contracts (contracts under which payment is made under a long-term credit arrangement) written in Bitcoin. Can you imagine someone writing a mortgage contract denominated in Bitcoin?

Bitcoin's volatility also renders it unattractive for most corporations to hold in lieu of cash reserves. Indeed, Bitcoin, which is considered an intangible (something, incidentally, that brings inconsistent and opaque accounting treatment in its wake), throws considerable risk on to balance sheets. In short, it is not a reliable store of value. It's no surprise, therefore, that most corporations

are unwilling to take on the risks associated with holding Bitcoin on their balance sheets. A recent survey found that roughly 5 percent of finance executives said that "they planned to hold bitcoin as a corporate asset in 2021" and "84 percent of respondents said they did not plan to ever hold bitcoin as a corporate asset," citing volatility as their foremost concern.

Furthermore, very few items are purchased with Bitcoin. Items are not only not priced in Bitcoin, but the transaction costs associated with Bitcoin are excessively high for both buyers and sellers.

Bitcoin clearly falls short of meeting the four standard criteria to be designated as a currency. Accordingly, it should not be viewed as a currency but as a speculative asset with a fundamental value of zero. That being said, Bitcoin does have an objective market price. That price is determined by speculators operating in a whirlpool in which they are purchasing an asset with very little or no utility in the hope of selling it later at a higher price: greater fools and all that.

If Bitcoin's failure to meet the currency criteria isn't bad enough, it even falls short of the aims of its architect (or architects), the pseudonymous Satoshi Nakamoto, who envisioned that Bitcoin would function as a currency. Nakamoto anticipated that Bitcoin would address three problems with "government" money, each of which Bitcoin fails to solve.

First, Nakamoto asserted that Bitcoin would overcome the lack of trust associated with fiat monies issued by central banks. But Bitcoin, which is fiat, has a history defined by fraud and breaches of trust, illustrated by the Mt. Gox scandal. Second, Nakamoto designed Bitcoin to address privacy concerns. However, about 95 percent of all cryptocurrency trading occurs on centralized exchanges. These exchanges often collect identifying information from their users and have a history of failing to protect such information. Finally, Nakamoto complained of the "massive overhead costs" of commercial bank transactions that "make micropayments impossible." Yet, due to technological limitations and fees charged by exchanges and crypto-payment providers, Bitcoin is impractical and too costly to facilitate most transactions. Popular cryptocurrency exchange Coinbase charges a "base rate for all purchase and sale transactions in the US [of] 4%."

Beyond Bitcoin, there is ample potential for innovation in private money, specifically a price-stable digital asset. Several attempts have been made, such as the popular stablecoin Tether and Facebook's Libra, but these efforts have been fraught with problems. Tether claims to be "100% backed by our reserves." However, in 2021 an investigation by New York Attorney General Letitia James found that "Tether's claims that its virtual currency was fully backed by U.S. dollars at all times was a lie." Additionally, as reported by Bloomberg, JPMorgan Chase & Co. strategists including Josh Younger and Joyce Chang wrote in a report that Tether has "famously not produced an independent audit and has claimed in court filings that they need not maintain full backing." This is less than reassuring. Libra failed to establish itself in its original form, and, renamed and restructured, is supposed to be relaunched in the near future.

Thanks to ease of entry and competition, inferior cryptocurrency products will struggle, in the end, to survive. Just look at Bitcoin. Although its market capitalization has skyrocketed, Bitcoin's share of the total crypto market has fallen from 94 percent in April 2013 to 61 percent today. Eventually, Bitcoin's current limited use value will likely be eclipsed by the offerings of superior challengers. So, just what might an effective competitor look like?

It would be in the form of a private cryptocurrency board. A traditional currency board issues a currency that is freely convertible at an absolutely fixed exchange rate with a foreign anchor currency or gold. Therefore, under a currency-board arrangement, there are no capital controls. The currency issued by a currency board is backed 100 percent with anchor-currency reserves. So, with a currency board, its currency is simply a clone of its anchor currency. Currency boards have existed in about 70 countries, and none have failed — including the North Russian currency board installed on November 11, 1918, during the Russian Civil War.

What all currency boards — past and present — have in common is that they are public institutions, but there is no requirement that currency boards be publicly owned. A private cryptocurrency board would be the ideal institutional arrangement for the crypto world.   For example, its home offices and reserves could be located in Switzerland, a safe-haven financial center, and it could be governed under Swiss law. It could be operated with a small staff, as is the case with all traditional currency boards. As for its anchor, it could be a currency issued by a central bank, or gold, which is not issued by a sovereign. Furthermore, given its digital nature, the balance-sheet information of a private cryptocurrency board, including its reserves, could be publicly available and audited by independent auditors on a regular basis.

With such a system, the crypto world would finally have a product that is more than just a speculative house of cards.

Digital Currencies and the Future of the Monetary System[*]

By AGUSTÍN CARSTEN[*]

Introduction

It is an honour to speak to this select group of Hoover Institution affiliates, Stanford faculty and Stanford students – who are surely the policymakers, entrepreneurs and innovators of tomorrow.

In my remarks today, I will address the digitisation of money. Does the economy need digital currencies? Digital money itself is not new. Commercial bank money has been digital for decades, and we already use digital means of payment on a daily basis. Central banks already provide wholesale digital money to banks.

In today's lecture, though, I would like to discuss new forms of digital currencies or "digital cash" that have been in the news lately, including central bank digital currencies, or CBDCs. If we need digital currencies of these new kinds, who should issue them, and how should they be designed? What are the implications of digital currencies for the monetary system? These are weighty issues that are much on the minds of central bankers, scholars and the general public. Today I hope to clarify the concepts and sketch a path for the way forward.

1.Do we need new digital currencies? If so, who should issue them?

Let's start with whether the economy needs digital currencies, and from whom.

It is stating the obvious that our economy is in the middle of a technological revolution. A combination of new digital technologies and greater online activity allows huge volumes of data to be collected, managed and telecommunicated. This has dramatically lowered the costs of many tasks. It has resulted in powerful, hyper-scalable applications that have disrupted entire industries – everything from taxis to print media. New players have entered the digital economy to provide these services. While advances in information technology and communications have been under way for many decades, the past decade has ushered in truly far-reaching changes. The Covid-19 pandemic may have further accelerated the pace of digital change.

The technological revolution has also reached the financial system – and even the design of money itself. Just to name one example, on primary foreign exchange (FX) venues, market-makers can now access real-time prices at five-millisecond time intervals. Project Rio, a new application for monitoring fast-paced markets developed at the BIS Innovation Hub, allows the entire market order book to be monitored every 100 milliseconds, or 36,000 times every hour.

The first point of entry into finance is the market for payment services, which are foundational to all economic activity. Payments are attractive for digital disrupters because they are relatively less capital- intensive than other financial services, and the information they generate is highly valuable for cross- selling. Perhaps it is no surprise that we've seen a burst of digital innovation in payments, including new digital payment offerings by fintech startups, big techs and incumbents.

Many payment innovations build on improvements to underlying infrastructures that have been many years in the making. For instance, harnessing technological progress, central banks around the world have instituted real-time gross settlement (RTGS) systems over the past decades. Meanwhile, operating hours of these systems have continued to lengthen around the globe, and in several countries are already operating almost 24/7. Also on the retail side, innovation is rampant,

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[*]This speech was given at Hoover Institution policy seminar on 27 January, 2021.
[*]Agustín Carsten, General Manager, Bank for International Settlements

and a growing number of economies– 51 by our last count – have fast retail payment systems, which allow 24/7 instant settlement of payments between households and businesses (Graph 1). These include systems like the Unified Payment Interface (UPI) in India, CoDi in Mexico, PIX in Brazil and the FedNow proposal in the US. Together, these innovations have shown that the existing system can adapt, providing good examples of how innovation in public- private partnerships is working.

Diffusion of retail fast payment systems[1]

Number of countries   Graph 1

— RTGS systems   — Fast payment systems
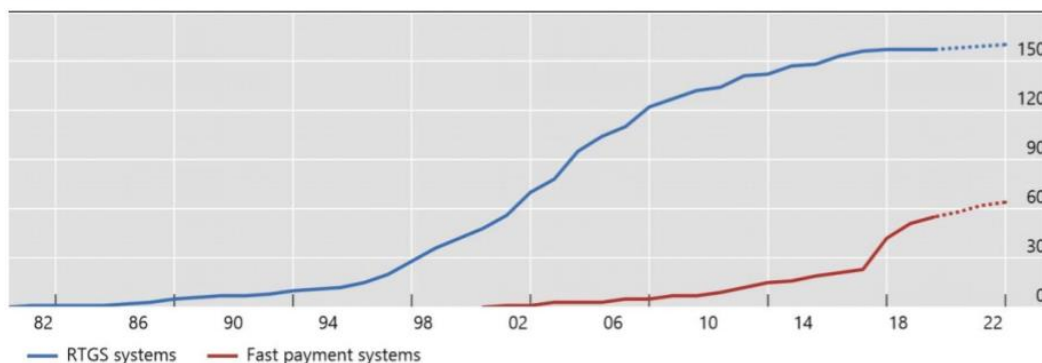
[1] The dotted part of the lines corresponds to projected implementation.

Source: BIS, "Central banks and payments in the digital era", *Annual Economic Report 2020*, June 2020, Chapter III.

Yet no one is compelled to choose the path of the existing monetary system. In addition to improvements to existing systems, many attempts to innovate in less traditional fields have been unleashed. One example is digital currencies – which could transcend both traditional account-based money and physical cash. As already mentioned, account-based money has been digital for decades, as electronic deposits on a digital ledger. Yet there have been calls and attempts to digitise all money, including cash. In my view, fully replacing either bank accounts or cash is neither desirable nor realistic, but let us discuss what a further digitisation of money could look like.

Narayana Kocherlakota – one of the world's leading monetary theorists, former president of the Federal Reserve Bank of Minneapolis and a former Stanford professor – argued in a famous 1998 paper that "money is memory". By substituting for an otherwise complex web of bilateral IOUs, money is a substitute for a publicly available and freely accessible device that records who owes what to whom.

The idea that money is the economy's memory leads us to two forks in the road for the design of digital money (Graph 2). At these junctions, decisions about architecture and access need to be taken. First, it needs to be ensured that the memory is always and everywhere correct. In payments parlance, this means ensuring the integrity and safety of the payment system, as well as the finality of payments. How to do this relates to the role of a central intermediary versus a decentralised governance system. And second, rules to guide who has access to this information, and under what circumstances, need to be determined, with appropriate safeguards in place to protect privacy. In other words, we need to establish both proper identification and privacy in the payment system. Let me discuss these in turn.
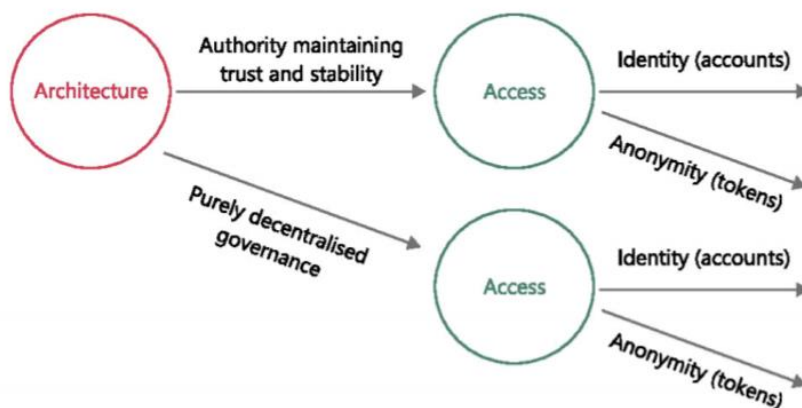
Two forks in the road for digital currencies   Graph 2

If societies want digital money, the first fork in the road is the choice of operational architecture. Should the payment system rely on a trusted central authority (such as the central bank) to ensure integrity and finality? Or could it be based on a decentralised governance system, where the validity of a payment depends on achieving consensus among network participants on what counts as valid payments?

This is the concept behind Bitcoin. Satoshi Nakamoto's protocol envisions a decentralised consensus, with no need for a central intermediary. Yet in practice, it is clear that Bitcoin is more of a speculative asset than money. One contact recently told me that like Bitcoin is "Tesla without the cars"– observers are fascinated by it, but the actual value backing is lacking. Perhaps the Bitcoin network should be seen more like a community of online gamers, who exchange real money for items that only exist in cyber space. Bitcoin poses as its own unit of account, but fluctuations in value mean it is unrealistic to set prices in bitcoin. This also undermines its usefulness as a means of exchange, and makes it a poor store of value. The structure of the Bitcoin market is decidedly concentrated and opaque, and there is research evidence on price manipulation.

Above all, investors must be cognisant that Bitcoin may well break down altogether. Scarcity and cryptography alone do not suffice to guarantee exchange. Bitcoin needs a hugely energy-intensive protocol, called "proof of work", to safely process transactions. Currently, so-called miners sustain the system's security, and are rewarded with newly minted coins. A sad side effect is that the system uses more electricity than all of Switzerland. In the future, as Bitcoin approaches its maximum supply of 21 million coins, the "seigniorage" to miners will decline. As a result, wait times will increase (Graph 3, left-hand panel) and the system will be increasingly vulnerable to the "majority attacks" that are already plaguing smaller cryptocurrencies (right-hand panel).

Bitcoin is increasingly vulnerable; others already have been "majority attacked"　Graph 3

Substantially longer waiting time results when block reward declines[1]

A timeline of cryptocurrency majority attacks since 2017

Attacker disadvantage: ── 1/2　── 1/9
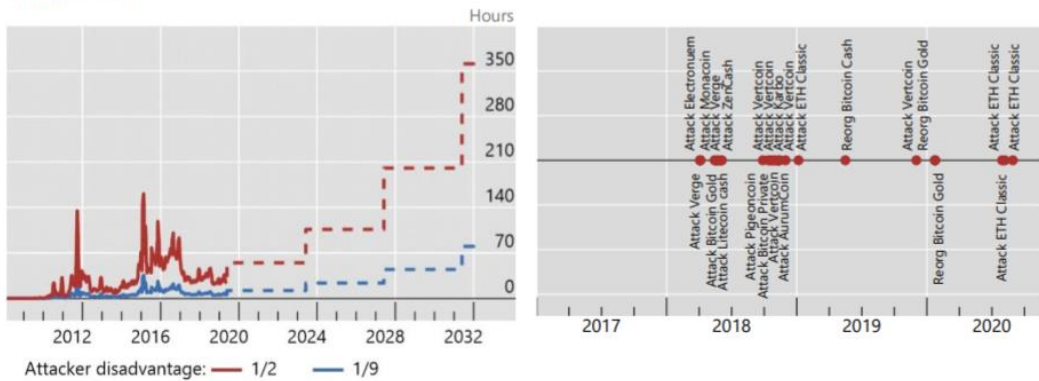
[1] The lines show the implied waiting time (number of block confirmations before merchants can safely assume that a payment is irreversible) required to make an economic attack unprofitable: the attacker rents mining equipment on a short-term basis and executes a change-of-history attack. The dashed pattern indicates predicted values (see Auer (2019) for calculations).

Sources: R Auer, "Beyond the doomsday economics of 'proof-of-work' in cryptocurrencies", *BIS Working Papers*, no 765, January 2019; S Shanaev, A Shuraeva, M Vasenin and M Kuznetsov, "Cryptocurrency value and 51% attacks: evidence from event studies", *The Journal of Alternative Investments*, Winter, 2020; blocksdecoded.com; bravenewcoin.com; btcmanager.com; coinbase.com; Coindesk.com; deribit.com; github.com; medium.com.

What then of so-called stablecoins – cryptocurrencies that seek to stabilise their value against sovereign fiat currencies or another safe asset? Facebook's Libra – recently renamed Diem – was initially marketed as a "simple currency for billions". It would import credibility by being pegged to a basket of stable currencies like the US dollar and euro. More recent incarnations of Diem would be denominated in individual sovereign currencies, looking more like so-called e-money or other digital payment services. This is certainly more credible than Bitcoin. But there are still serious governance concerns if a private entity issues its own currency and is responsible for maintaining its asset backing. Historical examples show us that there may be strong incentives to deviate from an appropriate asset backing, such as pressure to invest in riskier assets to achieve higher returns. Overall, private stablecoins cannot serve as the basis for a sound monetary system. There may yet be meaningful specific use cases for stablecoins. But to remain credible, they need to be heavily regulated and supervised. They need to build on the foundations and trust provided by existing central banks, and thus to be part of the existing financial system.

I side here with Milton Friedman, who argued, "Something like a moderately stable monetary framework seems an essential prerequisite for the effective operation of a private market economy. It is dubious that the market can by itself provide such a framework. Hence, the function of providing one is an essential governmental function on a par with the provision of a stable legal framework." This idea remains as relevant as ever in the digital age.

So, clearly, if digital money is to exist, the central bank must play a pivotal role, guaranteeing the stability of value, ensuring the elasticity of the aggregate supply of such money, and overseeing the overall security of the system. Such a system must not fail and cannot tolerate any serious mistakes.

The second fork in the road is the question of how access should be arranged. There are many nuances, but the main choice is whether access should be around verification of identity as in bank accounts (sometimes called "account-based access") or around validity of the object being traded

as with physical cash, for instance with cryptography ("token-based access").   In other words, is it "I am, therefore I own" or "I know, therefore I own" (Graph 4)?

Account-based access compared with token-based access   Graph 4
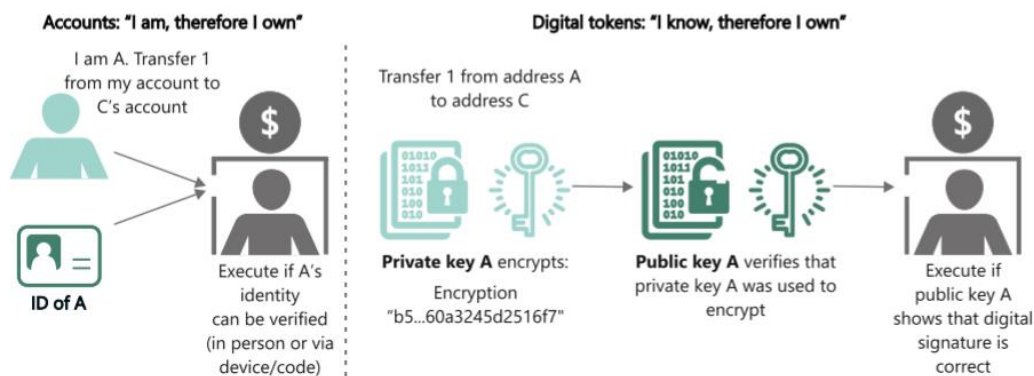
In an account-based CBDC (left-hand side), ownership is tied to an identity, and transactions are authorised via identification. In a CBDC based on digital tokens (right-hand side), claims are honoured based solely on demonstrated knowledge, such as a digital signature.

Source: R Auer and R Böhme, "The technology of retail central bank digital currency", *BIS Quarterly Review*, March 2020, pp 85–100.

Again, this harks back to the notion of money as the memory of society's economic interactions and the need for identification in it. Just as our memories are tied to experiences we have in specific relationships, money does not exist in a vacuum that is separate from economic relationships. Economic transactions weave a web of long-term relationships between suppliers, intermediaries and customers, as well as between borrowers and lenders. Such a web of trading creates – and rests on – a reservoir of relationship-specific capital that sustains financial relationships. This capital is built up with the identification of all counterparties, as well as some degree of traceability of the underlying transactions.

Historical examples show that identification has been critical to allow commerce to flourish. For instance, in 18th century Europe merchants used so-called bills of exchange to solve the lack of trust between physically remote lenders and borrowers. Instead of extending loans directly to borrowers in distant cities, merchants could make arrangements with others whom they personally knew, creating a web connecting far-flung parties together. Another example are the Maghreb traders of the 11th century. As Avner Greif – also of Stanford – famously showed, it was identity and traceability that allowed these traders to sustain trade, even over long distances and in the presence of great uncertainty.

This is even more the case today: your virtual ID is key to government benefits like pensions and cash transfers. Some form of identification is crucial for the safety of the payment system, preventing fraud, and supporting anti-money laundering and combating the financing of terrorism (AML/CFT). There are trade-offs between access and traceability. Socially, there are many benefits to having more information, for example to prevent money laundering or tax evasion. Good identification can help, giving law enforcement authorities new tools to fulfil their mandate.

So overall, my sense is that a purely anonymous system will not work. And the vast majority of users would accept for basic information to be kept with a trusted institution – be that their bank or public authorities. The idea of complete anonymity is hence a chimera. Users have to leave a trace and share information today with financial intermediaries. This makes it easier for them to

work online and prevent losses. To recount one recent anecdote, the user who lost his hard drive with $220 million of bitcoin would have probably liked to have a backup.

So if we take the path I have laid out just now, where do we end up? I argue that we end up with central bank digital currencies with some element of identification – that is, with primarily account-based access.

Today we have the possibility to produce a technologically superior representation of central bank money. This can combine novel digital technologies with the tried and true characteristics of central banks – such as trust, transparency, legal backing and finality – that others would need to either rely on or create for themselves from the ground up.

2.Designing CBDCs for the benefit of societies

Let me turn now to CBDC design.

There are two types of central bank digital currencies. The first is in the wholesale realm, for payments between financial institutions and large commercial parties. In the last few years, there has been a lot of activity around both private and central bank-issued wholesale digital currencies. These efforts could introduce efficiency gains, for instance by allowing faster settlement and delivery versus payment. Yet they may not be all that disruptive. Again, digital central bank money for wholesale purposes already exists, in the form of central bank reserves. Notably, privately issued wholesale digital currencies, also called utility tokens or wholesale stablecoins, are not separate currencies per se. They still depend on central banks for the finality of clearing and settlement. Like the stablecoins I discussed before, they still have an "umbilical cord" connecting them to the existing financial system.

The second type of digital currency is in the retail space, and it is here where the real disruption lies. Retail digital currencies could be used in daily transactions by households and businesses, and depending on their design, they could upend our existing financial system.

The BIS has surveyed central banks around the world on their engagement with CBDCs. In a new BIS Paper, we see that a full 86% of 65 respondent central banks are now doing some kind of research or experimentation (Graph 5, left-hand panel). Some are working primarily on the wholesale side, and some primarily on retail, but the largest number are looking into both (centre panel). Increasingly, we see central banks moving beyond research towards actual pilots (right-hand panel). Since 2020, there has been a live CBDC, with the Sand Dollar project in the Bahamas. The People's Bank of China is performing large-scale pilots across China. And the Boston Fed is working with the MIT Digital Currency Initiative on retail CBDC research that will be open source, for all to review.

Central bank engagement on CBDCs is rising

Share of respondents   Graph 5

Engagement in CBDC work | Focus of work[1] | Type of work in addition to research[1]

Wholesale · General purpose · Both | Experiments/proofs of concept · Development/pilot arrangement

■ 2018 ■ 2019 ■ 2020
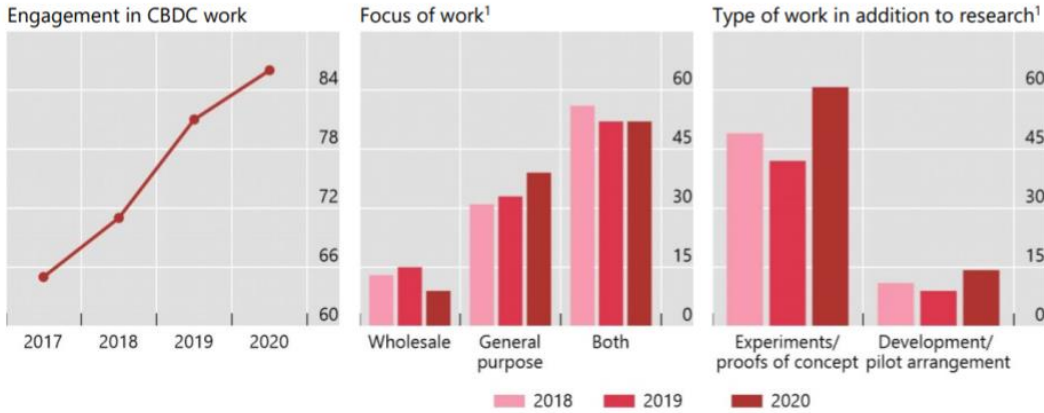
[1] Share of respondents conducting work on CBDC.

Source: C Boar and A Wehrli, "Ready, steady, go? Results of the third BIS survey on central bank digital currency ", *BIS Papers*, no 114, January 2021.

The motivations for central banks engaging in CBDC work vary across central banks, and across retail versus wholesale projects (Graph 6). But it is striking that in both cases, and particularly for those central banks that have moved beyond research toward proofs of concept or pilots, safety and robustness are highlighted as being a key requirement. In the context of declining cash use and a lack of universal access to the banking system, many central banks see CBDC as a means to ensure that the public maintains access to a safe, publicly issued payment option to complement cash. Notably, central banks see opportunities in digital technologies, not least to enhance payments efficiency and promote financial inclusion. Thus, the question here is not so much "Do we need digital currencies?" but "Can central banks grasp the opportunity for what could be a technologically superior representation of central bank money?".

Main motivations of CBDC work by stage

Average importance   Graph 6

Retail CBDC   Wholesale CBDC

Research only ━━ **Research +** ━━ **Research +**
                    Proof-of-concept   **Proof-of-concept + Pilot**
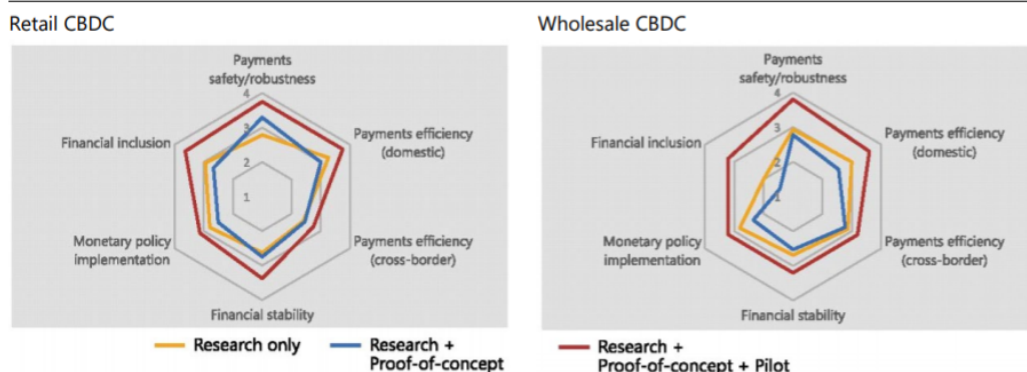
(1) = "Not so important"; (2) = "Somewhat important"; (3) = "Important"; (4) = "Very important".

Source: C Boar and A Wehrli, "Ready, steady, go? Results of the third BIS survey on central bank digital currency ", *BIS Papers*, no 114, January 2021.

The work on CBDCs does not imply replacing private sector initiatives. Of course, we need to take advantage of private sector innovation, and in many research projects and pilots the private sector is a key partner. The CBDC work shows that while disruptive innovation can be a threat, it can also be an opportunity. Thus, even with CBDC, central banks are sticking to what money has always been: a social convention that involves a role both for the private sector and for the central bank or other public authorities. In this sense, money is an instance of a public-private partnership.

Thus, CBDCs can and must also be designed to preserve the two-tiered financial system, as a public-private partnership. In terms of involvement by the private sector, we should not think only about models where the central bank provides retail services directly (such as the FedAccounts idea). From a user perspective, a successful retail CBDC would need to provide a resilient and inclusive digital complement to physical cash – but that does not preclude an important role for the private sector.

Research at the BIS scopes out how two-tier "Hybrid" and "Intermediated" CBDC architectures can involve the private sector as the default operator of payments, with the central bank optionally operating a back-up infrastructure to provide additional resilience (Graph 7). Users could pay with a CBDC just as today, with a debit card, online banking tool or smartphone-based app, all operated by a bank or other private sector payment provider. However, instead of these intermediaries booking transactions on their own balance sheets as is the case today, they would simply update the record of who owns which CBDC balance. The CBDC itself would be a cash-like claim on the central bank. In this way, the central bank avoids the operational tasks of opening accounts and administering payments for users, as private sector intermediaries would continue to perform retail payment services. The benefit is that there are no balance sheet concerns with private sector intermediaries. Further, these architectures also allow the central bank to operate backup systems in case the private sector runs into technical outages.

Hybrid CBDC architectures allow for public-private partnership in payments — Graph 7
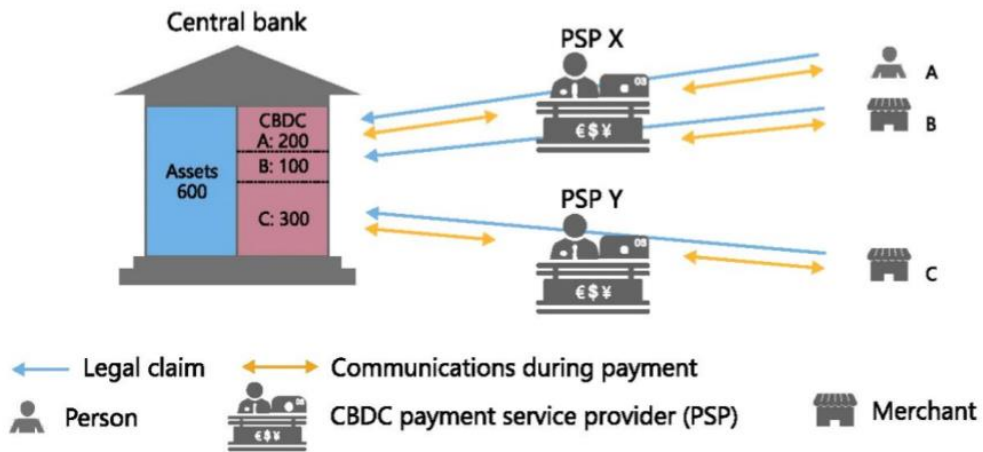
Sources: R Auer and R Böhme, "The technology of retail central bank digital currency", *BIS Quarterly Review*, March 2020, pp 85–100; R Auer and R Böhme, "Central bank digital currency: the quest for minimally invasive technology", *BIS Working Papers*, forthcoming.

A system that in many ways resembles today's system could run successfully on distributed ledger technology (DLT), as a BIS working paper shows. This paper finds that despite all the limitations with Bitcoin and other permissionless cryptocurrencies, greater economic promise lies with the "permissioned" variant of DLT. In permissioned DLT, a known network of validators replaces the traditional model with one central validator. The BIS Innovation Hub has already demonstrated that this works in a lab environment, in a proof of concept that involved the settlement of tokenised assets in central bank money using a DLT-based software. Going beyond the lab environment, the working paper shows that the technology may have economic potential primarily in niche markets. It shows that while the permissioned version of DLT holds more promise than the permissionless one, a trusted central intermediary fares even better. DLT hence can improve upon the traditional model of centralised exchange only where trust in, and enforcement of, the rule of law is limited.

In addition to the governance of the system itself, the governance rule of how participants can access it also warrants attention. What about the role of identification, and of the transaction data that digital currencies will generate? Here, we need to compare different governance rules and analyse the role of the public and the private sector in guarding data. Of course, the danger of data breaches or abuse by public authorities warrants a careful approach. But there are designs where some level of individual privacy can be preserved – a CBDC does not have to entail an Orwellian Big Brother, where the central bank sees each and every transaction.

Private sector intermediaries have a role to play in this, too, as settlement agents in a competitive payment system. In particular, private intermediaries could (temporarily) record and guard users' data. Yet decisions on data privacy are very important. This is not just a technical issue, but an important policy issue that transcends the financial sphere. Central banks will need to listen to societies in this respect. Moreover, public sector supervision and clear frameworks for the governance of data will still be needed. If multiple parties are involved in collecting, transferring and storing data, it must be ensured that one institution is ultimately responsible to the user. If this is done successfully, such a system could help maintain privacy while allowing access to law enforcement under clearly defined rules, much like today's system. Moreover, it could put

competitive pressure on today's intermediaries, pushing for more efficiency, lower costs and better service in payment markets.

Again, different jurisdictions may pursue different avenues. This relates in part to different preferences regarding data privacy across different societies. In China and India, for instance, users are much more comfortable with their data being securely shared (Graph 8). And in China, the approach of the People's Bank of China in its CBDC, the e-CNY, is to periodically record all user data from private intermediaries. In Europe and the United States, users report in surveys being more worried about their privacy. For these cases, there are also technical designs that allow the central bank to be shielded from knowing identities, or even from having access to retail transaction data, recognising that it may not want this information.

Preferences regarding privacy vary across countries

In per cent   Graph 8
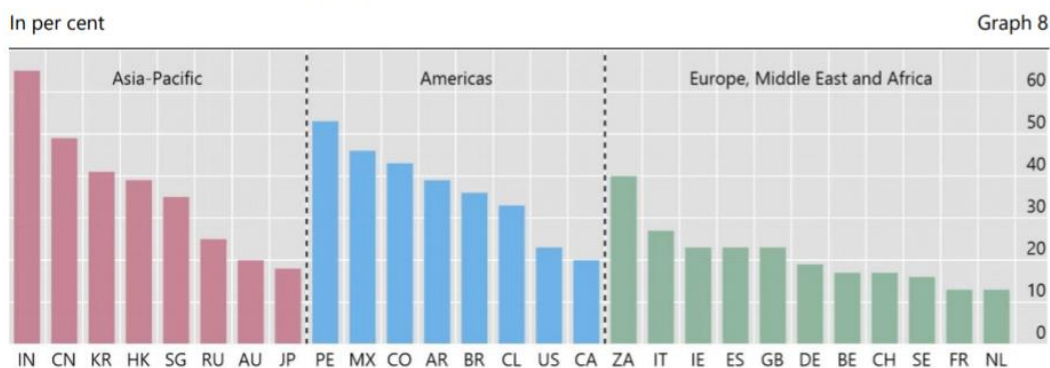
Agree or strongly agree to share the data[1]

[1] The question in the survey reads, "I would be comfortable with my main bank securely sharing my financial data with other organisations if it meant that I received better offers from other financial intermediaries"; for Belgium, the figure covers Belgium and Luxembourg.

Source: S Chen, S Doerr, J Frost, L Gambacorta and H S Shin, "The fintech gender gap", *BIS Working Papers*, forthcoming; EY, *Global FinTech Adoption Index 2019*, June 2019.

Above all, the discussion of identification in CBDC needs to be considered in the wider context of digital ID. The use of personal data is necessary to improve the provision of financial services. Financial inclusion is about overcoming inequality, in particular by reducing information asymmetries. CBDCs can be the entry point for financial services, but they need to be linked to an ID. By offering the unbanked access to a digital ID, authentication can help to support inclusion in the long term and to formalise the informal economy. While this appears to create trade-offs, as citizens also value their privacy and enjoy the anonymity of cash, there can be long-term gains from overcoming this.

Again, this seems to be the direction in which central banks are moving. As central banks report being more likely to issue CBDCs in the medium term (Graph 9, left-hand and centre panel), CBDCs tied to an identity scheme ("primarily account-based CBDCs") are also relatively more common (right-hand panel). These can serve as the basis for well functioning payments with good law enforcement. The idea that CBDCs will be like $100 bills floating around is a mischaracterisation of what CBDC would look like in practice. My own view is that CBDCs without identity (purely token-based CBDCs) will not fly. First, they would open up big concerns around money laundering, the financing of terrorism and tax evasion. Second, they may undermine efforts to enhance financial inclusion, which are based on good identification and building up an information trail for access to other financial services. Third, they could have destabilising cross-

border effects, allowing large and sudden shifts of funds between economies. For these reasons, we need some form of identity in digital payments.

Likelihood of CBDC issuance is increasing, with account-based access preferred — Graph 9

Responses on likelihood of retail CBDC issuance in the medium term[1]

Responses on likelihood of wholesale CBDC issuance in the medium term[1]

Relatively more central banks are leaning toward account-based access
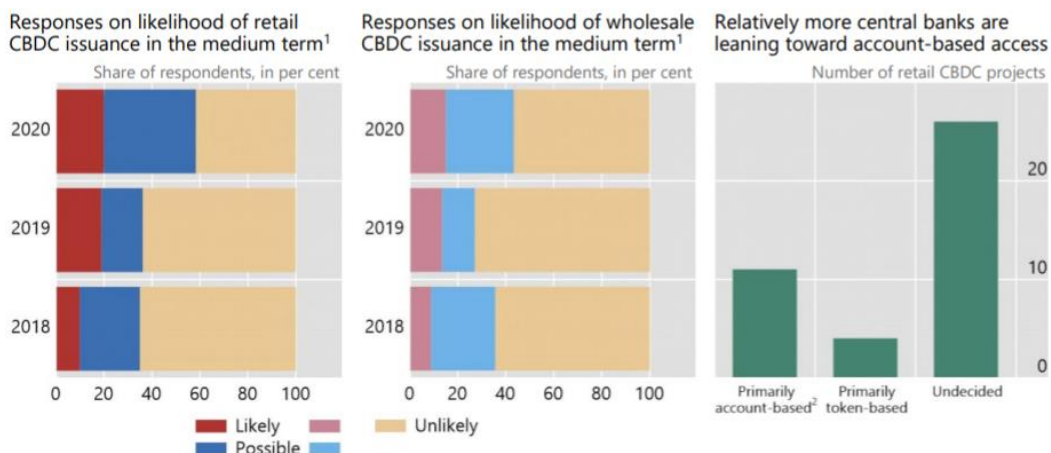
[1] Medium term: 1–6 years. "Likely" combines "very likely" and "somewhat likely". "Unlikely" combines "very unlikely" and "somewhat unlikely".   [2] Includes models with token-based access for small transactions.

Sources: C Boar and A Wehrli, "Ready, steady, go? Results of the third BIS survey on central bank digital currency ", *BIS Papers*, no 114, 2021; R Auer, G Cornelli and J Frost, "Rise of the central bank digital currencies: drivers, technologies and approaches", *BIS Working Paper*, no 880, August 2020.

3.Implications for the monetary system

Let me move now to the implications for the monetary system.

If they are properly designed and widely adopted, CBDCs could become a complementary means of payment that addresses specific use cases and market failures. They could act as a catalyst for continued innovation and competition in payments, finance and commerce at large.

But if that happens, how will it affect national financial systems beyond payments? And what are the international repercussions of CBDC issuance?

Let me discuss these considerations through the lens of the core principles for CBDC issuance, as laid out in a recent report of the BIS, the Board of Governors of the Federal Reserve System and six other major central banks. This report laid out a Hippocratic Oath for CBDC design, the premise to "first, do no harm".

First and foremost, this oath implies that a precondition for CBDC issuance is that its design will not disintermediate commercial banks, nor lead to heightened volatility of their funding sources. Central banks do not dismiss these risks. But there are tools to address digital runs and the potential for disintermediation, like caps on the size of CBDC holdings, or variable interest rates that discourage very large holdings by users. If depositors did temporarily move funds from bank deposits to CBDCs during financial turmoil, central banks could also quickly re-channel liquidity back to commercial banks, much as they do now with open market operations. Structurally, I do not anticipate the central bank becoming a major player in intermediating savings in the economy. While such risks do need to be managed, CBDCs do not need to threaten the stability of bank funding or lending to the real economy.

Second, as long as CBDC is supplied in response to transactional demand for it, this oath means that the impact on monetary policy and its transmission will be limited. Naturally, the monetary

policy implications have received ample attention. In theory, retail CBDCs could be interest-bearing, influencing monetary policy transmission and, in today's context, for some advanced economies, allowing for more negative policy rates. However, one has to keep in mind that since CBDC would complement cash rather than replace it, and since another policy objective is to limit the central bank's systemic footprint, these monetary policy effects might be contained in practice. Much as cash holdings and even total central bank assets are currently moderate in relation to bank deposits (Graph 10), I expect that CBDC holdings will not become very large. This could also mean that the central bank toolkit will remain largely unaffected.

CBDCs can be designed to have a limited systemic footprint – like cash today

As a percentage of GDP   Graph 10

Cash holdings are moderate...[1]   ...and consumers' sight deposits vastly exceed central bank balance sheet sizes[1,2]

■ Cash in circulation   ■ Bank deposits   ■ Central bank assets
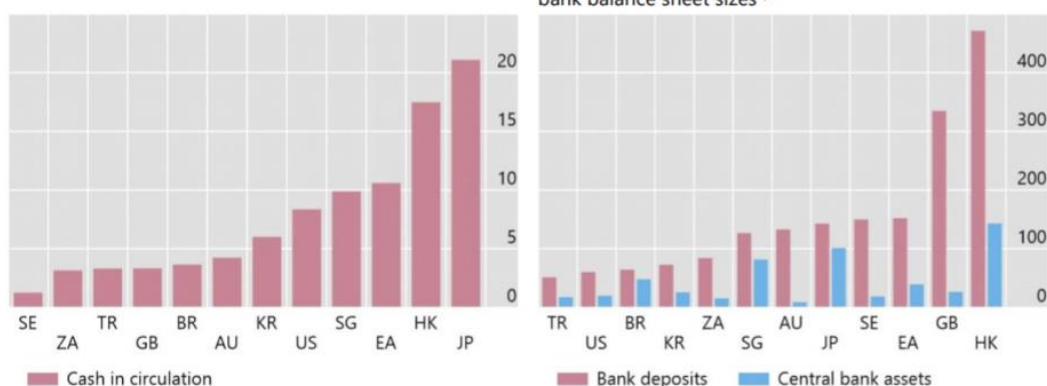
[1] Data for 2018.   [2] Closest alternative where data is not available.

Source: R Auer and R Böhme, "Central bank digital currency: the quest for minimally invasive technology", *BIS Working Paper*, forthcoming.

Third is the international aspect and the threat of international currency competition. Payment system design is a domestic choice, but it has important international implications. Wherever there are macroeconomic or institutional reasons for dollarisation today, foreign CBDC issuance may aggravate this threat, by making it even easier for users to adopt a foreign (digital) alternative. Some have argued that an e-CNY or digital euro could even challenge the dominance of the US dollar as a global reserve currency. But here, I doubt that CBDCs alone will tip the balance – especially if they are account-based. Indeed, the main reasons why a reserve currency is attractive are related to the macroeconomy. The dollar is the world's premier reserve currency because it has a stable value (low inflation), a large supply of safe assets and the credibility of the US economic and legal system. Investors can also easily access the US's deep and efficient capital markets, without worrying about capital controls. These factors are likely to remain the primary drivers of global reserve currency status.

Yet beyond currency competition, there are opportunities from CBDCs to enhance the efficiency of cross-border payments. Multi-CBDC arrangements (Graph 11) could tackle frictions in today's correspondent banking system, such as differences in opening hours, varying communication standards and a lack of clarity around exchange rates or fees.

Potential models for multi-CBDC arrangements — Graph 11
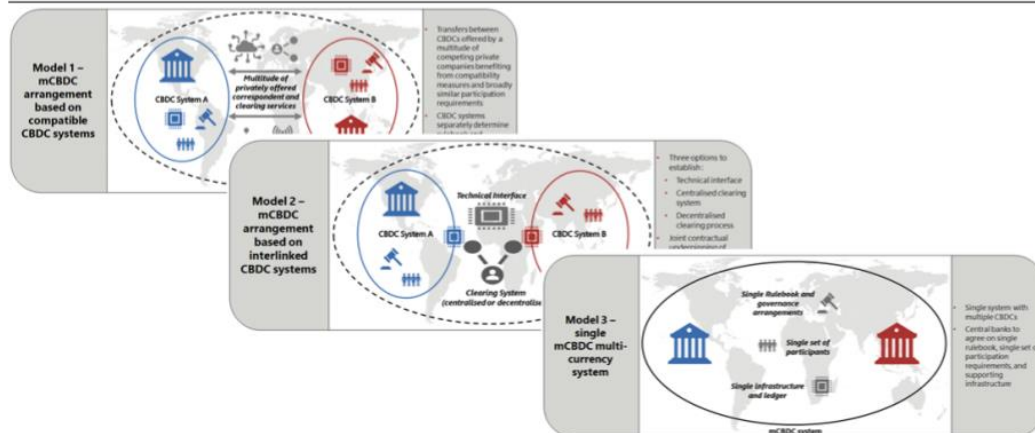
Source: R Auer, P Haene and H Holden, "Multi-CBDC arrangements and the future of cross-border payments", forthcoming.

Conclusion

Let me conclude. Sound money is central to our market economy, and it is central banks that are uniquely placed to provide this. If digital currencies are needed, central banks should be the ones to issue them. If they do, CBDCs could also play a catalytic role in innovation, spurring competition and efficiency in payments.

In this light, even as they fight the fires related to the Covid-19 pandemic, central banks around the world have stepped up their CBDC design efforts (Graph 12). This should not be seen primarily as a reaction to the emergence of cryptocurrencies or the announcement of corporate stablecoin projects. Rather, they are proactively researching a new form of money and how it could improve retail payments in the digital area, in line with central bank mandates.

CBDCs research and pilots around the globe   Graph 12

Project phase:
- Live retail CBDC
- Retail pilot ongoing
- Retail pilot completed
- Retail research
- Retail research and wholesale project
- Wholesale project
- N/A
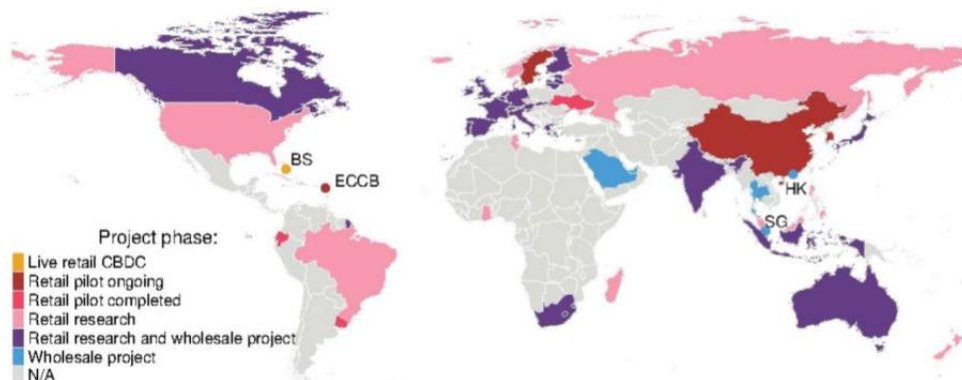
BS = The Bahamas; ECCB = Eastern Caribbean Central Bank; HK = Hong Kong SAR; SG = Singapore.

The use of this map does not constitute, and should not be construed as constituting, an expression of a position by the BIS regarding the legal status of, or sovereignty of, any territory or its authorities, to the delimitation of international frontiers and boundaries and/or to the name and designation of any territory, city or area.

Source: R Auer, G Cornelli and J Frost, "Rise of the central bank digital currencies: drivers, approaches and technologies", *BIS Working Paper*, no 880, August 2020.

However, developing CBDC comes with a host of technological, legal and economic issues that warrant careful examination before issuance. Central banks – the guardians of stability – will proceed carefully, methodically and in line with their mandates. Issuing a CBDC is a national choice. Wherever issued, CBDCs will be an additional payment option that coexists with private sector electronic payment systems and cash. Careful design – such as the architecture defining the roles of the central bank and private intermediaries – would ensure that they preserve the two-tiered financial system, and that monetary policy implementation and financial stability will not be jeopardised.

In all this, the need for international coordination cannot be overstated. It is up to individual jurisdictions to decide whether they issue CBDCs or not. But if they do, issues such as "digital dollarisation" and the potential role of CBDCs in enhancing cross-border payments need to be addressed in multilateral forums. The BIS is supporting this international discussion, ensuring that central banks can continue learning from one another and can cooperate on key issues in design. In this way, central banks can work together to support digital money ready for the economy of the future.

Green Push Puts CBDC Centre Stage*

By GARY SMITH*

Bitcoin's sharp rise and the continued demand for green investment products form two of the major investment stories shaping early 2021. They are odd bedfellows. Bitcoin is the largest cryptocurrency and has the poorest green credentials. It requires a vast amount of energy to mine the coin. Even more is needed to maintain the blockchain on which it exists. A report from Cambridge University revealed the startling news that bitcoin now consumes as much energy in a year as Argentina.

The rally in the price of bitcoin (it passed $57,000 on 21 February and is approaching that again after a brief correction) has prompted a flurry of speculation over what the upside potential might be. One forecast suggested that the price could hit $300,000 before the end of 2021, helped by the knowledge that supply is capped at 21m coins, with over 18m already having been mined.

But its energy consumption problem will only get worse as bitcoin creeps towards its cap. The mathematical formula behind bitcoin ensures it gradually becomes more difficult and intensive to mine.

As well-known institutional investors add bitcoin to their portfolios, the bulls hope that this rally may have more durability. Tesla fits the bill as a new kind of institutional investor and it is the furore surrounding their recent bitcoin purchase that has helped to highlight its poor green credentials. However, it also prompted the beginning of a public relations fightback from bitcoin fans.

They base their riposte on three arguments. First, conventional fiat currency also has an environmental cost. Second, renewable energy is a key electricity provider in regions where bitcoin mining is common. Third, the energy footprint of bitcoin is smaller than that of gold.

The argument that fiat money has an overlooked environmental cost begins with the observation that bank branches (important for distributing fiat money) have large lighting and heating needs. Notes and coins also have minting and distribution costs. It has even been suggested that the new polymer bank notes can't easily be recycled and therefore score poorly compared to digital money.

As bank branches close and cash use shrinks, though, the footprint of old-fashioned currency improves. The current fiat system already operates with digital money created by commercial banks. This type of digital money has a much lower energy cost than bitcoin, not needing to be mined or maintained on distributed ledger technology. Finally, bank branches offer services other than storing and distributing cash, making the comparison imperfect.

Bitcoin's renewable energy claims also don't stand up. Most bitcoin mining takes place in China, where coal is a key source of electricity, though many miners work in areas where hydroelectric power is a major contributor to the grid. Hydroelectric power, however, has mixed green credentials, courtesy of the cement required in construction. There is also biodiversity loss associated with building dams.

Both gold and bitcoin mining are energy intensive. But bitcoin fans argue that its energy footprint is less than half that of gold's. Gold, however, is not just used as a store of value. The majority of gold mined each year is used in industry and jewellery, not made into bullion, making this argument less applicable.

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*This article first appeared on OMFIF Commentary on March 11, 2021.
*Gary Smith is Managing Director of Sovereign Focus and Consultant for Tabula Investment Management.

A more apt comparison would be with central bank digital currencies. In contrast to bitcoin, though, CBDCs are unlikely to require DLT. Instead, they will probably operate on existing payment infrastructure, as can be seen with China's recent test.

However, even if a CBDC used DLT, it would still not need to be mined. Bitcoin miners need to demonstrate proof of work to earn their newly minted coin. CBDC can be created at the click of a mouse.

Another benefit of CBDC is that it will be centralised rather than decentralised. This allows for simpler consensus algorithms to confirm wallet contents. Bitcoin is specifically designed to operate without the need to place trust in a central authority. A decentralised ledger (where everybody can see everything) is massive and takes up a lot of computing power.

Despite the efforts of aficionados, bitcoin will continue to lack green credentials. The green investment revolution is real, gathering momentum and becoming central to the strategy of many investors.

Green investment funds, and the major benchmark providers, are unlikely to be impressed with cryptocurrencies that utilise blockchain or other similar technology. Despite a spirited fightback, bitcoin still cannot shake its poor reputation. There is little chance of that changing.

CBDC Front Runners*

By CHRIS PAPADOPOULLOS, PIERRE ORTLIEB AND LEVINE THIO[*]

Several advanced and prominent central bank digital currency initiatives are setting the global standard in research, identification of credible policy objectives, use cases and technological design. These projects are also among the first to outline approaches to the on-the-ground realities and practicalities of implementation.

The People's Bank of China's digital currency/electronic payment project is by far the biggest in scale and furthest along in implementation. The PBoC is working alongside private sector players to distribute digital M0 among its population. The most recent joint venture is with the Society for Worldwide Interbank Financial Telecommunication, where SWIFT will obtain a local licence and manage local network management activities, all in compliance with Chinese regulations. Despite the scope of SWIFT's activities, which are limited, it signals China's growing intention to explore how their systems could integrate with global payment infrastructure.

Cambodia is another country taking a public-private approach. Its Bakong initiative, however, is not purely a CBDC system. Instead, it is working to reinvent its core infrastructure, allowing more payment players to participate, generating greater innovation and competition.

The Swedish Riksbank was an early explorer of retail CBDC, identifying a strong policy objective and use case amid the declining use of cash. One important objective of the e-krona project is to solve issues with bank deposit disintermediation. The project remains under review, however, as the benefits are debated in government.

The Monetary Authority of Singapore has made iterative progress on its project since 2016. The focus now is on using its payment network prototype, developed in collaboration with JPMorgan and Temasek, to continue to serve as a test network. It will facilitate collaboration with other central banks, as well as the financial industry as they work together to develop next generation cross-border payment infrastructure.

The Bahamas' sand dollar project offers a number of big lessons for implementing a CBDC and tackling on-the-ground realities of deployment during a pandemic. The result has been a number of novel innovations which tackle offline payment and settlement issues, ensuring inclusion through low-cost access and creating a resilient network.

These countries are leading the world when it comes to CBDC, providing a guide for how others could develop their own projects.

CHINA
China could use its advanced position to help internationalise the renminbi

The People's Bank of China's research into central bank digital currency, started in 2014, began to bear fruit last year. Digital currency trials were announced across four cities: Shenzhen, Suzhou, Chengdu and Xiong'an, with lotteries aiding participation. Over 2m Shenzhen citizens signed up for the lottery, with 50,000 winning a wallet containing 200 digital yuan. China plans a broader roll-out of its CBDC in 2022, through its digital currency/electronic payment project, known as E-CNY.

Chinese authorities are pondering how to introduce the currency without disrupting the current financial system. The digital currency may even complement existing financial services and payments providers rather than compete with them. Mu Changchun, head of the PBoC's digital currency research institute, said last year that the digital currency will not compete with payments giants WeChat Pay and Alipay. Changchun said, 'WeChat and Alipay are wallets, while the digital yuan is the money in the wallet.'

China is also paying close attention to the impact of its digital currency on the banking system. Four state-owned banks will distribute the digital currency and will be central to its existence. This two-tier model, where consumers still must have accounts at commercial banks, distinguishes itself from the one-tier model, where consumers would have their own account at the central bank. A two-tier model ensures that commercial banks can still offer financial services to their customers. There are also suggestions that the PBoC could relend digital currency deposits to commercial banks to replace their funding. This may give the central bank even more oversight of the use of its digital currency and could lead to more monetary policy tools.

There is discussion about whether the digital currency can be used for making cross-border payments more efficient and play a role in the internationalisation of the renminbi, but thus far China's efforts have been focused domestically. We may expect iterative expansion along the belt and road in the next cross-border phase.

The PBoC is reaching further with its experiments by introducing a phone-free digital yuan, where a smart card-like device can be used for payments. This will dispense with the need for an internet connection, important in a country where 40% of people, chiefly those living in the countryside, do not use a smartphone. This card would provide more inclusive access to the digital yuan, increasing its use and furthering China's lead in the technology.

CAMBODIA

Bakong debuted in late 2020, aiming to promote use of the local currency

Bakong, Cambodia's newly introduced mobile platform, is not a fully-fledged central bank digital currency. Rather, the nation says it is a 'backbone payment system', a unified, interoperable service that allows customers of different banks and payment service providers to send money to one another. But Bakong does incorporate features of distributed-ledger technology in a closed-loop system, safeguarding privacy and integrity.

The focus is on retail payments and Bakong fits in where other countries would have a real-time gross settlement system, which Cambodia previously lacked. The wholesale payments system is unchanged and operates through the national clearing system, though the central bank has said it is keeping an eye on other central banks' work on distributed ledger technology.

Bakong is designed to be a back-end structure that won't compete with current payment services providers and banks. Cambodia was well placed for something like Bakong, as it had a high rate of mobile phone ownership but a low rate of financial inclusion.

As well as boosting financial inclusion, Bakong could also encourage the use of Cambodia's riel. The economy is dollarised and an interoperable payment system that works like an RTGS would make using local currency more convenient, encouraging its circulation. The riel is held back by a lack of large denominations, making significant transactions cumbersome. 'We aim to improve financial inclusion, efficiency and safety, as well as promote the use of our local currency,' Serey Chea, director general of the National Bank of Cambodia, told OMFIF last year.

Some of the challenges in launching Bakong have been making it fit with the current network of financial services providers – banks, payment service providers and telecoms companies – without making them redundant.

Another has been to introduce standardised quick response codes across the system, which need to replace current QR codes used by payment firms and banks for customer transactions.

Cambodia is looking to the develop the system in the future. Bakong has taken steps to allow cross-border transactions. 'We are working on cross-border operations and have already signed a memorandum of understanding with Malaysia's Maybank,' Chea said. 'We want to allow migrant workers – many of whom are women – to send money back home free of charge and have more control over their finances.'

SINGAPORE
Project Ubin lays foundations for Singapore's retail central bank digital currency

In July 2020, the Monetary Authority of Singapore completed the final phase of its central bank digital currency project, Project Ubin. Project Ubin's goal was to develop a simple yet efficient alternative to the existing system, based on central bank issued digital tokens. Five stages of blockchain experiments, involving over 40 financial and non-financial firms, were carried out over half a decade. With each stage, spearheaded by MAS, reports were released that explained the technical details.

In the first two stages, MAS partnered with a consortium of financial institutions. Teaming up with R3, a distributed ledger technology company, in the first phase in 2016, MAS looked at prototype design principles. Together with five technology partners, the second phase the following year was concerned with developing software for three different models for decentralised interbank payment and settlement. In the third phase, delivery-versus-payment capabilities were advanced. These demonstrated settlement finality, interledger interoperability and investor protection. The accompanying technical report also expanded on resiliency considerations and a framework to govern posttrade settlement processes, such as arbitration.

The Bank of Canada, Bank of England and MAS collaborated on Ubin's fourth phase, which assessed models for improving cross-border payments and settlements. In 2019, BoC and MAS were successful at using CBDCs to perform cross-border and cross-currency payments. Project Ubin's final stage tested the commercial viability and value of a blockchain-based payment network and its ability to integrate with commercial blockchain applications. Temasek, JPMorgan and Accenture worked with MAS on this last phase, which culminated with the creation of a multi-currency network prototype.

After the completion of Project Ubin, MAS has continued working on the prototype to develop next generation cross-border payments, infrastructure and deploy blockchain technology. Sopnendu Mohanty, chief fintech officer at MAS, said that a shared taxonomy across different parties or standards is needed, with the transformation of the payment system being an urgent task.

Apart from the technical knowledge it produced, one of the lasting legacies of Project Ubin may be greater collaboration between financial and non-financial institutions. While MAS is staying quiet on if they will release a CBDC in the near future, experiments and discussions will continue. It may not be long before we see a Singaporean retail central bank digital currency.

SWEDEN
Falling cash use and the emergence of private competitors are driving the Sverige Riksbank to rethink money

The Sverige Riksbank's e-krona project, first started in 2017, launched its pilot last December. The endeavour, due to last until November 2022, serves as a learning experience of what has been called the world's most cashless society.

Previous projects explored the legal, technical and economic impacts of the e-krona, including possible consequences for bank balance sheets and its fit with the Riksbank's mandate. The pilot wants to answer these questions in a more practical manner by giving users an e-wallet which they can use to store, spend and send retail central bank digital currency.

The Swedish central bank sees two reasons for issuing a retail CBDC. First, Swedes are using less cash. The Riksbank notes that, as of 2018, only 13% of survey respondents made their most recent purchase with cash, compared to 39% in 2010. Second, the emergence of private challengers to monetary sovereignty – such as Facebook's Diem – is pushing the central bank to explore CBDC. 'The state needs to have a role in the payment market,' the bank remarks on its website, to maintain the stability of the monetary system. As an intermediary step, the bank submitted a request to Sweden's parliament that a panel of experts explore the merits of CBDC and requested a review of the concept of legal tender to ensure continued, universal access to money.

The Riksbank said it would test various designs, including token- and account-based solutions, on R3's Corda platform, in collaboration with Accenture. The latter has previously worked on CBDC projects in Canada and Singapore. The RIX central payment system will serve as a platform for banks to acquire e-krona and users will have to activate their wallets through these banks before they can use the digital currency. However, once this is completed, the CBDC can be used for everything from retail payments to transfers, and the Riksbank has announced it will explore the possibility of offline transactions.

The e-krona's distributed ledger technology network will be entirely separate from RIX, granting the system an added layer of resilience. The central bank will still control the DLT network, granting access to new nodes.

As the Swedish government explores the feasibility of e-krona, a great deal on focus will be on the effects of disintermediating deposits on the banking sector. Sweden and the world is set to learn several important lessons from its pilot.

BAHAMAS
World can learn lessons from the Bahamas as they plan their own digital currencies
While 2021 started with only one live central bank digital currency project – the Bahamas's sand dollar which launched in October 2020 – it won't end the year with so few. Central banks are piloting new CBDC endeavours, exploring possible design options, policy implications and impacts on intermediaries. As such, the archipelago is at the forefront of a wave of technological change and will provide an object lesson for others.

The Bahamas' environmental features made the development of a CBDC a priority. Spread across 700 islands and keys, the nation is prone to natural disasters, has an unstable power supply and sees increasing financial inclusion as a key issue. The central challenge behind the sand dollar, then, was creating a simultaneously resilient, inclusive and convenient payment network.

The Central Bank of the Bahamas developed a retail CBDC with potential wholesale applications, which could be used both to settle transactions between financial institutions and by consumers. Initially, digitalised Bahamian dollars were held by six authorised institutions, which in turn could transfer funds between themselves.

Consumers, in the meantime, use an app to store, move or pay with the sand dollar. Reuters reported in December 2020 that Bahamians were finding the CBDC easy to use and convenient, showing early signs of success. Businesses, meanwhile, were happy to avoid high credit card transaction fees.

The sand dollar is built on a proprietary software stack, Cortex, developed by technology partner NZIA. This set-up can manage all aspects of CBDC issuance, including movement, usage, risk

management, compliance, engagement and accessibility, as NZIA noted in the September 2020 OMFIF DMI Journal. At the same time, the platform is open-ended, allowing participants to build on top of the network. In addition to the programmability of the network, the CBDC itself is programmable, allowing the government issuer to, for example, set an expiration date or only allow certain uses for the funds.

The launch of the CBDC required new legal, regulatory and physical infrastructure. As part of this rollout, parliament passed a digital assets and registered exchanges bill, facilitating the registration, regulation and management of digital token exchanges. In addition, project engineers were required to set up low cost, redundant networks to 'support the backbone of the existing network connections servicing the country.' As more CBDCs come online, the Bahamas will prove to be a useful guide.

Green Finance

Getting the Green Deal done – How to Mobilize Sustainable Finance*

By Klaas Knot[*]

Over the years, Bruegel has become synonymous with excellent and policy-relevant research. Your work helps people like me to do our jobs better. That is also recognized by others. In the "2020 Global Go To Think Tank Index Report" published by the University of Pennsylvania Bruegel ranks as the number one non-US think tank in the world. That's worthy of congratulations!

Let me start by taking you back thirty years ago, when Europe stood before the great economic challenge at that time: transforming the crippled communist economies of Central and Eastern Europe into modern market economies. When I worked at the IMF in the late 1990s, in our reports we referred to this group of countries as transition economies.

As Bruegel has also pointed out, thirty years later we are all transition economies now. Not only must we make our fossil-based economies carbon neutral by 2050, to prevent catastrophic climate change. But we must do so while recovering from a public health and economic crisis. I focus on climate change, but the challenge is really much broader. It includes all forms of environmental degradation that make our economies unsustainable.

Europe's Green Deal tackles these multiple crises head-on. It is ambitious, it is comprehensive, and it focusses on growth. And with the Next Generation EU recovery package, and reinforcements to the EU budget, it is backed by unprecedented public financial firepower. The new Sustainable Finance Agenda that is coming out soon, will likely provide plans to mobilize much needed private investments. And that is exactly why the best economic response to the COVID crisis is to start implementing the Green Deal as soon as possible. After the euro crisis, after Brexit, Europe is leading the way, which makes me a proud European today.

But true leaders not only show the way. They also make sure everyone is on board. The introduction to the European Climate Law proposal states, and I quote:

'The European Green Deal reaffirms the Commission's ambition to make Europe the first climate-neutral continent by 2050.'

Laudable in and of itself. But frankly, it would be much better for the planet if, by 2050, we were the last continent to be climate-neutral. Because that would mean that other nations have caught up with us and even surpassed us. And then the whole world will have become climate neutral before the crucial 2050 deadline.

I am optimistic that Europe will team up with the new American leadership, and possibly with China and India and others, to form the powerhouse, the engine, that gets the world back on track

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to meet the Paris agreement. Because in order to get the energy transition really done, we will need to work together in many areas. Because there's not a European, or an American or a Chinese climate problem, there is only a global climate problem.

Now let's go back to Europe. As we all know, getting the European economy sustainable for future generations requires large investments. A big part of these investments need to be made by the private sector. And for these private investments to scale up sufficiently, and for the financial sector to finance them, we need to get the right conditions in place. What needs to be done? And what can governments, central banks and supervisors do?

First of all, we need a better business case for green investments. One policy instrument is absolutely key here, and that is to raise the effective price of greenhouse gas emissions. Carbon emissions are the main, but not the only contributor to greenhouse gases. I'm an economist. Some may call it naïve, but I have this firm belief, backed by experience, that for economic transformation to take hold, you need to have relative prices that reflect the true scarcity of economic resources. In this case, by pricing in the climate cost of greenhouse gas emissions. Internalizing the externality. That will make it far easier for firms and households to determine the future value of their assets and liabilities. This will alter their incentive framework. Then, market forces will drive things in the right direction. This ball lies squarely in the court of governments. The EU Green Deal sets out ambitious plans to make carbon pricing more effective, and it is crucial these plans are not watered down. This is the one thing that makes all the other things that we do, much more effective.

Secondly, investors and the financial sector need clear and credible transition plans from governments. A plan that provides answers to questions like: what emission targets will be met and when? What actions are necessary to achieve these targets? What regulation is going to be implemented and in what sequence? What investments will the government make itself? How are we going to compensate vulnerable groups? In answering these questions we can draw lessons from the economic transition of thirty years ago. For example, I recall the debate about 'gradualism' versus 'cold turkey'. Some reforms, like changing relative prices, you may have to do as soon as possible. Others, like changes in productive capacity, will take more time.

What's also important is that it should be a plan that will still be in place after the next election. A plan that gives investors a sense of where we are going. That offers perspective, provides opportunities, and reduces investment risk. Here, again, I think the Green Deal goes a long way in fulfilling this need for a comprehensive plan. And now we have to enshrine it in law, work out the details and get it implemented.

Apart from carbon pricing and having a plan in place, what else do we need to do to get the money flowing to where it's green?

Well, thirdly, banks, insurance companies and pension funds need to be more aware of the climate risks they face. And manage these risks accordingly. Financial institutions are vulnerable to the physical consequences of a changing climate. Just ask the insurance companies. And, as I said, it is broader than climate change. In last year's report 'Indebted to Nature', we showed that Dutch financial institutions alone have over half a trillion euros in exposures to companies with high or very high dependency on a well-functioning ecosystem. Companies whose business may be at risk due to biodiversity loss and other forms of environmental degradation.

Financial institutions also run transition risks. For instance, the bank loan provided to a car manufacturer may be at risk if it fails to develop and build clean vehicles that meet new energy regulations and changing consumer demands on time. So climate risk is a new and important driver of financial risk. Financial supervisors must push financial institutions to manage this risk adequately. Just as they do with other risks.

Pressing for good risk management stems primarily from our mandate as supervisors to keep financial institutions safe and sound. But there is an important by-product. Once these institutions have a better understanding of the impact of climate-related risks on their balance sheets, this will impact their investment decisions. Less money will flow to fossil-fuel investments, and more to green investments. This way, financial institutions can become a powerful force in pushing the green transition.

I have not yet seen clear evidence of this reallocation effect playing out on a significant scale. For one thing, it's difficult for banks and other financial firms to manage their exposures as long as they lack good information about what is green and what is not.

That brings me to my fourth point, and that is disclosure. The information that the financial sector uses is only as strong as the corporate disclosures it is built upon. That is why the quantity, quality and consistency of corporate reporting on sustainability-related information must improve. Credible and comparable information should be readily available for all market participants, shareholders and other stakeholders.

This calls for a global solution. I believe the reporting such information is most effective when it is aligned with the requirements of global accounting standards, and therefore reflected in the audited annual accounts of companies. This also ensures a level playing field across jurisdictions. The International Financial Reporting Standards Foundation, the IFRS, is best positioned to set such standards. Therefore the IFRS has recently announced to take steps in that direction. Europe, as a frontrunner, has a key role to play in making this global effort succeed. The Italian G20 Presidency has asked the Financial Stability Board to explore how progress can be made here, based on the Recommendations of its Task Force on Climate-related Financial Disclosures.

Finally, European capital markets need to supply more risk capital. At the moment, European firms mainly depend on banks for their funding, and to some extent on capital markets. They only have limited access to private funding markets, which are very small in the EU, at least compared to the US. We need European financial markets to supply more diverse types of risk capital needed to fund the energy transition. Risk capital that typically comes from venture capitalists, private equity funds, and investment funds. And we also need to do something about the existing carbon-bias in European capital markets. In that respect, the European Commission's action plan for the Capital Markets Union could be further improved by stimulating better access to risk capital for green investments. At the same time, funding of non-green investments will need to become more expensive. Apart from carbon pricing, better disclosure is, again, key here. Once it becomes clear for investors that a company's foot print is not sustainable, risk premia will rise.

Central banks can also help to correct the carbon bias in capital markets. In the euro area, central bank purchases of corporate bonds follow a market neutrality principle. This means that the purchases reflect the broader corporate debt market. But what does this neutrality mean if there is a carbon bias in European capital markets because the relative price of carbon emissions is distorted? Central banks could explore how, within the boundaries of their mandates, they can redesign their monetary policy instruments to prevent such biases from occurring, and instead contribute to unlocking more green investments. We could take the existing EU policies, such as the Non-Financial Reporting Directive and the EU taxonomy for sustainable activities, as a starting point in this respect.

I spoke about the need for carbon pricing and transition plans, about the need for good risk management and disclosure, and the need for more supply of risk capital.

When it comes to the role of the financial sector, I may have inadvertently left you with the impression that finance always follows the real economy. If governments and central banks and other policymakers and standard setters provide all the right conditions, funding for the green transition will follow suit. Although I think this is largely true, it is not entirely how I see the role

of the financial sector. Financial market players should not wait for all the regulations, and conditions, and perfect data sets to be in place before they can have impact. They perform a crucial role in the economy by helping companies to grow and create jobs and wealth. That means they have a social responsibility of their own to make sure that their business models support a sustainable economy. It is good to see that many financial institutions are working on reducing their carbon footprint. To them I would say, keep up the good work, and branch out where possible. And to the others I say, don't just talk the talk, but also walk the walk.

Maybe only now, thirty years later, we fully realize how much courage it took for our Central and Eastern European partners to embark on their bold experiment. Without an existing blueprint. Under economic circumstances that make our troubles today look relatively benign. But they had little choice. And neither do we. So let's learn from their experience and take courage from their example. Even if we do not yet know exactly what a carbon-neutral economy looks like, and how it will change our everyday lives. The EU Green Deal is ambitious and bold. And now we have to get to work to implement it and to fund it. And at the same time, to reach out beyond our borders. To work together with governments, regulators, private investors, financial sector, climate experts, and central banks from all countries. To overcome the policy challenges. And to make sure that we meet the Paris Agreement targets, and tackle climate change in time.

ESG Criteria are Distorting Markets and Portfolio Decisions*

By SIMON OGUS*

The last 12 months have highlighted the urgency of environmental, social and governance needs around the world, as the climate crisis and the pandemic wreaked havoc. Individuals and institutions are trying their best to adapt to these circumstances. But will investment along Environmental, Social and corporate governance (ESG)9 themes produce favourable outcomes or will it accelerate a descent into market socialism?

In 1970, American economist Milton Friedman asserted that the only social responsibility of business is 'to use its resources and engage in activities designed to increase its profits… so long as it stays within the rules of the game'. This presupposes that principals in private corporations have a vested interest in monitoring their charges and can rein in errant operators. In practice, three decades of serial monetary debasement and central bank underwritten moral hazard have destroyed any semblance of the discipline offered by an effective cost of capital.

At the same time, the rise of passive investing has further undermined managerial monitoring, voting and holding individuals to account. When this is combined with judicial systems that are perceived to be disproportionately punishing blue collar crime over white – especially at the upper echelons of corporate structures – it fuels an increasingly frayed socio-political environment.

Added to this toxic mix are market distortions stemming from ESG investment criteria guiding portfolio decisions. This new approach to capitalism, where self-interest and public interest collide, is seen as warm and fuzzy. In such a politically correct era, it is increasingly 'brave' to disavow in public. Afterall, who can reasonably object to concepts such as a cleaner environment, end to slave labour and world peace?

We live in the world as it is, not the world we would like it to be. This is not to argue that individual and collective actions cannot be catalysts for change. President Joe Biden may seek to pursue a less erratic and emotional approach to foreign policy than his predecessor, but few believe that relations with an increasingly assertive Beijing are likely to improve considerably. They could conceivably deteriorate further around matters of human rights and political models, accompanied by a weaponisation of capital flows.

In Hong Kong, irrespective of political developments in the last year, the backdrop of financial markets has been highly supportive, with capital flows largely uninterrupted. Hong Kong remains indispensable as a controlled funnel for financial flows in and out of mainland China.

Hong Kong's capital markets are on a roll and this seems set to continue. But could the US under Biden get 'smarter' with its capital market policies and employ ESG considerations to further weaponise cross-border capital flows?

Asia has a high number of developing and developed economies where the seeds of political correctness are only just beginning to sprout. It is almost impossible for any company in the region – or emerging markets more generally – to be truly investible across the full range of ESG criteria.

Hypocrisy is becoming widespread in developed markets. We have electronic vehicle producers advertising vegan interiors, while punting in cryptocurrencies that consume more energy than a medium-sized country. Social media companies provide platforms for spewing hate and misinformation under the guise of free speech.

Corporate hypocrisy is hard to stomach and even harder if capital flows are increasingly directed according to self-appointed arbiters of what is acceptable or otherwise. Corporate executives and market practitioners have consistently expressed frustration and deep cynicism on the subject.

Rather than waiting for external pressure and box ticking, strategically dynamic firms should be looking out for a potential catalyst for change and to get ahead of the narrative. A company that treats its workers well and avoids harming its customers and the environment around its production is more likely to be sustainable than one that pursues a modern-day variant of Satanic Mills capitalism. Good company owners will recognise that building a sustainable and profitable business involves establishing deep wells of trust with their workforce, suppliers and customers.

It is up to individuals and institutions to adapt as best they can to the changing landscape. The risk is that governments, re-energised by interventions to fix the problems created by their own omissions and the powers afforded to them by the pandemic, will seize on the ESG wave to advance their geopolitical aims.

Time to Align Finance with Biodiversity Objectives*

By SIMON BUCKLE AND EDWARD PERRY*

The planet is heading towards its sixth mass extinction, with 25% of plant and animal species at risk. Companies (and the financiers) are part of the problem and should become part of the solution.

The destruction of biodiversity has significant implications for the viability and profitability of companies. An estimated $44tn of global value added depends on the ecosystem services that biodiversity provides. As a result, businesses are exposed to poorly understood risks. At the same time, the negative impacts of many companies' activities on biodiversity create significant societal risks, as well as liability risks for the companies.

Stopping biodiversity loss requires transforming production and consumption patterns. These changes can only be achieved through coherent and effective policies, and by aligning finance with biodiversity objectives. Global biodiversity spending is around $78bn-$91bn per year, mostly public expenditure. The challenge is not only to increase financing for biodiversity; it is also to reduce that which is harmful to biodiversity. Potentially harmful public support is more than five times total biodiversity spending. Financing that is harmful to biodiversity is likely to be much higher.

Adopting an ambitious post-2020 global biodiversity framework with specific and measurable targets is vital for sending a clear policy signal to businesses and financial institutions. Governments should mainstream biodiversity into their own budgets and fiscal measures – reforming harmful subsidies, greening public procurement, and pricing biodiversity loss through economic instruments. The immediate priority, however, must be to factor biodiversity into Covid-19 recovery measures. With almost $12tn committed to date globally, spending decisions by governments could be decisive for biodiversity and therefore longer-term economic resilience and prosperity.

Businesses, investors, issuers and financial regulators need to systematically account for biodiversity in all areas of decision-making. This requires metrics, methodologies and a common framework for measuring and reporting biodiversity-related dependencies, impacts and risks. The future Taskforce on Nature-related Financial Disclosures will aim to address these needs, drawing on existing measurement approaches and instruments, such as the Organisation for Economic Co-operation and Development guidelines for multinational enterprises on responsible business conduct. The RBC guidelines represent international consensus on the responsibility of businesses regarding adverse impacts on society and the environment, including biodiversity.

Biodiversity loss and climate change are urgent and interlinked challenges. We cannot effectively address one without tackling the other. Yet until recently, biodiversity loss had been relatively neglected in policy and finance. The increasing attention that businesses, investors and central banks are giving to biodiversity provides some hope that that this is about to change.

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Working Paper

Is the Renminbi a Safe-Haven Currency?

Evidence from Conditional Coskewness and Cokurtosis*

By CHENG XIN, CHEN HONGYI AND ZHOU YINGGANG*

Abstract: *We examine whether the renminbi (RMB) is a safe-haven currency in terms of its effectiveness in hedging financial stress for global equity investors. The coskewness of the RMB (the covariance between the RMB premium and equity volatility) is mostly negative, implying that the RMB is not a good hedge in times of market volatility. Moreover, the positive cokurtosis of the RMB (the covariance between the RMB premium and equity skewness) implies that the RMB is unable to hedge against stock market crashes. Neither the coskewness nor the cokurtosis of the RMB is priced, suggesting that equity investors with skewness and kurtosis preferences would not use the RMB to hedge against financial stress. Therefore, the RMB is not yet a safe- haven currency.*

Keywords: currency hedging, conditional coskewness, conditional cokurtosis, idiosyncratic skewness, international asset pricing

1. Introduction

A safe-haven asset tends to hold its value if stock markets experience extreme negative returns (Baur and McDermott, 2010). Safe-haven currencies are those that give hedging benefits in times of financial market volatility or financial distress (Habib and Stracca, 2012). Conventionally, the US dollar (USD), the Swiss franc (CHF), and the Japanese yen (JPY) have been safe-haven currencies.

[1]Some market participants have argued that the renminbi (RMB), the Chinese currency, joined the group of safe-haven currencies after it was included in the Special Drawing Rights (SDR) basket as a global reserve currency in 2016, with the other components of the SDR being traditional safe-haven currencies (Aizenman et al., 2020). Although the RMB did indeed hold its value against the US dollar during the 2008 financial crisis, others dispute the RMB's status as a safe haven and assert that the RMB will not become a safe-haven currency until Chinese economic and broader institutional reforms are implemented because the RMB is not sufficiently liquid and

not readily convertible. This paper investigates the role of the RMB as a safe-haven currency in the face of financial stress.

The most intuitive approach to evaluating the hedging benefits of currencies is based on the correlation (or covariance) between equity and currency markets (Dumas and Solnik, 1995; De Santis and Gerard, 1998). From this perspective, investors use foreign currencies to minimise the risk of a diversified portfolio and long those currencies that are more negatively correlated with international equity portfolio returns to minimise the overall portfolio volatility. Campbell et al. (2010) show that the US dollar, the euro, and the Swiss franc move against the international equity market. Thus, these currencies should be attractive to risk-minimising global equity investors despite their low average returns. However, there are two main limitations associated with the correlation approach. On the one hand, the correlation cannot capture the nonlinear response of a safe-haven currency to an extreme shock (Habib and Stracca, 2012; Fatum and Yamamoto, 2016; Fatum et al., 2017). On the other hand, the hedging benefits of the currency might not be fully captured by the correlation approach, as investors typically go beyond the mean-variance preference when they flee to safety (Chan et al., 2018).

By dealing with the above shortcomings, we attempt to contribute to the safe-haven currency literature as follows. First, we use a regime-switching approach, a nonlinear method, to derive currency coskewness and cokurtosis and measure the nonlinear response of safe-haven currencies to a global stock market shock. In the literature, Baur and McDermott (2010) provide an intuitive method to study whether gold is a safe haven with dummies measuring extreme downturns in the global stock market at different scales using a linear model. Following Baur and McDermott (2010), Ming et al. (2020) study whether gold is a safe haven against extreme downturns in the Chinese stock market, and Baur and Smales (2020) show that precious metals are ideal safe havens against uncertainty measured by geopolitical risk. Similarly, Habib and Stracca (2012) and Habib et al. (2020) investigate the drivers of safe-haven currency behaviour using a linear model and treat the VIX as the measure of market uncertainty.

Unlike the above linear models, Chan et al. (2018) measure a currency's hedging capacity with its coskewness with the global stock market (the covariance between the currency premium and equity volatility) using a multivariate regime-switching approach, which can better capture the joint distribution of asset returns empirically and theoretically (Ang and Bekaert, 2002; Guidolin and Timmermann, 2008; Branch and Evans, 2010) and situate the time-varying beta method within the literature (Christiansen et al., 2011). We extend this approach to derive not only currency conditional coskewness but also cokurtosis, which refers to the stable performance of a currency (as measured by currency return) during times of financial stress (as measured by stock market volatility or skewness).Our time-varying coskewness and cokurtosis may contain more information in integrated global asset markets since they are driven by the joint distribution of currency and equity returns. Additionally, they are more intuitive than other measures based on extreme value theory and copulas as well as other (nonlinear) comovements used in the recent literature. Intuitively, a higher and positive currency coskewness means that when stock volatility increases, the currency risk premium also increases. Similarly, a lower and negative currency cokurtosis means that when the stock market has a higher possibility to crash, the currency risk premium tends to be higher. In contrast, Bekiros et al. (2017) study the nonlinear relationship between an asset and stock market using continuous wavelet approach and copula models, which are pure econometric models and less intuitive. Moreover, regime-switching-based estimates are typically determined with considerably more accuracy than estimates of the higher moments obtained directly from realised returns (Guidolin and Timmermann, 2008).

Second, currency conditional coskewness and cokurtosis have a strong economic foundation in the skewness and kurtosis preference of investors who consider the capacity of a currency to hedge volatility and crashes in the global stock market. The skewness and kurtosis preference are based

on "prudence"[2] (e.g., Kimball, 1990) and "temperance" (e.g., Denuit and Eeckhoudt, 2010), respectively, signifying that investors desire higher (positive) skewness and lower (negative) kurtosis (Rubinstein, 1973; Kraus and Litzenberger, 1983). An investor examines an asset's contribution to the skewness and kurtosis of a broadly diversified portfolio, referred to as coskewness and cokurtosis of that asset with the portfolio. The literature has provided supportive empirical evidence that coskewness and cokurtosis on stock, bond, and option markets are significant in determining expected returns (e.g., Harvey and Siddque, 2000; Dittmar, 2002; Vanden, 2006; Guidolin and Timmermann, 2008; Yang et al., 2010). In contrast, crash risk, captured by currency (idiosyncratic) skewness (Brunnermeier et al., 2008; Burnside et al., 2010) and the global foreign exchange volatility factor (Menkhoff et al., 2012), is not informative about the hedging properties of currencies from a broadly diversified portfolio point of view. Although the currency covariance with global equity volatility in Lustig et al. (2011) is conceptually similar to currency coskewness, we propose time-varying currency coskewness and cokurtosis, which are essentially risk factors. Chan et al. (2018) evaluate the hedging benefits of currency coskewness but not cokurtosis. In a recent paper, Opie and Riddiough (2020) find that currency returns are predictable, accounting for their hedge capacity against global factor returns from a broadly diversified portfolio point of view, but their research is conducted under a mean and variance framework.

Third, we evaluate the hedging capacity of onshore and offshore RMB using currency coskewness and cokurtosis and compare it with this capacity of the Japanese yen. On one hand, Japanese yen is found to be the safest currency (Fatum and Yamamoto, 2016) and possesses desirable hedging benefits in times of financial market volatility (Chan et al., 2018). On the other hand, though offshore RMB (CNH) is much less regulated and is de facto fully convertible because it is freely traded outside of mainland China, Fatum et al. (2017) find no evidence to suggest that offshore RMB is a safe haven. Similarly, we find that onshore RMB (CNY) has positive coskewness with the global equity market in some periods, while offshore RMB (CNH) has positive coskewness with the emerging stock market. The patterns imply that the CNY can only hedge against global stock market volatility to some extent, while the CNH can only hedge against emerging stock market volatility. In contrast, the JPY has positive coskewness in all periods with a larger scale and is a better hedge in a volatile market, as it appreciates when equity volatility increases. Moreover, the cokurtosis of both onshore and offshore RMB with the equity market is positive, and thus neither can hedge against a stock market crash. In contrast, JPY cokurtosis is negative, suggesting even higher hedging effectiveness during a stock market crash.

Furthermore, we investigate whether the features of a currency as a safe haven are priced in its future excess return using predictive regressions. In general, we find that RMB coskewness with stock markets is not priced in the RMB's future excess return. In contrast, the counterpart of the JPY is priced, suggesting that prudent equity investors use the JPY rather than the RMB to hedge against global stock market volatility. Moreover, the conditional cokurtosis of the RMB and JPY with the equity market does not command a statistically or economically significant ex ante risk premium with the expected positive sign. By implication, temperate investors use neither the RMB nor the JPY to hedge against global stock market crashes. On the whole, the RMB is not yet a safe-haven currency, while the JPY exhibits the safe-haven property to some degree. These results are robust aftercontrolling for currency beta (Lustig et al., 2014；Verdelhan, 2018), volatility factors (Lustig et al., 2011; Menkhoff et al., 2012), and crash risk (Brunnermeier et al., 2008; Burnside et al., 2010). For a further robustness check, we use the more intuitive method of Baur and McDermott (2010) and find similar results.

The rest of the paper is organised as follows. Section 2 describes the data and gives a preliminary

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[2] Prudence suggests a precautionary saving motive, the propensity to prepare and safeguard oneself in the face of uncertainty. It is in contrast to risk aversion, which is how much one dislikes uncertainty and turns away from uncertainty if possible.

analysis. Section 3 discusses the regime-switching models and derives their conditional moments. Section 4 presents the empirical results, and Section 5 checks the robustness of the main results. Section 6 concludes and offers final remarks.

2. Data Description

Our analysis employs monthly data on exchange rates, the global stock market index, and interest rates. All data series, except for the time series of CNH exchange rates, cover the period from July 2005 to December 2019. Specifically, the CNY sample starts in July 2005, when the exchange rate of onshore RMB (CNY) started to float. To facilitate comparison, the JPY sample also starts in July 2005. The CNH sample starts in August 2010 when the CNH was launched. The monthly CNY and JPY exchange rates against the USD are obtained from the International Financial Statistics (IFS) database offered by the International Monetary Fund, while the monthly exchange rate of the CNH against the USD is from Bloomberg.

We use the Morgan Stanley Capital International (MSCI) global stock market index, including the MSCI world index, Asia index, and emerging markets index, to represent the world stock market, Asian stock market, and emerging stock market. The MSCI world index is a broad global equity index that represents large and mid-cap equity performance across 23 developed countries. Similarly, the components of the Asia stock index cover equities in developed market and emerging market countries in Asia, and the components of the emerging markets index cover equities in 26 emerging market countries. All the stock market indices mentioned above are US-dollar-denominated and represent the risk faced by a US dollar-based investor who is unhedged against exchange rate risk.

Figure 1 displays the evolution of the world stock market index and the JPY, CNY, and CNH exchange rates against the USD. When the 2008 financial crisis intensified with the collapse of Lehman Brothers, the Japanese yen appreciated and moved in the opposite direction to the world stock market index. In contrast, onshore RMB remained stable until the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Having appreciated gradually for five years, the CNY devalued significantly after the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Following the inclusion of the RMB into the SDR basket in October 2016, the CNY appreciated for some time, which might be one of the reasons that some market participants argue that the RMB is a safe-haven currency. The last panel of Figure 1 displays the exchange rate trends of offshore RMB. Offshore RMB was initiated in 2010 and shared a similar pattern with onshore RMB.

Figure 1 Evolution of the World Stock Market Index and JPY and RMB Exchange Rates (CNY for Onshore RMB and CNH for Offshore RMB) against USD
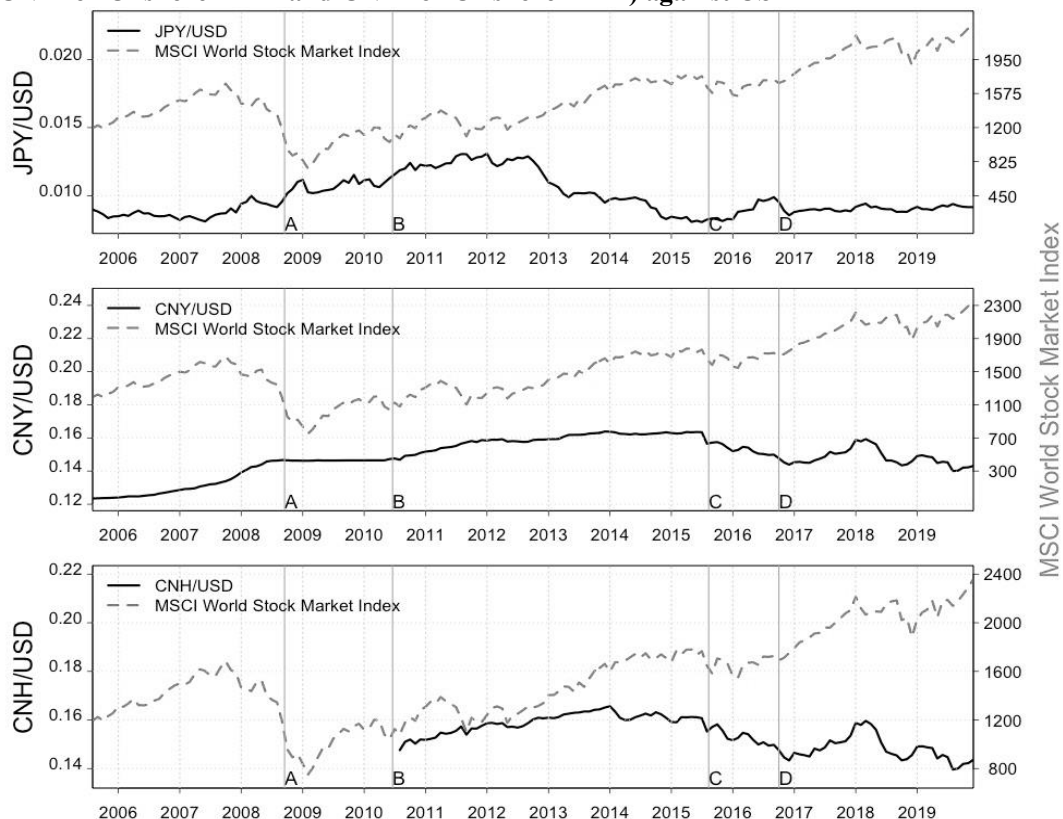
Note: The exchange rates are labelled on the left vertical axis, and the world stock market index is labelled on the right vertical axis. Several relative events are annotated with the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

As shown in Figure 1 above, the CNY/USD time series is not monotonically decreasing. With monthly data from the IMF and daily data from Datastream, Figure 2 offers a closer look at the response of the CNY during the 2008 financial crisis. While the world stock market index dropped significantly in the crisis period, the CNY remained stable and even appreciated slightly, which could be another reason that some market participants argue that the RMB is a safe haven.

Figure 2 A Closer Look at the RMB Response during the 2008 Financial Crisis
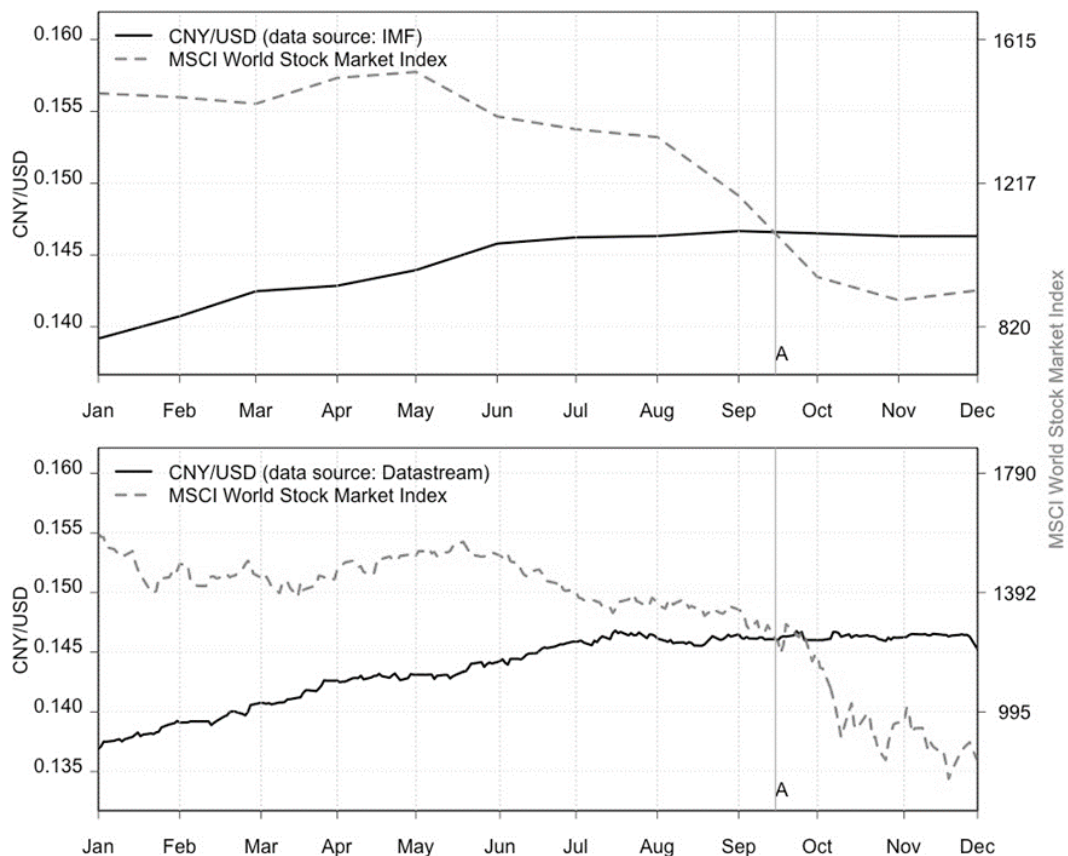
Note: The exchange rates of onshore RMB (CNY) are labelled on the left vertical axis, and the world stock market index is labelled on the right vertical axis. In addition, label A represents the date when Lehman Brothers went bankrupt in September 2008.

Figure 3 further illustrates the time-varying correlation of the global stock market return with changes int he JPY, CNY, and CNH exchange rate against the USD. The correlation of the JPY with the global stock market is almost negative, especially when the global stock market goes down. In contrast, the correlation of the CNY and CNH with the global stock market is often positive. One significant exception is that the CNY was negatively correlated with the global stock market in the period of the 2008 financial crisis.

Figure 3 Rolling Correlations of the World Stock Market with JPY and RMB Exchange Rates against USD (CNY for Onshore RMB and CNH for Offshore RMB)

Note: The figure presents the evolution of the correlation between the return of the world stock market index and the returns of JPY/USD, CNY/USD, and CNH/USD. The rolling correlation estimates are based on a window length of 24 monthly observations and illustrate that the correlation changes over time. The horizontal line marks the position of the zero axes.Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

Furthermore, we use 3-month treasury bill rates to measure the potential losses and gains of an investor who converts holdings from the US dollar to another currency, such as onshore and offshore RMB or the Japanese yen. The 3-month treasury bill rates of the US and Japan are from Datastream, while the Chinese data are from WIND. Notably, we use the 3-month deposit rate of offshore RMB from Bloomberg to measure the gains of holding assets denominated in offshore RMB because there is no active offshore RMB treasury market. Correspondingly, we measure the losses of a US dollar-based investor who converts the US dollar to offshore RMB using the 3-month deposit rate of the US dollar.

Since government bonds are always treated as safe assets (Habib et al., 2020) and the strength of the flight to safety is affected by the interest rate (Boucher and Tokpavi, 2019), we calculate the excess return (premium) for stock market indices and currencies following Habib and Stracca (2012) and Chan et al. (2018). The stock excess return is the log difference of MSCI stock market indices minus the US 3-month treasury bill rate, a proxy for the US and world risk-free rate. The currency excess return is the interest rate differential (the foreign interest rate minus the US interest rate) plus the rate of foreign currency appreciation against the US dollar, which measures the excess returns to a US investor from borrowing in US dollars to hold foreign currencies. All measures of excess return above are annualised.

Table 1 reports summary statistics for the premiums of stock market indices and currencies. The average stock premiums against the US interest rate for the world, Asian, and emerging stock markets are 4.679%, 3.594%, and 5.417%, respectively. All stock premiums exhibit negative skewness and positive excess kurtosis, suggesting a high probability of those markets experiencing financial crises. The premiums for onshore and offshore RMB are 2.203% and 1.301%, respectively, while the JPY premium is -1.400%. The striking difference can probably be attributed to the currencies' respective hedging properties, as will be demonstrated in the empirical study. The volatility of the currency premiums varies from 10.834% for the CNY and 14.357% for the CNH to 31.506% for the JPY. All the currency premiums exhibit negative skewness and positive excess kurtosis as well, suggesting a higher probability of those currencies having an extreme negative excess return. In addition, the left long and fat tails of the RMB are much more pronounced than their JPY counterparts, which indicates a less desirable hedging property of the RMB. Most notably, the premiums for all stock markets and currencies are stationary at 10% significance, which indicates a favourable property for modelling with a regime-switching model.

Table 1 Summary Statistics

	Mean	Std dev	Skewness	Kurtosis	ADF Test
World stock market premium	4.679%	51.619%	-0.834	5.359	-8.782*
Asian stock market premium	3.594%	57.156%	-0.653	4.710	-8.669*
Emerging market premium	5.417%	74.508%	-0.494	5.108	-7.936*
Premium of Japanese Yen	-1.400%	31.506%	-0.263	3.779	-7.959*
Premium of onshore RMB	2.203%	10.834%	-1.528	10.335	-7.580*
Premium of offshore RMB	1.301%	14.357%	-0.597	4.499	-7.020*

Note: The table reports summary statistics for the monthly stock market premiums and currency premiums. Stock premiums are the log differences of MSCI indices minus the US 3-month treasury bill rate, a proxy for the risk-free rate. Currency premiums are log interest rate differentials (foreign interest rate minus US interest rate) plus the rates of foreign currency appreciation against the US dollar. All measures are annualised.

3. Empirical Methodology

The empirical methodology in this study combines two models. The main analysis employs the regime-switching approach, from which we derive the conditional currency coskewness and

cokurtosis as well as other conditional moments. Then, we conduct predictive regressions of the future currency premium on the conditional currency coskewness and cokurtosis, controlling for the conditional beta, idiosyncratic volatility, and skewness and correcting for the error-in-variables problem. We also check the robustness of the main results using a more intuitive method following Baur and McDermott (2010).

3.1. Regime-Switching Models

From an econometric perspective, regime-switching models belong to a general class of mixture distributions and can generate time-varying moments through the use of some simple distributions, such as the normal distributions in each regime. Following much of the literature (e.g., Gray, 1996; Ang and Bekaert, 2002; Connolly et al., 2005; Guidolin and Timmermann, 2008), we focus on the two-state regime-switching model, which has an intuitively appealing interpretation: a bear state has higher volatility due to economic recessions and/or market crashes, while a bull state has less volatile returns.

Moreover, we specify the conditional means in Eq. (1) as Chan et al. (2018) do,

$$\begin{pmatrix} r_t^s \\ r_t^c \end{pmatrix} = \begin{pmatrix} \mu_i^s \\ \mu_i^c \end{pmatrix} + \begin{pmatrix} \lambda_i^s & 0 \\ 0 & \lambda_i^c \end{pmatrix} \begin{pmatrix} RF_{t-1} \\ RD_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^s \\ \varepsilon_{it}^c \end{pmatrix} (1)$$

where μ_i^s and μ_i^c are the constant means of stock and currency premiums given regime i, RF_{t-1} is the first lagged risk-free rate (the US interest rate), and RD_{t-1} is the first lagged interest differential (the foreign interest rate minus the US interest rate). λ_i^s and λ_i^c are the regression coefficients given regime i. The risk-free rate is closely attuned to discount rates and has significant predictive power for future stock returns. The interest rate differentials are well known to have significant predictive power for positive currency premiums from the carry trade. Lustig and Verdelhan (2007) and Campbell et al. (2010) both use interest rate differentials as the sole conditioning variable to study currency premiums. It would be interesting to see whether interest rate differentials can predict currency premiums differently in different regimes. In general, the conditional means might not linearly depend only on the first lag of the instrument, and there are other instruments. Thus, the specification adopted here represents a trade-off between flexibility and parsimony.

For the conditional variance-covariance matrices, we assume that ε_{it} follows an i.i.d. bivariate normal distribution. Then, the conditional distribution of r_t is a mixture of two i.i.d. bivariate normal distributions as follows.

$$r_t | F_{t-1} \sim \begin{cases} IIN(\boldsymbol{\mu_{1t}}, \boldsymbol{H_{1t}}), & w.p. \ p_{1t}, \\ IIN(\boldsymbol{\mu_{2t}}, \boldsymbol{H_{2t}}), & w.p. \ p_{2t}. \end{cases} (2)$$

Since mixtures of the normal distribution can approximate a broad set of density families, this assumption is not very restrictive. Moreover, the variances and correlation are assumed to be constant with each regime, and switches between regimes can generate conditional heteroskedasticity.

The parsimonious specification for the conditional variance-covariance matrices is as follows,

$$\boldsymbol{H_{it}} = \boldsymbol{D_{it}} \boldsymbol{R_{it}} \boldsymbol{D_{it}}, \boldsymbol{D_{it}} = \begin{bmatrix} \sqrt{h_i^s} & 0 \\ 0 & \sqrt{h_i^c} \end{bmatrix}, \boldsymbol{R_{it}} = \begin{bmatrix} 1 & 0 \\ \rho_i & 1 \end{bmatrix}, i \in \{1,2\} (3)$$

where h_i^s and h_i^c are the constant conditional volatilities of stock and currency premiums given regime i. ρ_i is the constant conditional stock-currency correlation given regime i. Nevertheless, we also address below the possibility that the estimated correlations between stock and currency premiums may vary across two regimes.

Furthermore, we specify the transition probabilities as a function of the lagged interest rate differentials RD_{t-1}, which strikes a good balance in defining regimes of both currency and equity

markets. Recent literature, such as Lustig et al. (2011) and Menkhoff et al. (2012), use the interest rate differential or, equivalently, the forward discount to sort currencies into portfolios and then construct the risk factor based on the comparison between the portfolios of high versus low quintiles, where a_i and b_i are unknown parameters and Φ is the cumulative normal distribution function, which ensures that $0 < p_{ii,t} < 1$. This specification makes the transition probabilities monotonic in the instrument, thus facilitating interpretation of the parameters.

$$p_{ii,t} = p(S_t = i | S_{t-1} = i, \mathbf{F}_{t-1}) = \Phi(a_i + b_i RD_{t-1}), i \in \{1,2\} \qquad (4)$$

With the above specification, we obtain quasi-maximum likelihood estimates (QMLEs) for model parameters and use the standardised likelihood ratio test proposed by Hansen (1992) to test for the existence of regimes[6]. In addition, diagnostic tests are conducted on the standardised residuals from the regime-switching model and the corresponding single-regime model.

We derive the general formula of the centred conditional moments as shown in Eq. (5).

$$E[(r_t^s - \mu_t^s)^k (r_t^c - \mu_t^c)^l | F_{t-1}, \theta] \qquad (5)$$

In particular, Eq. (6) calculates the conditional currency beta against the stock excess return, which is the conditional standardised covariance between the stock and currency excess returns. A negative conditional currency beta means that the currency and stock excess returns move in opposite directions and, in turn, that the currency has hedge capacity against the downturn of the stock market.

$$\beta_t = \frac{E[(r_t^s - \mu_t^s)(r_t^c - \mu_t^c)|F_{t-1}, \theta]}{E[(r_t^s - \mu_t^s)^2 | F_{t-1}, \theta]} \qquad (6)$$

Eq. (7) calculates the conditional standard deviation of the currency excess returns.

$$std_t^c = \sqrt{E[(r_t^c - \mu_t^c)^2 | F_{t-1}, \theta]} \qquad (7)$$

Eq. (8) calculates the conditional currency coskewness, which is the conditional standardised covariance between the currency excess return and the volatility of the stock excess return. A positive conditional currency coskewness means that the currency excess return increases when the volatility of the stock excess return increases and, in turn, that the currency has hedge capacity against a volatile stock market.

$$cos_t^c = \frac{E[(r_t^c - \mu_t^c)^3 | F_{t-1}, \theta]}{(\sqrt{E[(r_t^c - \mu_t^c)^2 | F_{t-1}, \theta]})^3} \qquad (8)$$

Eq. (9) calculates the conditional currency skewness as follows.

$$skew_t^c = \frac{E[(r_t^s - \mu_t^s)^2 (r_t^c - \mu_t^c)|F_{t-1}, \theta]}{E[(r_t^s - \mu_t^s)^2 | F_{t-1}, \theta]\{E[(r_t^c - \mu_t^c)|F_{t-1}, \theta]\}^{1/2}} \qquad (9)$$

Eq. (10) calculates the conditional currency cokurtosis, which is the conditional standardised covariance between the currency excess return and the skewness of the stock excess return. A negative conditional currency cokurtosis means that the currency excess return increases when the stock excess return has a higher probability of crashing (smaller skewness) and, in turn, means that the currency has hedge capacity against a stock market crash.

$$cok_t^c = \frac{E[(r_t^s - \mu_t^s)^3 (r_t^c - \mu_t^c)|F_{t-1}, \theta]}{\{E[(r_t^s - \mu_t^s)^2 | F_{t-1}, \theta]\}^{3/2}\{E[(r_t^c - \mu_t^c)|F_{t-1}, \theta]\}^{1/2}} \qquad (10)$$

Eq. (11) calculates the conditional currency kurtosis as follows.

$$kurt_t^c = \frac{E[(r_t^c - \mu_t^c)^4 | F_{t-1}, \theta]}{(\sqrt{E[(r_t^c - \mu_t^c)^2 | F_{t-1}, \theta]})^4} \qquad (11)$$

3.2. Currency Coskewness and Cokurtosis Pricing Effects

By extending Chan et al. (2018), we approximate the pricing kernel through a fourth-order Taylor expansion and examine whether currency coskewness and cokurtosis with the stock market

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[6] Note that the likelihood ratio test does not have the standard X[2] distribution for Markov-switching models due to unidentified nuisance parameters. The standardised LR test proposed by Hansen (1992) can circumvent this problem and provides an upper bound of the p-value for general cases.

are priced in currency premiums beyond the conventional beta factor as follows,

$$r_{t,t+m}^c = \lambda_0 + \lambda_1 \hat{\beta}_t + \lambda_2 \widetilde{cos}_t^c + \lambda_3 \widetilde{cot}_k^c + \varepsilon_t^c \qquad (12)$$

where $r_{t,t+m}^c$ is the currency excess return over the m-month horizon. The expected beta, $\hat{\beta}_t$, controls the traditional CAPM pricing effect. The second factor is the conditional currency coskewness. Instead of including $\widehat{cos}_t^c$ directly, we separate the additional effect of $\hat{\beta}_t$ and use the orthogonal residual $\widetilde{cos}_t^c$. We further orthogonalise the conditional currency cokurtosis from $\hat{\beta}_t$ and $\widetilde{cos}_t^c$ to examine the additional pricing effect of the conditional currency cokurtosis.

If λ_1 is significantly positive, the conditional currency beta earns a positive risk premium, implying that the currency's hedge capacity against a stock market downturn is desirable to risk-averse investors. If λ_2 is significantly negative, the conditional currency coskewness earns a negative risk premium, implying that investors with a skewness preference are willing to accept the negative risk premium to take advantage of the currency's hedge capacity against a volatile stock market. If λ_3 is significantly positive, the conditional currency cokurtosis earns a positive risk premium, implying that the currency's hedge capacity against stock market crashes is desirable to investors with a kurtosis preference.

Moreover, extending Menkhoff et al. (2012), we include other possible risk factors and orthogonalise them by order of moments to separate the additional effect of high-order moment factors from low-order moment factors as follows,

$$r_{t,t+m}^c = c_0 + c_1 \hat{\beta}_t + c_2 \widetilde{std}_t^c + c_3 \widetilde{cos}_t^c + c_4 \widetilde{skew}_t^c + c_5 \widetilde{cok}_t^c + c_6 \widetilde{kurt}_t^c + e_t^c \qquad (13)$$

where $\hat{\beta}_t$ is the beta risk factor. $\widetilde{std}_t^c$ is the idiosyncratic currency volatility, proxied by the residual from the auxiliary regression of the conditional standard deviation orthogonal to $\hat{\beta}_t$. $\widetilde{cos}_t^c$ is the residual of the conditional currency coskewness orthogonal to $\hat{\beta}_t$ and $\widetilde{std}_t^c$. $\widetilde{skew}_t^c$ is the idiosyncratic currency skewness, which is the residual of the conditional currency skewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, and $\widetilde{cos}_t^c$. $\widetilde{cok}_t^c$ is the conditional currency cokurtosis orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, $\widetilde{cos}_t^c$, and $\widetilde{skew}_t^c$. The final factor $\widetilde{kurt}_t^c$ is the idiosyncratic currency kurtosis, which is the residual of the conditional currency kurtosis orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, $\widetilde{cos}_t^c$, $\widetilde{skew}_t^c$, and $\widetilde{cok}_t^c$.

The regression produces an estimate of the risk exposure vector, $c = [c_1, c_2, c_3, c_4, c_5, c_6]'$. We want to see whether the "pure" effects of the conditional currency coskewness (cokurtosis) risk are negatively (positively) priced in currency returns beyond the traditional beta and volatility risks, i.e., $c_3 < 0$ and $c_5 > 0$.

With a significant and negative c_3, currency coskewness is negatively priced in the future currency excess return, indicating that investors with a skewness preference are willing to accept a lower future excess return for the currency because of its good hedging property against stock market volatility. In contrast, with a significant positive c_3 and negative currency coskewness, the currency has an undesirable coskewness property. The higher future excess return is to compensate for the coskewness risk, as investors will flee these currencies, which will depreciate during times of market volatility. In sum, the coskewness for a safe-haven currency should be negatively priced in its future excess return.

Similarly, currency cokurtosis is positively priced in the currency return with a significant and positive c_5, indicating that investors with a kurtosis preference are willing to accept a lower future excess return for the currency when the stock market has lower skewness because of its good hedging property against a stock market crash. In sum, the cokurtosis for a safe-haven currency should be positively priced in its future excess return.

As the regressions are conducted using estimates from the regime-switching model, the variables may be measured with noise. To deal with the errors-in-variables problem, the coefficient estimates are adjusted for a serial correlation of 24 lags and heteroskedasticity following Newey and West (1987).

3.3. An Alternative Method

As an alternative, we employ a relatively intuitive model following Baur and McDermott (2010), as shown below.

$$c_t = a + b_t s_t + e_t$$
$$b_t = c_0 + c_1 D(s_t q_{10}) + c_2 D(s_t q_5) + c_3 D(s_t q_1) \qquad (14)$$
$$h_t = \pi + \alpha e_{t-1}^2 + \beta h_{t-1}$$

c_t and s_t are the currency and world stock market index returns, respectively. The error term, e_t, follows a GARCH(1,1) process, as shown in Eq. (14). The dummy variables, denoted as $D(\cdots)$, capture extreme stock market movements and are equal to one if the stock market exceeds a certain threshold given by the 10%, 5%, and 1% quantiles of the return distribution. If one of the corresponding parameters of the dummy variables c_1, c_2, or c_3 is significantly different from zero, there is evidence of a nonlinear relationship between the currency and the stock market. If the parameters are nonpositive (including c_0), the currency acts as a weak safe-haven currency. If the parameters are negative and significantly different from zero, the currency under investigation functions as a strong safe haven.

4. Empirical Results

4.1. Results on Regime-Switching Model Estimation

The analysis proceeds with the estimation of the single-regime model as a benchmark and the two-state regime-switching model. Based on estimated likelihood functions and the resulting likelihood ratio tests (not reported here), the regime-switching model for each currency fits significantly better than the corresponding single-regime model. Table 2 shows the estimation results for the USD-denominated world stock market and currency premiums.

We first examine the parameters for the conditional volatilities as shown in Eq. (2). h_i^s and h_i^c are the constant conditional volatilities of stock and currency premiums given regime i, and the second regime is a bear state with higher volatility for the world stock and currency premiums. Taking the result for the JPY as an example, h_1^s and h_2^s are 0.061 and 0.456 in the bull and bear states, respectively, while h_1^c and h_2^c are 0.064 and 0.114 in the bull and bear states, respectively, implying that the volatilities for the JPY and the stock market are higher in the bear state than in the bull state.

Then, we check the fitness of the mean equation. As shown in Eq. (1), λ_i^s is the regression coefficient of the risk-free rate given regime i on the stock market excess return. The estimates of λ_2^s for the JPY and the CNY are significantly negative in the bear regime, indicating a negative association between the US interest rate and the world stock excess return in more volatile market conditions, in line with intuition. λ_i^c is the regression coefficient of interest rate differentials given regime i on the currency excess return. The estimates of λ_1^c for the CNY and the CNH are significantly positive, proving that the interest rate spread has positive predictive power for the excess return of the RMB in the bull state, in turn suggesting profitable carry trades in the bull (or low-volatility) state. In contrast, neither λ_1^c nor λ_2^c for JPY is significant, indicating that the relatively lower JPY premium is not the result of the carry trade (Christiansen et al., 2011).

More importantly, we focus on the constant conditional stock-currency correlation ρ_i. We find that the correlation between the excess return of the JPY and the world stock market is significantly negative in the bear state with $\rho_2 = -0.169$, suggesting that the JPY tends to appreciate against the USD in a downturn volatile stock market. However, stock-currency correlations are significantly positive for the CNY and the CNH in the bear state, with $\rho_2 = 0.344$ for the CNY and $\rho_2 = 0.423$ for the CNH. The above results preliminarily imply that the Japanese yen may offer better diversification opportunities than onshore and offshore RMB do under undesirable

stock market conditions.

Table 2
Regime-Switching Model Estimation for World Stock Market and Currency Premiums

Regime	JPY		CNY		CNH	
	$i = 1$	$i = 2$	$i = 1$	$i = 2$	$i = 1$	$i = 2$
μ_i^s	0.137***	0.042	0.057	0.198***	0.157***	0.028
	(4.464)	(0.549)	(1.099)	(3.478)	(3.075)	(0.570)
μ_i^c	-0.140***	0.072*	0.023***	-0.023	0.010	-0.044**
	(-4.691)	(1.778)	(7.005)	(-1.202)	(1.203)	(-2.527)
λ_i^s	0.022	-14.294**	-0.170	-13.155***	4.439	-0.081
	(0.018)	(-1.707)	(-0.043)	(-4.451)	(0.253)	(-0.019)
λ_i^c	-1.954	-3.904	0.702***	2.248	2.287***	2.008***
	(-1.352)	(-0.660)	(5.339)	(1.623)	(5.778)	(2.762)
h_i^s	0.061***	0.456***	0.298***	0.202***	0.077***	0.216***
	(4.912)	(6.377)	(11.389)	(5.829)	(3.311)	(6.968)
h_i^c	0.064***	0.114***	0.001***	0.028***	0.001***	0.028***
	(6.397)	(8.067)	(8.416)	(7.119)	(3.166)	(6.481)
ρ_i	-0.080	-0.169**	0.118	0.344***	-0.017	0.423***
	(-0.757)	(-1.991)	(1.304)	(3.978)	(-0.073)	(5.329)
a_i	1.542***	-1.810***	1.899***	-2.158***	-0.150	-0.418
	(7.041)	(-6.869)	(7.561)	(-7.873)	(-0.470)	(-1.483)
b_i	11.579	-64.481***	-0.406	33.645**	62.079***	-56.883***
	(1.154)	(-3.634)	(-0.028)	(2.356)	(3.419)	(-3.362)

Note: The table estimates the regime-switching model for the monthly world stock market and currency premiums using $\begin{pmatrix} r_t^s \\ r_t^c \end{pmatrix} = \begin{pmatrix} \mu_i^s \\ \mu_i^c \end{pmatrix} + \begin{pmatrix} \lambda_i^s & 0 \\ 0 & \lambda_i^c \end{pmatrix} \begin{pmatrix} RF_{t-1} \\ RD_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^s \\ \varepsilon_{it}^c \end{pmatrix}$, where $\begin{pmatrix} \varepsilon_{it}^s \\ \varepsilon_{it}^c \end{pmatrix} \sim$ IIN $(\mathbf{0}, \mathbf{H}_{it})$, and $\mathbf{H}_{it} = \mathbf{D}_{it} \mathbf{R}_{it} \mathbf{D}_{it}, \mathbf{D}_{it} = \begin{bmatrix} \sqrt{h_i^s} & 0 \\ 0 & \sqrt{h_i^c} \end{bmatrix}, \mathbf{R}_{it} = \begin{bmatrix} 1 & 0 \\ \rho_i & 1 \end{bmatrix}, i \in \{1,2\}$, and transition probabilities $p_{ii,t} = p(S_t = i | S_{t-1} = i, \mathbf{F}_{t-1}) = \Phi(a_i + b_i RD_{t-1}), i \in \{1,2\}$, where RF_{t-1} is the first lagged US risk-free rate and RD_{t-1} is the first lagged interest rate difference (foreign interest rate minus US interest rate). S_t is the unobserved regime at time t. $\mathbf{F}_{t-1}$ is the past information set. Φ is the cumulative normal distribution function. The parameter estimates are the QMLE. The t-statistics are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

4.2. Results on Conditional Currency Coskewness and Cokurtosis

We derive conditional currency coskewness and cokurtosis, as well as other moments, based on the model estimated in the previous process. Table 3 summarises the statistics of the conditional

currency moments.

Panel A of Table 3 summarises the averages of the conditional moment estimates derived as in Eqs. (6)-(11) for the JPY, CNY, and CNH. On the whole, the conditional moment estimates of all currency premiums are very close to their unconditional counterparts, as shown in Table 1. The evidence hints at the adequacy of the regime-switching model specification in describing the data-generating process up to the second moment and the well-known challenge in modelling the expectation of the third and fourth moments (e.g., Harvey and Siddique, 1999; Yang et al., 2010).

Table 3

Summary Statistics of Conditional Moment Estimates Derived from Stock–Currency Regime-Switching Models and Orthogonal Regressors

Currency	JPY	CNY	CNH
Panel A: Average of Conditional Moments against the World Stock Market			
conditional currency beta	-0.125***	0.048***	0.126***
conditional currency standard deviation	0.308***	0.092***	0.136***
conditional currency co-skewness	0.292***	0.003	-0.140***
conditional currency skewness	0.187***	-0.474***	-0.432***
conditional currency co-kurtosis	-1.124***	0.576***	1.443***
conditional currency kurtosis	3.214***	12.919***	5.108***
Panel B: Standard Deviation of the Orthogonalised Conditional Moments			
conditional currency beta	0.040	0.047	0.031
orthogonalised currency standard deviation	0.022	0.008	0.005
orthogonalised currency co-skewness	0.041	0.031	0.012
orthogonalised currency skewness	0.030	0.362	0.017
orthogonalised currency co-kurtosis	0.035	0.013	0.039
orthogonalised currency kurtosis	0.026	0.550	0.047

Note: The table reports summary statistics of the conditional moment estimates for the currencies. *, **, and *** in Panel A are the significance levels of a T-test, indicating whether the conditional moment estimates are significantly unequal to zero at the 1%, 5%, and 10% levels.

The conditional beta of the JPY is significantly negative, while the counterparts for onshore and offshore RMB are significantly positive, suggesting that the JPY is more desirable than the RMB in a downturn stock market with an increasing JPY premium. Similarly, the coskewness of the JPY is significantly positive, while the counterparts for onshore and offshore RMB are significantly negative, again indicating that the JPY is more favourable than the RMB in a volatile market with an increasing JPY premium. Moreover, the cokurtosis of the JPY is significantly negative, while the counterparts for onshore and offshore RMB are significantly positive, suggesting that the JPY is preferable to the RMB because the premium of the JPY increases when the stock market has a higher probability of crashing.

On the whole, the patterns imply that the JPY is a safe-haven currency not only because of its hedge capacity against world stock market downturns but also because of its hedge capacity against world stock volatility and crashes. In comparison, the RMB is not a safe-haven currency in the full sense.

Panel B of Table 3 summarises the standard deviation of the corresponding orthogonalised conditional moment estimates. We detect the economic significance of coskewness and cokurtosis using the standard deviation of the orthogonalised counterparts by investigating how much future currency premiums change if coskewness and cokurtosis increase by one standard deviation in the empirical study.

We also compare time-varying patterns of hedging benefits across currencies. Figure 4 plots the

conditional betas of the currency premium against the world stock market premium. A negative conditional currency beta means that the currency and stock excess returns move in opposite directions and, in turn, that the currency has hedge capacity against a downturn in the stock market. The currency beta of the JPY is negative in the whole sample, while the currency betas of the CNY and the CNH are positive, indicating that the JPY can hedge against downturns in the world stock market, while the RMB cannot.

Figure 4 Conditional Currency Betas with the World Stock Market
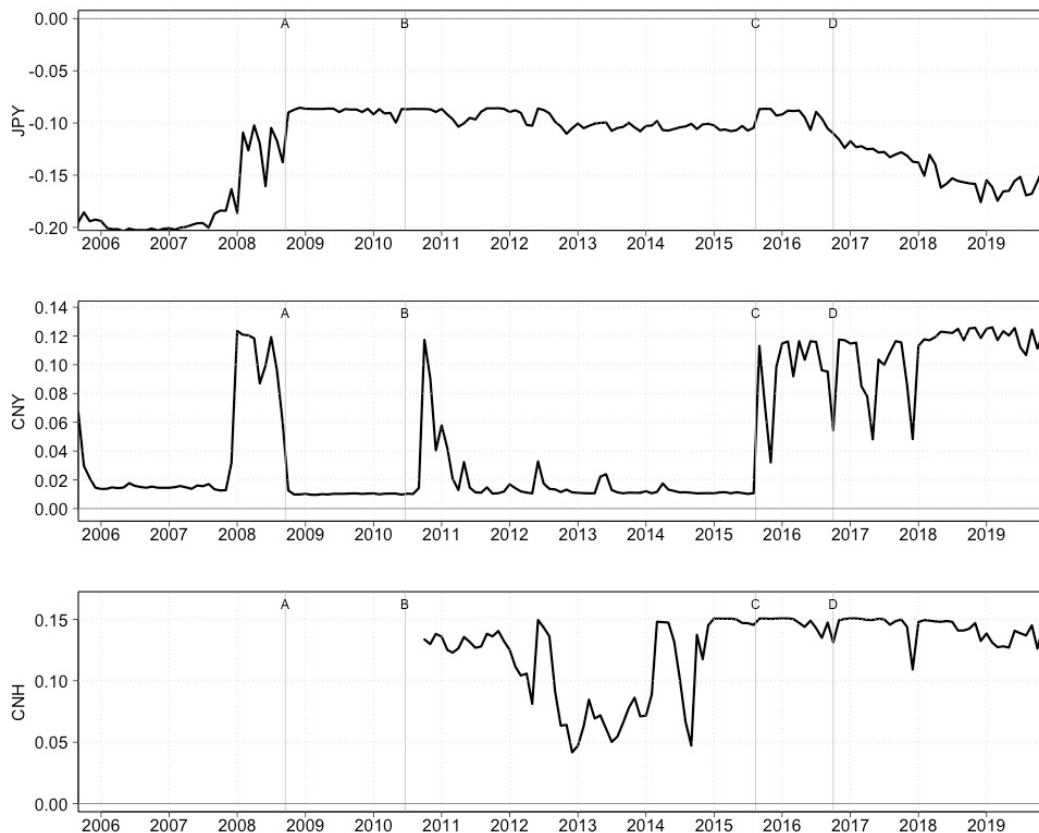
Note: The horizontal line marks the position of the zero axes. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

Figure 5 plots the conditional coskewness of the currency premiums against the world stock market premium. A positive conditional currency coskewness means that the excess return of the currency increases when the volatility of the stock excess return increases and, in turn, that the currency has hedge capacity against a volatile stock market. The JPY coskewness is always positive. Interestingly, the JPY coskewness decreased sharply after the 2008 financial crisis. Conversely, the CNY coskewness jumped from negative to positive in 2008 and stayed positive from 2008 to 2017, suggesting that the CNY played a hedging role against the volatility of the

world stock market during the 2008 financial crisis. However, we do not find a similar pattern for the CNH. The CNH coskewness remained mostly negative for the whole sample, implying that the CNY can only hedge against stock market volatility to some extent, while the CNH cannot hedge against volatility of the world stock market at all.

In sum, the JPY is a safe-haven currency from the perspective of its hedging property against volatility in the world stock market. Moreover, the CNY hedged against a volatile stock market only during a particular period of the 2008 financial crisis.

Figure 5 Conditional Currency Coskewness with the World Stock Market
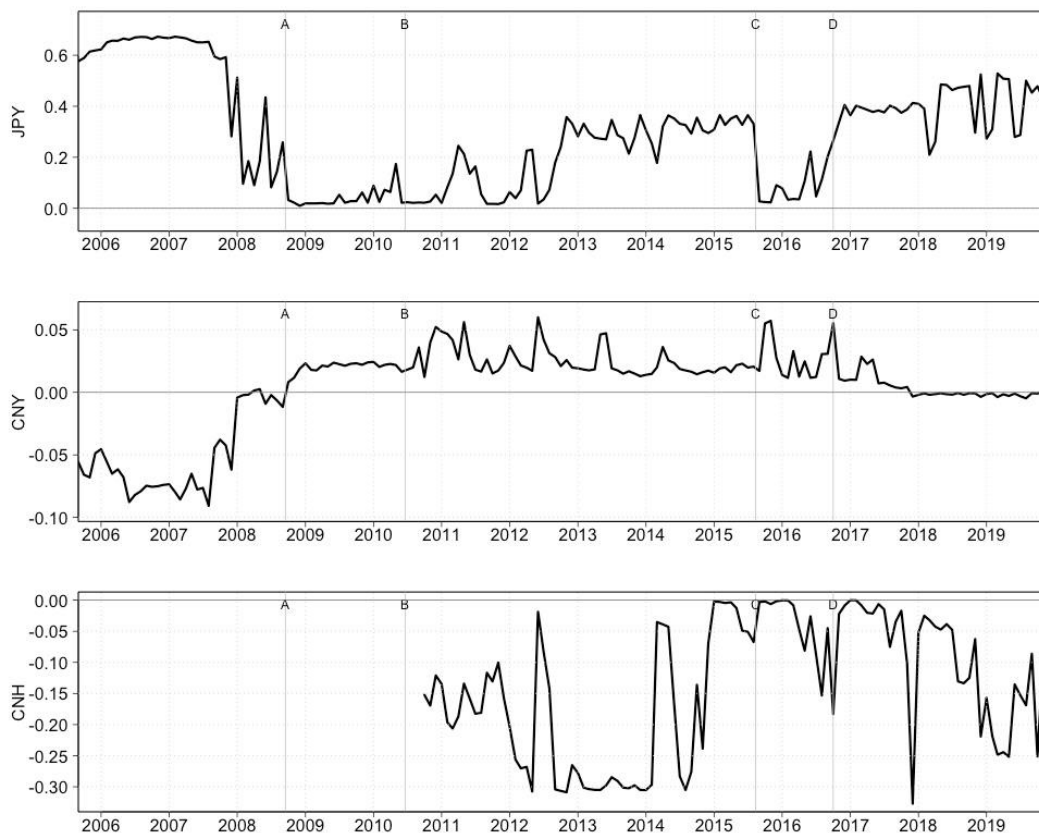
Note: The horizontal line marks the position of the zero axes. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

Figure 6 plots the conditional cokurtosis of currency premiums with the world stock index premium. A negative conditional currency cokurtosis means that the excess return of the currency increases when the stock excess return has a higher probability of crashing (smaller skewness) and, in turn, that the currency has hedge capacity against a stock market crash. The JPY cokurtosis is always negative for the whole sample, which implies that the JPY can hedge against a world stock market crash. In contrast, cokurtosis for both the CNY and the CNH is always positive, which implies that neither onshore RMB nor offshore RMB is a safe-haven currency in the full

sense, especially from the point of view of cokurtosis.

Figure 6 Conditional Currency Cokurtosis with the World Stock Market
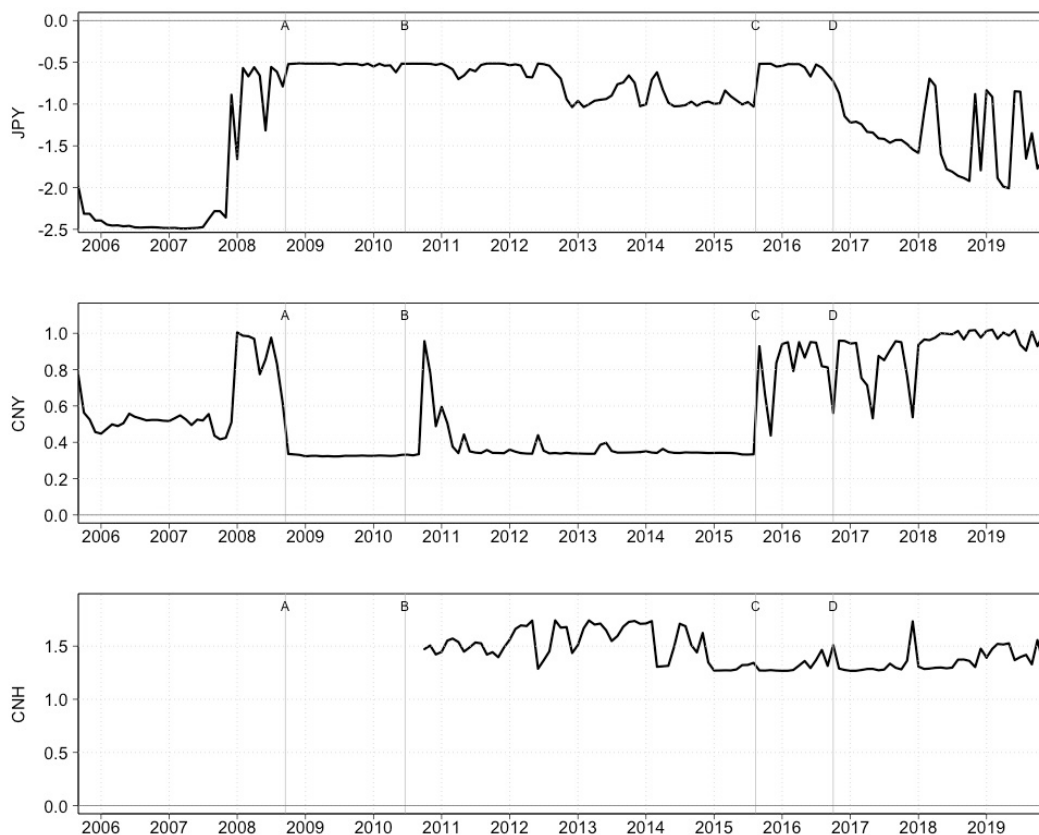
Note: The horizontal line marks the position of the zero axes. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

4.3. Results on Pricing Effects of Conditional Currency Coskewness and Cokurtosis

To investigate how currency coskewness and cokurtosis are priced in future currency premiums beyond the conventional beta factor, we run a regression according to Eq. (12) and report the results in Table 4. The coskewness for a safe-haven currency should be negatively priced in its future excess return, and the cokurtosis for a safe-haven currency should be positively priced in its future excess return. However, almost none of the coefficients for the CNY and CNH is statistically significant at conventional significance levels with the expected sign, suggesting that the RMB is not acknowledged as a safe-haven currency among global investors with a skewness or kurtosis preference. Only the coefficients of JPY coskewness are statistically significant with the expected sign for 1-, 3-, and 6-month excess returns.

In addition to the statistical significance, we evaluate the economic significance of the pricing effect of coskewness on future currency excess returns, which is proxied by the products of the

regression coefficients of coskewness in Table 4 and the corresponding standard deviations in Table 3. The pricing effect of coskewness for the JPY is economically large and decreases gradually as the forecast horizon increases. For example, a one-standard-deviation increase in the JPY coskewness induces a decrease of 7.0%, 4.7%, and 2.9% in the next future 1-, 3- and 6-month currency excess returns, respectively. Overall, JPYcoskewness commands statistically and economically significant negative ex ante excess returns.

In contrast to the relatively robust pricing effects of JPY coskewness, the coefficients of cokurtosis for the JPY, which should be positive, are not significant with the expected sign, suggesting that global investors with a kurtosis preference do not seek to trade off the JPY's future excess return with its hedge capacity against aworld stock market crash.

We further include other possible risk factors and run a regression according to Eq. (13). The results are shown in Table 5. Nevertheless, the coefficients of currency coskewness for the JPY are statistically significant with negative signs in the 1-, 3-, and 6-month excess returns. Similarly, the currency excess returns decrease by 5.1%, 3.4%, and 3.0% in the next 1, 3 and, 6 months, respectively, if the JPY coskewness increases by one standard deviation.

None of the coefficients for cokurtosis of the JPY, which should be positive, are significant with the expected sign. The results illustrate that investors with a skewness preference are willing to accept the JPY's negative future premium to take advantage of the JPY's hedge capacity against world stock market volatility. In contrast, none of the coefficients for coskewness and cokurtosis of the CNY and CNH are priced with the expected signs, signifying that the RMB's minor hedge capacity is not acknowledged by investors at all.

Table 4
Pricing Effects of Currency Coskewness and Cokurtosis with the World Stock Market

Currency	$\hat{\beta}_t$	$\widetilde{cos}_t^c$	$\widetilde{cok}_t^c$	R^2	Economic Impact	
					$\widetilde{cos}_t^c$	$\widetilde{cok}_t^c$
Panel A: 1-Month Excess Returns						
JPY	0.281	-0.824***	-0.061	5.2%	-7.0%	0.0%
	(0.385)	(0.231)	(0.137)			
CNY	-0.296	-0.012	-1.588*	5.9%	0.0%	-2.2%
	(0.241)	(0.257)	(0.88)			
CNH	-0.391**	0.065	0.274	1.4%	0.0%	0.0%
	(0.199)	(0.191)	(0.212)			
Panel B: 3-Month Excess Returns						
JPY	-0.241	-0.549**	-0.082	2.5%	-4.7%	0.0%
	(0.481)	(0.237)	(0.124)			
CNY	-0.402**	0.055	-0.241	3.0%	0.0%	0.0%
	(0.173)	(0.253)	(0.592)			
CNH	-0.034	0.112	0.144	0.4%	0.0%	0.0%
	(0.233)	(0.205)	(0.195)			
Panel C: 6-Month Excess Returns						
JPY	-0.035	-0.337*	-0.123	1.3%	-2.9%	0.0%
	(0.486)	(0.189)	(0.082)			
CNY	-0.216	-0.191	0.525	1.6%	0.0%	0.0%

	(0.189)	(0.299)	(0.862)			
CNH	-0.343	0.274	0.227	1.9%	0.0%	0.0%
	(0.309)	(0.333)	(0.233)			
Panel D: 12-Month Excess Returns						
JPY	-0.913	0.032	-0.070	1.5%	0.0%	0.0%
	(0.608)	(0.382)	(0.150)			
CNY	-0.286	-0.371*	0.346	2.9%	-1.3%	0.0%
	(0.296)	(0.213)	(0.381)			
CNH	0.041	-0.313	-0.536	2.0%	0.0%	0.0%
	(0.314)	(0.202)	(0.341)			

Note: The table presents the results of the following regressions: $r_{t,t+m}^c = \lambda_0 + \lambda_1 \hat{\beta}_t + \lambda_2 \widetilde{cos}_t^c + \lambda_3 \widetilde{cot}_k^c + \varepsilon_t^c$, where $r_{t,t+m}^c$ is the currency excess return over the m-month horizon. $\hat{\beta}_t$ is the traditional beta risk. $\widetilde{cos}_t^c$ is the residual of the conditional currency coskewness orthogonal to $\hat{\beta}_t$. $\widetilde{cos}_t^c$ is the conditional currency coskewness orthogonal to $\hat{\beta}_t$ and $\widetilde{cos}_t^c$.

Table 5
Pricing Effects of Currency Coskewness and Cokurtosis with the World Stock Market

Currency	$\hat{\beta}_t$	$\widetilde{std}_t^c$	$\widetilde{cos}_t^c$	$\widetilde{skew}_t^c$	$\widetilde{cok}_t^c$	$\widetilde{kurt}_t^c$	R^2	Economic Impact	
								$\widetilde{cos}_t^c$	$\widetilde{cok}_t^c$
Panel A: 1-Month Excess Returns									
JPY	0.276	2.332***	-1.242***	0.023	-0.655*	-0.025	6.0%	-5.1%	-2.3%
	(0.410)	(0.776)	(0.434)	(0.685)	(0.337)	(0.74)			
CNY	-0.293	1.718	-0.238	0.062***	-1.465**	0.016	11.5%	0.0%	-1.9%
	(0.182)	(1.576)	(0.212)	(0.021)	(0.718)	(0.012)			
CNH	-0.396**	0.248	-0.311	-0.714	0.231	0.920***	9.9%	0.0%	0.0%
	(0.167)	(1.732)	(0.809)	(0.610)	(0.204)	(0.195)			
Panel B: 3-MonthExcess Returns									
JPY	-0.261	1.516**	-0.838*	-0.118	-1.064***	0.005	3.8%	-3.4%	-3.7%
	(0.497)	(0.650)	(0.443)	(0.638)	(0.297)	(0.760)			
CNY	-0.404***	2.176***	-0.213	0.014*	-0.428	-0.012	6.5%	0.0%	0.0%
	(0.144)	(0.835)	(0.231)	(0.008)	(0.407)	(0.012)			
CNH	-0.032	0.452	1.588**	-1.396***	-0.172	0.100	4.8%	1.9%	0.0%
	(0.200)	(1.575)	(0.675)	(0.524)	(0.200)	(0.232)			
Panel C: 6-Month Excess Returns									
JPY	-0.048	0.790	-0.717**	-0.649*	0.680	1.239**	3.2%	-3.0%	0.0%
	(0.473)	(0.780)	(0.299)	(0.386)	(0.498)	(0.569)			
CNY	-0.216	-0.514	-0.175	-0.015	0.477	-0.001	1.8%	0.0%	0.0%
	(0.193)	(0.953)	(0.362)	(0.022)	(0.905)	(0.008)			
CNH	-0.333	2.798	1.790***	1.235**	0.326	-0.421**	7.2%	2.2%	0.0%

	(0.311)	(2.733)	(0.570)	(0.570)	(0.286)	(0.210)			
Panel D: 12-Month Excess Returns									
JPY	-0.967	-0.894	-1.000	0.262	0.948	0.485	4.8%	0.0%	0.0%
	(0.615)	(0.969)	(0.639)	(0.712)	(0.639)	(0.567)			
CNY	-0.285	-1.081	-0.329	-0.035**	0.063	0.004	4.2%	0.0%	0.0%
	(0.290)	(1.143)	(0.226)	(0.017)	(0.471)	(0.008)			
CNH	-0.045	-2.405	1.488	0.170	-0.370*	0.694***	7.5%	0.0%	-1.5%
	(0.215)	(1.850)	(1.087)	(1.150)	(0.220)	(0.218)			

Note: The table presents the results of the following regressions: $r^c_{t,t+m} = c_0 + c_1\hat{\beta}_t + c_2\widetilde{std}^c_t + c_3\widetilde{cos}^c_t + c_4\widetilde{skew}^c_t + c_5\widetilde{cok}^c_t + c_6\widetilde{kurt}^c_t + e^c_t$, where $r^c_{t,t+m}$ is the currency excess return over the m-month horizon. $\hat{\beta}_t$ is the traditional beta risk. $\widetilde{std}^c_t$ is the idiosyncratic currency volatility, proxied by the residual from the auxiliary regression of the conditional standard deviation orthogonal to $\hat{\beta}_t$. $\widetilde{cos}^c_t$ is the residual of the conditional currency coskewness orthogonal to $\hat{\beta}_t$ and $\widetilde{std}^c_t$. $\widetilde{skew}^c_t$ is the idiosyncratic currency skewness, which is the residual of the conditional currency skewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}^c_t$ and $\widetilde{cos}^c_t$. $\widetilde{cok}^c_t$ is the conditional currency coskewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}^c_t$, $\widetilde{cos}^c_t$ and $\widetilde{skew}^c_t$. $\widetilde{kurt}^c_t$ is the idiosyncratic currency kurtosis, which is the residual of the conditional currency kurtosis orthogonal to $\hat{\beta}_t$, $\widetilde{std}^c_t$, $\widetilde{cos}^c_t$, $\widetilde{skew}^c_t$, and $\widetilde{cok}^c_t$.

5. Robustness Check

In this section, we conduct a similar analysis of the JPY, CNY, and CNH in the Asian and emerging stock markets and provide further evidence on the pricing effects of currency coskewness and cokurtosis.

Table 6: Regime-Switching Model Estimation for the Asian and Emerging Stock Markets and Currency Premiums

	JPY		CNY		CNH	
Regime	$i = 1$	$i = 2$	$i = 1$	$i = 2$	$i = 1$	$i = 2$
Panel A: Regime-Switching Model Estimation for the Currency and Asian Stock Markets Premiums						
μ^s_i	0.175***	-0.002	0.037	0.246***	0.079	0.006
	(4.983)	(-0.037)	(0.652)	(4.130)	(1.325)	(0.116)
μ^c_i	0.012	-0.023	0.023***	-0.026	0.051***	-0.056***
	(0.559)	(-0.703)	(7.084)	(-1.431)	(6.651)	(-3.138)
λ^s_i	-0.891	-1.569	1.387	-19.289***	8.988	-2.239
	(-0.630)	(-0.395)	(0.399)	(-6.087)	(0.338)	(-0.471)
λ^c_i	3.956***	-2.991	0.701***	2.470*	-0.144	2.223***
	(4.833)	(-0.990)	(5.375)	(1.812)	(-0.387)	(3.069)
h^s_i	0.046***	0.436***	0.359***	0.251***	0.192***	0.218***
	(3.399)	(8.357)	(10.796)	(5.810)	(4.990)	(7.115)
h^c_i	0.017***	0.130***	0.001***	0.028***	0.003***	0.027***
	(3.267)	(7.698)	(8.625)	(7.336)	(4.811)	(6.307)
ρ_i	0.338**	-0.140*	0.095	0.467***	0.566***	0.497***
	(1.968)	(-1.728)	(1.111)	(6.156)	(5.846)	(6.896)
a_i	0.573**	-1.381***	1.901***	-2.235***	-0.055	0.222
	(2.451)	(-6.667)	(7.531)	(-8.374)	(-0.140)	(0.610)
b_i	0.000	-20.692**	-0.794	38.174***	96.72***	-137.174***
	(0.000)	(-1.997)	(-0.053)	(2.758)	(3.675)	(-4.611)
Panel B: Regime-Switching Model Estimation for the Currency and Emerging Stock Market						

	Premiums					
μ_i^s	0.028	0.101	0.016	0.318***	-0.063	0.184***
	(0.574)	(0.897)	(0.209)	(4.754)	(-0.819)	(3.241)
μ_i^c	-0.121***	0.072	0.024***	-0.028	0.040***	-0.081***
	(-4.487)	(1.600)	(7.043)	(-1.593)	(4.181)	(-4.540)
λ_i^s	7.023***	-29.289**	4.691	-23.759***	13.596	-12.519***
	(3.617)	(-1.823)	(1.112)	(-6.891)	(0.383)	(-2.897)
λ_i^c	-2.021	-4.085	0.698***	2.572*	0.022	3.243***
	(-1.544)	(-0.603)	(5.301)	(1.926)	(0.037)	(4.512)
h_i^s	0.226***	0.872***	0.645***	0.362***	0.397***	0.262***
	(6.287)	(6.588)	(10.956)	(5.951)	(5.488)	(5.496)
h_i^c	0.066***	0.123***	0.001***	0.028***	0.006***	0.030***
	(6.768)	(7.052)	(8.679)	(7.791)	(7.479)	(5.722)
ρ_i	0.181*	-0.193	0.071	0.530***	0.581***	0.668***
	(1.897)	(-1.597)	(0.786)	(9.064)	(8.598)	(10.355)
a_i	1.822***	-1.930***	1.920***	-2.175***	3.598***	-1.895***
	(6.988)	(-5.715)	(7.611)	(-7.502)	(10.922)	(-5.671)
b_i	14.446	-78.463***	-0.395	33.351**	-96.991***	20.977*
	(1.569)	(-2.775)	(-0.026)	(2.183)	(-6.872)	(1.825)

Note: The table estimates the regime-switching model for the monthly Asian or emerging stock market and currency premiums using $\begin{pmatrix} r_t^s \\ r_t^c \end{pmatrix} = \begin{pmatrix} \mu_i^s \\ \mu_i^c \end{pmatrix} + \begin{pmatrix} \lambda_i^s & 0 \\ 0 & \lambda_i^c \end{pmatrix} \begin{pmatrix} RF_{t-1} \\ RD_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^s \\ \varepsilon_{it}^c \end{pmatrix}$, where $\begin{pmatrix} \varepsilon_{it}^s \\ \varepsilon_{it}^c \end{pmatrix} \sim IIN\left(\mathbf{0}, \mathbf{H}_{it}\right)$ and $\mathbf{H}_{it} = \mathbf{D}_{it}\mathbf{R}_{it}\mathbf{D}_{it}$, $\mathbf{D}_{it} = \begin{bmatrix} \sqrt{h_i^s} & 0 \\ 0 & \sqrt{h_i^c} \end{bmatrix}$, $\mathbf{R}_{it} = \begin{bmatrix} 1 & 0 \\ \rho_i & 1 \end{bmatrix}$, $i \in \{1,2\}$, and transition probabilities $p_{ii,t} = p(S_t = i | S_{t-1} = i, \mathbf{F}_{t-1}) = \Phi(a_i + b_i RD_{t-1})$, $i \in \{1,2\}$, where RF_{t-1} is the first lagged US risk-free rate and RD_{t-1} is the first lagged interest rate difference (foreign interest rate minus US interest rate). S_t is the unobserved regime at time t. F_{t-1} is the past information set. Φ is the cumulative normal distribution function. The parameter estimates are the QMLE. The t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels.

Table 6 presents the results of the estimation of the regime-switching model for the JPY, CNY, and CNH in the Asian stock market, as shown in Panel A and Panel B. The estimation results for the regime-switching model are generally in line with the main results in Table 2.

The correlation between the excess return for the JPY and the Asian stock market is significantly negative in the bear state with a smaller scale in absolute value, with $\rho_2 = -0.14$. In addition, ρ_2 is not significantly negative for the JPY in the emerging stock market. The results suggest that the JPY's hedge capacity in the Asian and emerging stock markets is limited.

We further present the summary statistics of the conditional moments of currencies against the Asian and emerging stock markets in Table 7. The main results are consistent with previous results, as shown in Table 3. The average coskewness of the JPY against the Asian stock market is significantly positive, while that of the CNY and CNH is negative, again indicating that the JPY is a better hedge against volatility in the Asian stock market. Similarly, the average coskewness of the JPY against the emerging stock market is significantly positive, while that of the CNY is negative. Surprisingly, the average CNH coskewness against the emerging stock market is significantly positive with a smaller value than that of the JPY, indicating that the CNH has hedge potential against volatility in the emerging stock market. In addition, the average cokurtosis of the JPY is significantly positive, while that of the CNY and CNH is significantly negative against both markets, implying again that the JPY is a better hedge against stock market crashes. Overall, neither the CNY nor the CNH is an ideal hedge against volatility and crashes in the global stock

market.

Table 7

Summary Statistics of Conditional Moment Estimates Derived from the Asian or Emerging Stock–Currency Regime-Switching Models

Currency	JPY	CNY	CNH
Panel A: Average of Conditional Currency Moments Estimates with the Asian Stock Market			
conditional currency beta	-0.068***	0.056***	0.141***
conditional currency standard deviation	0.311***	0.091***	0.131***
conditional currency coskewness	0.100***	-0.003	-0.036***
conditional currency skewness	0.161***	-0.467***	-0.402***
conditional currency cokurtosis	-0.598***	0.727***	1.509***
conditional currency kurtosis	3.958***	13.153***	4.613***
Panel B: Average of Conditional Currency Moments Estimates with the Emerging Stock Market			
conditional currency beta	-0.026***	0.051***	0.143***
conditional currency standard deviation	0.306***	0.091***	0.135***
conditional currency coskewness	0.221***	0.001	0.039***
conditional currency skewness	0.168***	-0.465***	-0.233***
conditional currency cokurtosis	-0.716***	0.725***	1.678***
conditional currency kurtosis	3.247***	13.116***	4.041***

Note: The table reports summary statistics of the conditional moment estimates for the currencies. *, **, and *** are the significance levels for a T-test, indicating whether the conditional moment estimates are significantly unequal to zero at the 1%, 5%, and 10% levels.

We plot the conditional beta, coskewness, and cokurtosis for each currency against the Asian and emerging stock markets as well as the world stock market for reference in Figure A, Figure B, and Figure C in the Appendix. The dynamics of conditional beta, coskewness, and cokurtosis for each currency against the Asian and emerging stock markets are quite close to those of the world stock market except CNH coskewness against the emerging stock market. CNH coskewness against the emerging stock market is mostly positive, suggesting that the CNH has hedge potential against volatility in the emerging stock market.

Tables 8 and 9 summarise the estimation results of the pricing effects for the Asian stock market and the emerging stock market, respectively.

JPY coskewness is not priced as expected in the Asian stock market, suggesting that the JPY's hedge capacity against the Asian stock market is not well acknowledged by investors. It might be that because the MSCI Asia index includes the Japanese stock market as a component, investors may not be willing to hedge against financial stress in the Asian stock market using the JPY. However, JPY coskewness is significantly priced with a negative premium in the 1-month and 12-month currency excess return in the emerging stock market with an economic significance of -4.6% and -3.9%, suggesting that investors in the emerging stock market are willing to trade off thefuture excess return of the JPY for its hedge capacity against volatility in the emerging stock market.

Surprisingly, in the emerging stock market, CNH coskewness is also priced like a safe-haven currency in the 1-month and 12-month currency excess return with an economic significance of -2.4% and -2.8%, as shown in Table 9. Considering the positive coskewness of the CNH against the emerging stock market, we conclude that the CNH has a certain degree of hedge capacity against volatility in the emerging stock market. The results illustrate that investors with a skewness preference are willing to accept the CNH's negative future premium to take advantage of the CNH's hedge capacity against volatility in the emerging stock market.

Table 8 Pricing Effects of Currency Coskewness and Cokurtosis with the Asian Stock Market

Currency	$\hat{\beta}_t$	$\widetilde{std}_t^c$	$\widetilde{cos}_t^c$	$\widetilde{skew}_t^c$	$\widetilde{cok}_t^c$	$\widetilde{kurt}_t^c$	R^2	Economic Impact $\widetilde{cos}_t^c$	$\widetilde{cok}_t^c$
Panel A: 1-Month Excess Returns									
JPY	-1.132	0.754*	1.683***	1.507***	0.183	-0.01	5.6%	5.2%	0.0%
	(0.707)	(0.385)	(0.374)	(0.532)	(0.998)	(0.741)			
CNY	-0.237*	1.993	-0.109	0.054***	-0.347	0.014	9.8%	0.0%	0.0%
	(0.139)	(1.682)	(0.109)	(0.020)	(0.229)	(0.014)			
CNH	-0.127	4.762***	0.498***	0.053	0.420	-0.020	3.7%	2.0%	0.0%
	(0.226)	(0.958)	(0.149)	(0.055)	(0.790)	(0.021)			
Panel B: 3-MonthExcess Returns									
JPY	-2.475**	0.327	-0.157	1.754**	-2.174***	-0.346	5.4%	0.0%	-2.6%
	(1.215)	(0.388)	(0.559)	(0.714)	(0.772)	(0.644)			
CNY	-0.311**	2.023**	-0.093	0.013*	-0.066	-0.025**	6.7%	0.0%	0.0%
	(0.121)	(0.926)	(0.092)	(0.007)	(0.146)	(0.010)			
CNH	-0.148	3.945*	0.390*	0.149**	-2.264***	-0.064***	8.5%	1.6%	-2.4%
	(0.240)	(2.076)	(0.200)	(0.067)	(0.645)	(0.015)			
Panel C: 6-Month Excess Returns									
JPY	-2.075***	0.653	1.689***	0.898**	0.495	0.150	5.3%	5.2%	0.0%
	(0.671)	(0.575)	(0.566)	(0.439)	(1.390)	(0.494)			
CNY	-0.159	-0.689	-0.079	-0.011	0.170	-0.015	2.1%	0.0%	0.0%
	(0.169)	(0.923)	(0.148)	(0.018)	(0.249)	(0.011)			
CNH	-0.416*	4.312**	0.047	-0.017	-2.955***	-0.067***	8.9%	0.0%	-3.1%
	(0.237)	(1.794)	(0.255)	(0.053)	(0.575)	(0.019)			
Panel D: 12-Month Excess Returns									
JPY	-1.997**	-0.232	-0.045	0.426	-0.326	2.905***	5.6%	0.0%	0.0%
	(0.828)	(0.499)	(0.692)	(0.583)	(1.058)	(1.022)			
CNY	-0.223	-1.056	-0.163	-0.028*	0.023	0.002	4.0%	0.0%	0.0%
	(0.245)	(1.202)	(0.103)	(0.016)	(0.160)	(0.013)			
CNH	-0.125	1.680	-0.413	0.047	3.278	0.020	3.6%	0.0%	0.0%
	(0.242)	(11.373)	(1.672)	(0.096)	(4.189)	(0.111)			

Note: The table presents the results of the following regressions: $r_{t,t+m}^c = c_0 + c_1\hat{\beta}_t + c_2\widetilde{std}_t^c + c_3\widetilde{cos}_t^c + c_4\widetilde{skew}_t^c + c_5\widetilde{cok}_t^c + c_6\widetilde{kurt}_t^c + e_t^c$, where $r_{t,t+m}^c$ is the currency excess return over the m-month horizon. $\hat{\beta}_t$ is the traditional beta risk. $\widetilde{std}_t^c$ is the idiosyncratic currency volatility, proxied by the residual from the auxiliary regression of the conditional standard deviation orthogonal to $\hat{\beta}_t$. $\widetilde{cos}_t^c$ is the residual of the conditional currency coskewness orthogonal to $\hat{\beta}_t$ and $\widetilde{std}_t^c$. $\widetilde{skew}_t^c$ is the idiosyncratic currency skewness, which is the residual of the conditional currency skewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$ and $\widetilde{cos}_t^c$. $\widetilde{cok}_t^c$ is the conditional currency coskewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, $\widetilde{cos}_t^c$ and $\widetilde{skew}_t^c$. $\widetilde{kurt}_t^c$ is the idiosyncratic currency kurtosis, which is the residual of the conditional currency kurtosis orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, $\widetilde{cos}_t^c$, $\widetilde{skew}_t^c$, and $\widetilde{cok}_t^c$.

Table 9
Pricing Effects of Currency Coskewness and Cokurtosis with the Emerging Stock Market

Currency	$\hat{\beta}_t$	$\widetilde{std}_t^c$	$\widetilde{cos}_t^c$	$\widetilde{skew}_t^c$	$\widetilde{cok}_t^c$	$\widetilde{kurt}_t^c$	R^2	Economic Impact	
								$\widetilde{cos}_t^c$	$\widetilde{cok}_t^c$
Panel A: 1-Month Excess Returns									
JPY	-1.013***	0.791	-1.586**	0.123	-0.101	-0.452	5.3%	-4.6%	0.0%
	(0.293)	(0.693)	(0.798)	(0.436)	(0.281)	(0.485)			
CNY	-0.252*	1.638	-0.087	0.050***	-0.384	0.012	9.8%	0.0%	0.0%
	(0.141)	(1.461)	(0.110)	(0.018)	(0.237)	(0.010)			
CNH	-0.160	-0.239	-1.346*	0.025	-1.315***	-0.007	7.2%	-2.4%	-2.8%
	(0.227)	(1.417)	(0.694)	(0.047)	(0.326)	(0.015)			
Panel B: 3-Month Excess Returns									
JPY	-0.722*	-0.088	-0.764	0.114	0.043	-1.835***	5.3%	0.0%	0.0%
	(0.404)	(0.844)	(0.713)	(0.442)	(0.322)	(0.689)			
CNY	-0.323***	1.871**	-0.066	0.010	-0.048	-0.016*	6.2%	0.0%	0.0%
	(0.124)	(0.813)	(0.094)	(0.007)	(0.140)	(0.008)			
CNH	-0.266*	1.017**	0.318	0.079**	-0.825***	-0.022**	4.2%	0.0%	-1.8%
	(0.154)	(0.494)	(0.509)	(0.035)	(0.272)	(0.010)			
Panel C: 6-Month Excess Returns									
JPY	-0.537	-0.205	-0.496	0.189	0.036	1.489**	3.2%	0.0%	0.0%
	(0.429)	(0.986)	(0.654)	(0.380)	(0.259)	(0.653)			
CNY	-0.183	-0.643	-0.060	-0.014	0.203	-0.014*	2.7%	0.0%	0.0%
	(0.179)	(0.808)	(0.140)	(0.017)	(0.245)	(0.008)			
CNH	-0.119	-1.403	0.361	-0.008	-0.282	-0.004	1.3%	0.0%	0.0%
	(0.205)	(1.885)	(0.746)	(0.049)	(0.677)	(0.023)			
Panel D: 12-Month Excess Returns									
JPY	0.095	-1.741	-1.360*	-0.157	0.652*	0.091	4.3%	-3.9%	3.7%
	(0.468)	(1.163)	(0.774)	(0.435)	(0.377)	(0.759)			
CNY	-0.254	-0.740	-0.162*	-0.027*	0.035	0.000	4.1%	-1.2%	0.0%
	(0.249)	(1.077)	(0.098)	(0.015)	(0.168)	(0.010)			
CNH	-0.400**	1.633*	-1.559**	0.178***	-1.049	-0.047	9.8%	-2.8%	0.0%
	(0.180)	(0.963)	(0.614)	(0.050)	(1.082)	(0.031)			

Note: The table presents the results of the following regressions: $r_{t,t+m}^c = c_0 + c_1\hat{\beta}_t + c_2\widetilde{std}_t^c + c_3\widetilde{cos}_t^c + c_4\widetilde{skew}_t^c + c_5\widetilde{cok}_t^c + c_6\widetilde{kurt}_t^c + e_t^c$, where $r_{t,t+m}^c$ is the currency excess return over the m-month horizon. $\hat{\beta}_t$ is the traditional beta risk. $\widetilde{std}_t^c$ is the idiosyncratic currency volatility, proxied by the residual from the auxiliary regression of the conditional standard deviation orthogonal to $\hat{\beta}_t$. $\widetilde{cos}_t^c$ is the residual of the conditional currency coskewness orthogonal to $\hat{\beta}_t$ and $\widetilde{std}_t^c$. $\widetilde{skew}_t^c$ is the idiosyncratic currency skewness, which is the residual of the conditional currency skewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$ and $\widetilde{cos}_t^c$. $\widetilde{cok}_t^c$ is the conditional currency coskewness orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, $\widetilde{cos}_t^c$ and $\widetilde{skew}_t^c$. $\widetilde{kurt}_t^c$ is the idiosyncratic currency kurtosis, which is the residual of the conditional currency kurtosis orthogonal to $\hat{\beta}_t$, $\widetilde{std}_t^c$, $\widetilde{cos}_t^c$, $\widetilde{skew}_t^c$, and $\widetilde{cok}_t^c$.

Finally, we check the robustness of the main results using an intuitive method following Baur and McDermott (2010). We estimate the model in Eq. (14) jointly using the maximum likelihood method for the return of the JPY, CNY, and CNH, as shown in Table 10. c_1, c_2, and c_3 are coefficients of dummy variables associated with extreme shocks in the stock market. If c_1, c_2, or c_3 is significantly different from zero, there is evidence of a nonlinear relationship between the currency and the stock market. If the parameters are non-positive (including c_0), the currency acts as a weak safe haven. If the parameters are negative and significantly different from zero, the currency under investigation functions as a strong safe haven.

The results in Table 10 show that in some cases, c_1, c_2, or c_3 is significant for the JPY, CNY, or CNH, suggesting that there is a nonlinear relationship between currency return and world stock market index return, which gives us another reason to measure the relationship of the currency and stock market premiums using the regime-switching model. Specifically, c_0 for the JPY is not significant, suggesting that the JPY is at least a weak hedge against an extreme shock in the world stock market. Though c_2 for the JPY is significantly positive, c_1 and c_3 for the JPY are significantly negative, and the sum of c_1, c_2, and c_3 is jointly below zero, suggesting that the JPY is a good hedge against an extreme shock in the world stock market. In contrast, neither the CNY nor the CNH is an ideal safe haven because c_0 and c_1 are significantly positive for the CNY and the CNH. However, the RMB has a minor hedge capacity against an extreme shock in the world stock market because c_2 for the CNY and CNH is significantly negative. The implications of the results estimated using the intuitive model are consistent with those of the main resultsobtained using the regime-switching approach..

Table 10

Nonlinear Response of Currencies to Shocks in the World Stock Market

Currency	a	c_0	c_1	c_2	c_3
JPY	-0.043	-0.059	-0.299[*]	0.366[**]	-0.349[**]
	(-0.179)	(-0.887)	(-1.764)	(2.008)	(-2.248)
CNY	0.030[***]	0.027[***]	0.147[***]	-0.185[***]	0.003
	(51.968)	(49.794)	(3.489)	(-3.787)	(0.073)
CNH	0.116	0.088[**]	0.190[**]	-0.247[***]	0.097
	(1.111)	(2.179)	(2.372)	(-3.497)	(1.368)

Note: The table presents the results of the following regressions: $c_t = a + b_t s_t + e_t$, $b_t = c_0 + c_1 D(s_t q_{10}) + c_2 D(s_t q_5) + c_3 D(s_t q_1)$, and $h_t = \pi + \alpha e_{t-1}^2 + \beta h_{t-1}$, where c_t and s_t are the currency return and stock return, respectively. The dummy variables denoted as $D(\cdots)$ capture extreme stock market movements and are equal to one if the stock market exceeds a certain threshold given by the 10%, 5%, and 1% quantiles of the return distribution. b_t captures the nonlinear response of the currency return to the return of the world stock market index.

We further calculate and display the overall nonlinear response for each currency to the world stock market index according to Eq. (14) using the parameters estimated above, as shown in Figure 7. b_t for the JPY is below zero during the 2008 financial crisis, indicating that the JPY is an ideal and robust hedge against extreme shocks.

In contrast, b_t for the CNY and CNH is mainly above zero, which indicates that the RMB is not a hedge against an extreme shock. Although b_t for the CNY becomes slightly negative in some periods, the magnitudes are quite small and much lower than those for the JPY. The above results estimated using the intuitive model are consistent with the main results.

Figure 7 Time-Varying Nonlinear Response of JPY, CNY, and CNH to Extreme World Stock Market Shocks
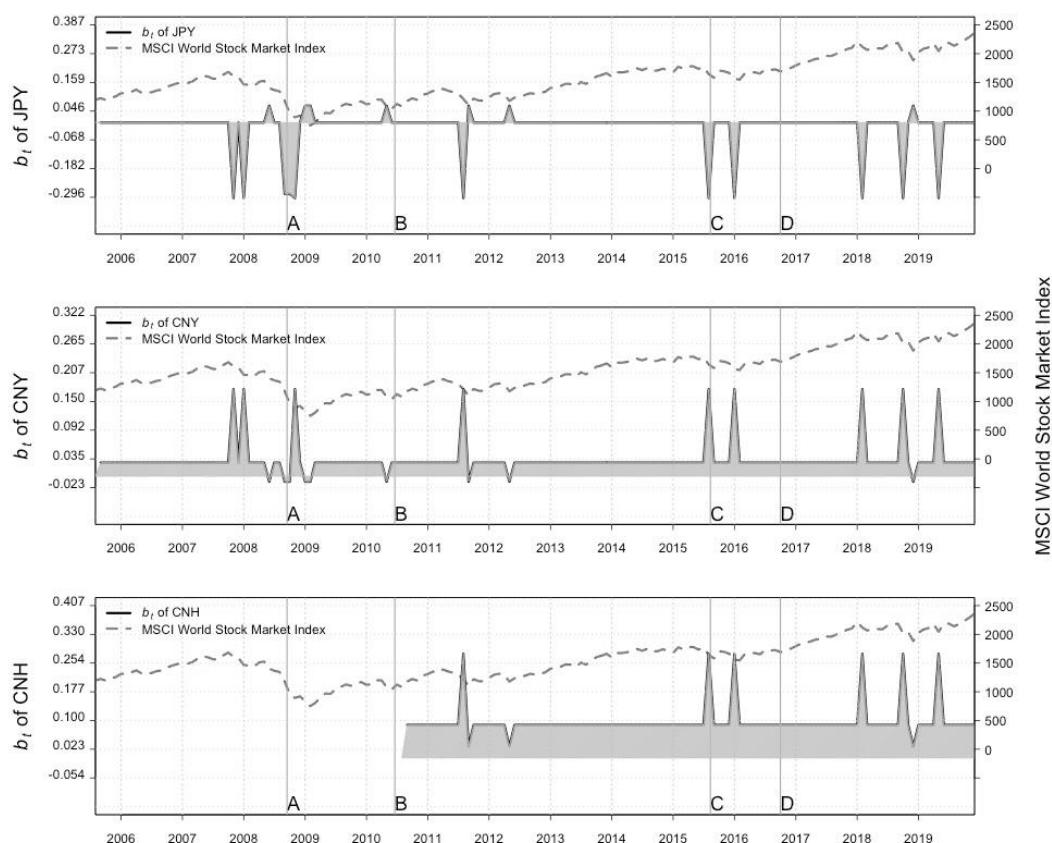
Note: The figure displays the evolution of b_t, which is estimated using Eq. (14), as well as the world stock market index for reference. The world stock market index is labelled on the right vertical axis, and b_t is labelled on the left vertical axis. b_t captures the nonlinear response of the currency return to the return of the world stock market index. The horizontal line marks the position of the zero axes. The shadow between the dashed line and the horizontal line clarifies whether b_t is above or below zero. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

6. Concluding Remarks

This study examines whether the RMB is a safe-haven currency in terms of currency coskewness and cokurtosis with the global stock market. Currency coskewness and cokurtosis directly address the essential characteristic of a safe-haven currency since they refer to the performance of a currency (as measured by currency excess return) during times of financial stress (as measured by global equity volatility and skewness).

We find that onshore RMB (CNY) has positive coskewness with the global stock market in some periods, while offshore RMB (CNH) has positive coskewness with the emerging stock market. The patterns imply that the CNY can only hedge against stock market volatility to some

extent, while the CNH can hedge against volatility in the emerging stock market. In contrast, the JPY has positive coskewness in all periods and is a better hedge in a volatile market, as it appreciates when equity volatility increases. Moreover, both onshore and offshore RMB cokurtosis with the equity market are positive and thus cannot hedge against a stock market crash. In contrast, JPY cokurtosis is negative, suggesting even higher hedging effectiveness during extreme stock market downturns.

We also document that RMB coskewness with stock markets is not priced in the RMB future excess return, while the JPY counterpart is priced, which suggests that prudent equity investors use the JPY rather than the RMB to hedge against global stock market volatility. Moreover, cokurtosis for neither the JPY nor the RMB is priced, implying that temperate investors use neither the RMB nor the JPY to hedge against global stock market crashes. Although the RMB has some characteristics as a safe-haven currency, it is not yet a safe-haven currency in the full sense.

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Appendix

Figure A Conditional Currency Betas with Stock Markets
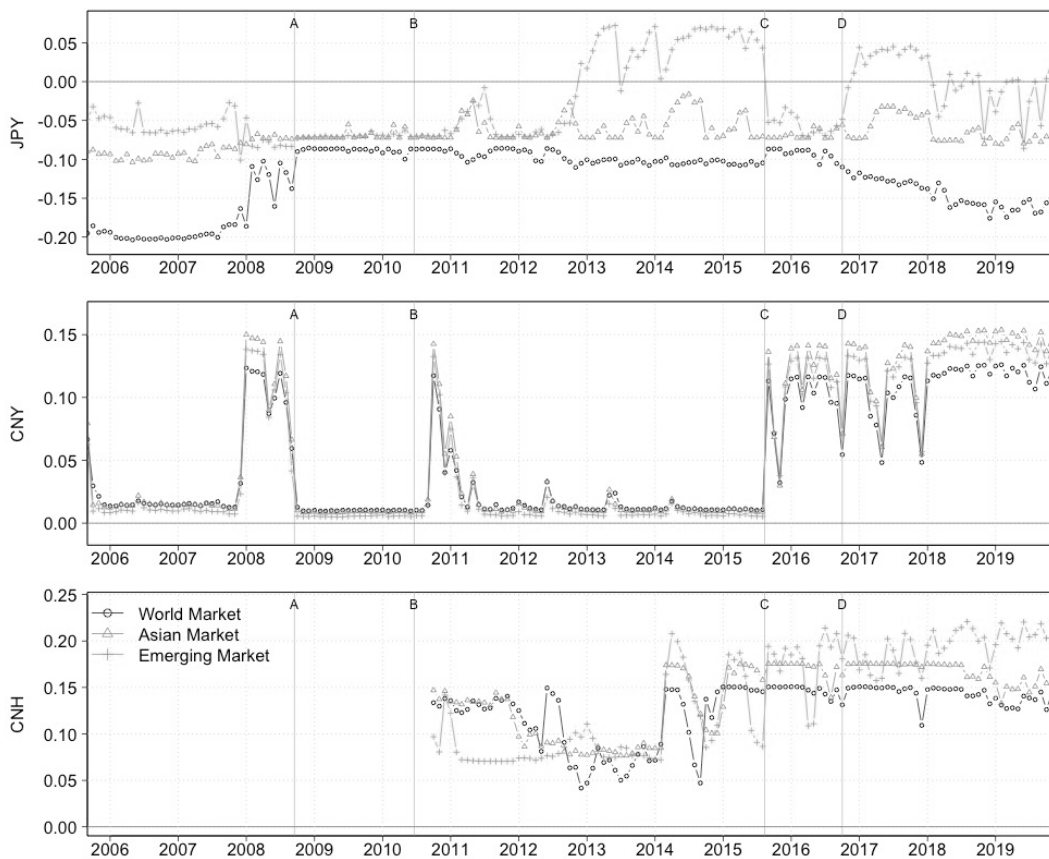
Note: The horizontal line marks the position of the zero axes. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

Figure B Conditional Currency Coskewness with Stock Markets
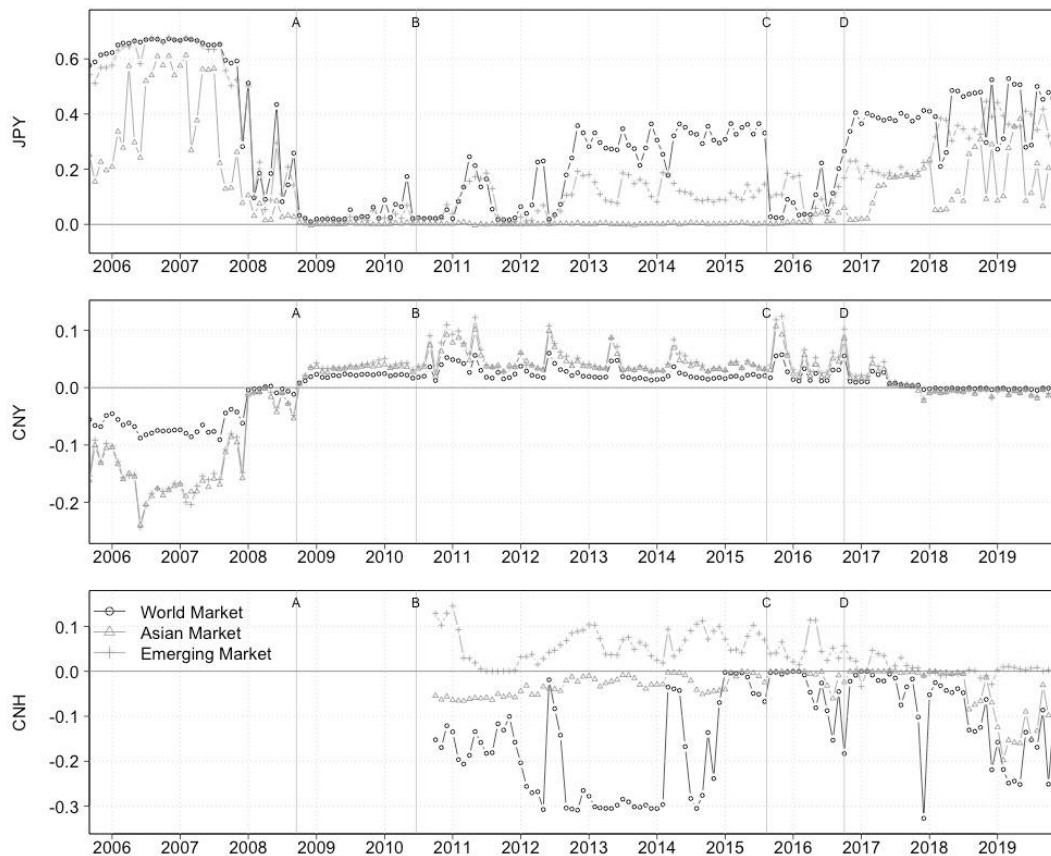
Note: The horizontal line marks the position of the zero axes. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

Figure C Conditional Currency Cokurtosis with Stock Markets
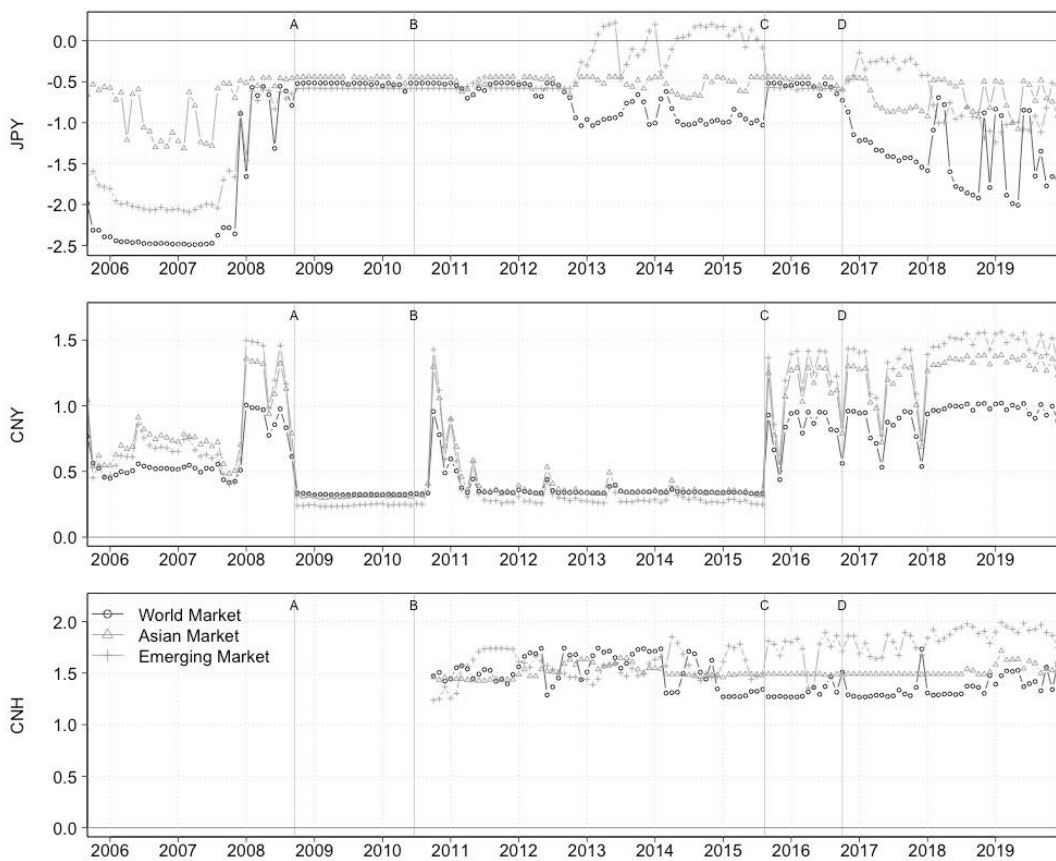
Note: The horizontal line marks the position of the zero axes. Several relative events are annotated on the tick marks and labelled accordingly. Label A represents the date when Lehman Brothers went into bankruptcy in September 2008. Label B represents the date when the Chinese central bank restarted the market reform of the RMB exchange rate in June 2010. Label C represents the date when the Chinese central bank modified the RMB central parity quotation mechanism in August 2015. Label D represents the date when the IMF included the RMB in the SDR basket in October 2016.

Volatility Information Difference between CDS, Options, and the Cross Section of Options Returns*

By GUO BIAO, SHI YUKUN AND XU YAOFEI *

Abstract: *We examine the difference in the information content in credit and options markets by extracting volatilities from corporate credit default swaps (CDSs) and equity options. The standardized difference in volatility, quantified as the volatility spread, is positively related to future option returns. We rank firms based on the volatility spread and analyze the returns for straddle portfolios buying both a put and a call option for the underlying firm with the same strike price and expiration date. A zero-cost trading strategy that is long (short) in the portfolio with the largest (smallest) spread generates a significant average monthly return, even after controlling for individual stock characteristics, traditional risk factors, and moderate transaction costs.*

Keywords: implied volatility; CDS; equity returns; equity option

1. Introduction

A credit default swap (CDS) is a contract in which the buyer, who wishes to protect themselves against the risk of default, makes a series of payments, often referred to as CDS spreads, to the protection seller and, in exchange, receives a payoff if a default event occurs. A put option is an option contract giving the buyer the right to sell a specified amount of an underlying security at a strike price within a specified time, if the underlying price decreases enough below the strike. Corporate CDSs and deep out-of-the-money equity put options are related because they both protect investors against downside risk. Numerous studies examine the information contents between these two markets. For example, Cao, Yu, and Zhong (2010) find that put option implied volatility is a determinant of CDS spreads. Carr and Wu (2007, 2010a) propose a joint valuation framework to estimate option prices and CDS spreads based on their covariation. Carr and Wu (2010b) further develop a method to infer the value of a unit recovery claim (URC) from put and CDS spreads and find that the two markets show strong co-movements with similar URC magnitudes. Nevertheless, many studies find that the two assets are not mutually replaceable because both reflect information and mitigate risks which are not being fully captured by the other. Guo (2016) links the two markets by extracting volatilities from their prices and provides evidence that the CDS implied volatility (CIV) and option implied volatility (OIV) are complementary. Kelly, Manzo and Palhares (2017) argue that CIV differs from OIV because the strike price of a CDS lies at a firm's default boundary, which is far deeper out-of-the-money than a firm's equity puts and thus, CIV and OIV reflect different regions of the risk-neutral asset distribution.Thus, the differences in the information content between CDS and option markets could be a new source of information for option pricing.

In particular, volatility is one of the most important determinants of option pricing. It is commonly exemplified in the literature that volatility is mispriced, especially for individual options. For example, Goyal and Saretto (2009) investigate the stock option returns by sorting stocks on the difference between historical realized volatility and at-the-money implied volatility.

The future volatility of a firm is expected to be close to its long-run historical volatility, considering the mean-reversion feature of volatility, and thus, large difference between realized volatility and implied volatility suggests that an option is mispriced. Previous studies have found that CIV and OIV are related, but different. Specifically, Guo (2016) shows evidence that CIV is a more efficient future realized volatility predictor than OIV. Therefore, we argue that a large deviation of OIV from CIV is indicative of option mispricing, from a cross market perspective.

Motivated by these arguments, in this study, we examine how volatility information differences between CDS and option markets relate to option pricing. In particular, we provide evidence that the normalized spread between the CIV and OIV can forecast the option straddle returns in the cross section, even after controlling for various firm characteristics and traditional risk factors. A straddle is an options strategy that involves buying both a put and a call option for the underlying security with the same strike price and the same expiration date. A trader profits from a long straddle when the underlying asset's volatility rises, regardless of the price of the underlying asset. Therefore, a straddle is an ideal speculation strategy to use to study volatility mispricing. Following Goyal and Saretto (2009), we choose to study the option straddle returns since we are interested in the implications of the relative volatility difference implied from credit and option market prices on subsequent option volatilities.

To measure the spread, we use the weekly five-year CDS contract with modified restructuring (MR) and select the deeply out-of-the-money put with i) absolute delta less than 15%, ii) with the longest maturity and iii) with the highest trading volume. This match procedure alleviates the concern of liquidity risk. We then estimate the implied volatilities for CIV following Kelly, Manzo and Palhares (2017) and for OIV. Finally, we normalize the volatility difference between CIV and OIV, named the Z-score. We sort stock straddle options into 5 quintiles of equal-weighted portfolios and construct a zero-cost trading strategy that is long (short) in the portfolio with the largest (smallest) Z-score of firms. The strategy generates a significant average raw monthly return of 6.96% with a t-statistic of 2.89. Another zero-cost strategy that is long (short) in the portfolio with a positive (negative) Z-score produces a raw monthly return of 4.75% with a t-statistic of 2.90.

These findings hold when we estimate alternative definitions of the CIV and OIV by using the Nelson-Siegel model, thus alleviating the concern that our results are driven by the chosen CDS and option maturities. We run a panel regression of straddle returns on Z-score controlling for usual stock risk characteristics, such as credit rating, size, book-to-market ratio, momentum, etc. Furthermore, we identify that skewness and kurtosis have predictive power for the straddle return, but with a small magnitude, and the Z-score is robustly significant in all regressions. Double sorts on Z-score and firm characteristics further confirm our findings that the abnormal returns cannot be fully explained by stock characteristics. We compute the alphas of the long-short straddle portfolios using the Fama-French three-factor model, the Carhart four-factor model, and the excess return of the zero-beta at-the-money (ATM) S&P 500 index systematic straddle factor by Coval and Shumway (2001). The alphas are all significant and slightly larger than the raw returns. The only significant coefficient is that of the market factor.

Previous literature identifies a huge impact of transaction costs on the profitability of option trading strategies (De Fontnouvelle et al, 2003; Mayhew, 2002; Goyal and Saretto, 2009). Due to the market friction, some trading strategies seems profitable, but others do not. To test the impact of market friction, we investigate whether the abnormal returns still exist by adding effective-to-quoted spread ratios to our straddle strategy. De Fontnouvelle, Fisher, and Harris (2003) and Mayhew (2002) report that the effective-to-quoted spread ratio is lower than 50%. In this study, we find that both the raw returns and the alphas become weaker with larger effective-to-quoted spread ratios. Nevertheless, they are still significant when the ratio is at 25% or less. In addition,

returns are more significant for less liquid options.

We discuss two possible explanations for the outstanding performance observed based on the Z-score. First, the pair of CIV and OIV values exhibits strong mean-reversion characteristics. A low (high) Z-score is related to a subsequent decrease (increase) of OIV. Therefore, a strategy that is long (short) in the straddle portfolio with the largest (smallest) score could generate a significant average return. We find CIV and OIV are co-integrated for 390 companies (88.84%) in our sample. This relationship suggests a temporal deviation and a relatively mispriced option volatility tends to reverse. On average, the half-life of the decay is equal to 1.2 months, which measures the expected time it takes for the CIV-OIV spread to revert to half of its initial deviation from the mean. Second, the spread constitutes a term premium component that can be predicted using five-year CDS and short-term (near one month) option, as we evidence in the main analysis. This result is similar to that of Han, Subrahmanyam, and Zhou (2017) who find that the slope of the CDS term structure (five-year minus one-year CDS spread) predicts future stock returns. Similarly, Vasquez (2017) shows that the slope of the implied volatility term structure (six-month minus five-week volatility on average) is related to future option returns. Nonetheless, we are unable to solve the term mismatch between CDSs and options, as the shortest CDS in our sample has a constant one-year maturity. Our conclusion is further supported by the robustness tests whereby the Nelsen-Siegel model with variable maturities is fitted and all the tests are re-run. The results indicate that the term premium is unlikely to be a major interpretation of the predictability.

Overall, our article is one of the first to document that the volatility spread between CDSs and options has a strong, significant relationship with subsequent option straddle returns. Previous studies on the option return predictability focus on option and stock markets. For example, Cao and Han (2013) find that idiosyncratic volatility is a determinant of delta-hedged option returns. Bali and Murray (2013) examine the role of risk-neutral skewness on the cross section of option portfolio returns and Goyal and Saretto (2009) show that the difference between stock realized volatility and at-the-money option implied volatility predicts option returns. Gang, Zhao and Ma (2019) investigates the predictive power of the put-call ratios (PCRs) on the China's 50ETF return. Our paper contributes to the literature by extending the work of these authors to the credit market.

The rest of this study is structured as follows. Section 2 introduces the methodology to extract CIV and the Nelsen-Siegel model. Section 3 explains the CDS and option data. Section 4 presents the empirical results and section 5 concludes.

2. Methodology

In this section, we present the methodology to extract the CIV from CDS spreads. We also introduce the Nelsen-Siegel model which is subsequently used for robustness tests.

2.1 CDS implied volatility

We follow the method of Kelly, Manzo and Palhares (2016) to calculate the CIV. Thereby, the risk premium in a firm's debt is approximated by its CDS spread and this   can be combined with Merton's (1974) model to invert the formula to obtain the CIV, notated by σ_A.

$$s(\sigma_A, L, T-t, r) = -\frac{1}{T-t}\ln\left(N(d_2) + \frac{N(-d_1)}{L}\right) \tag{1}$$

$$d_1 = \frac{-\ln(L)}{\sigma_A\sqrt{T-t}} + \frac{1}{2}\sigma_A\sqrt{T-t}, d_2 = d_1 - \sigma_A\sqrt{T-t} \tag{2}$$

In the above two formulas, s is a firm's CDS spread, L is the leverage (i.e. a firm's debt divided by its total asset, where debt is the sum of long and short maturity debts), T-t is the time to expiration of the CDS, and N(*) is the cumulative density function of standard normal distribution.

2.2 The extension of the Nelson-Siegel model based on implied volatility term structure

The Nelson-Siegel model proposes an excellent parametric method for modeling interest rate

term structure (Nelson, 1987). Furthermore, Stein (1989) and Park (2011) propose a two-factor volatility term structure model based on the Nelson-Siegel model. Nevertheless, their model fails to explain the hump-shape which can be observed in the implied volatility term structure. Guo, Han and Zhao (2014) propose a three-factor parametric volatility term structure model to account for the features observed in reality. Specifically, their model contains two mean-reversion processes for both the instantaneous implied volatility and mid-term implied volatility. In this model, the instantaneous implied volatility (σ_t) is assumed to have a mean-reverting feature with respect to the mid-term implied volatility ($\bar{\sigma}_t$), while the mid-term implied volatility is mean reverting with respect to the long-term implied volatility ($\bar{\bar{\sigma}}_t$). This can be captured in formulas as follows:

$$\mathrm{d}\sigma_t = -\alpha(\sigma_t - \bar{\sigma}_t)\,dt + \beta\sigma_t\varepsilon\sqrt{dt} \tag{3}$$

$$\mathrm{d}\bar{\sigma}_t = -\kappa(\bar{\sigma}_t - \bar{\bar{\sigma}}_t)\,dt + \xi\bar{\sigma}_t\varepsilon\sqrt{dt} \tag{4}$$

Here, the parameters α and κ control the mean-reverting speed and β and ξ are for volatility diffusion magnitude. Under the model setting of (3) and (4), the expected value of instantaneous volatility at t+j, conditional on information at time t, can be obtained as $\rho = \mathrm{e}^{-\alpha}$ and $\tau = e^{-k}$. Furthermore,

$$E_t(\sigma_{t+j}) = \mathrm{E}(\bar{\sigma}_{t+j}) + \rho^j[\sigma_t + E(\bar{\sigma}_{t+j})] \tag{5}$$

$$E_t(\bar{\sigma}_{t+j}) = \bar{\bar{\sigma}}_t + \tau^j(\bar{\sigma}_t - \bar{\bar{\sigma}}_t) \tag{6}$$

After integrating the instantaneous implied volatility from t to T, the implied volatility between t and T can be obtained as $IV_t(T)$:

$$IV_t(T) = \frac{1}{T}\int_{j=0}^{T}[\bar{\bar{\sigma}}_t + \rho^j(\bar{\sigma}_t - \bar{\bar{\sigma}}_t) + \rho^j\sigma_t - \tau^j(\bar{\sigma}_t - \bar{\bar{\sigma}}_t) - \bar{\bar{\sigma}}_t]dj$$

$$= \bar{\bar{\sigma}}_t + \frac{\rho^T - 1}{T\ln\rho}[\sigma_t - \bar{\bar{\sigma}}_t] - \rho^T(\bar{\sigma}_t - \bar{\bar{\sigma}}_t) \tag{7}$$

In order to simplify the model and avoid overfitting of volatility term structure, $\rho = \mathrm{e}^{-\alpha}$ is used in equation 7:

$$IV_t(T) = \beta_{0t} + \beta_{1t}\frac{1-e^{-\alpha\tau}}{\alpha\tau} + \beta_{2t}(\frac{1-e^{-\alpha\tau}}{\alpha T} - e^{-\alpha T}) \tag{8}$$

According to Diebold and Li (2006), we can rewrite equation 8 in a form similar to the Nelson-Siegel model for implied volatility term structure:

$$IV_t(T) = \beta_{0t} + \beta_{1t}\frac{1-e^{-\lambda\tau}}{\lambda\tau} + \beta_{2t}(\frac{1-e^{-\lambda\tau}}{\lambda\tau} - e^{-\lambda T}) \tag{9}$$

Here, β_0, β_1 and β_2 represent long-, short- and medium-term volatility, respectively. We then use this extension of the Nelson and Siegel model for CIV term structure. Finally, we run robust tests with the fitted parameters.

3. Data

The dataset is comprised of weekly CDS data on 439 US companies from WRDS-Markit between Jan 2002 to Dec 2014. We apply several criteria to select CDS contracts for inclusion in the investigation. Firstly, the selected companies need to have more than one-year of CDS data observations. Thus, companies issuing CDSs on an infrequent basis are excluded. Secondly, the selected CDSs need to have modified restructuring (MR). This criterion is used to eliminate the influence of the recovery rate on CDS valuation. Then, we match the CDS reference list to download the US-firm individual option data from OptionMetrics in WRDS, which includes all the Greeks, trading volumes, bid price, ask price, implied volatility, etc. Since our purpose is to investigate the information with respect to downside risk, we select deeply out-of-the-money put options with a positive bid and ask price, trading volume, open interest and implied volatility, and

with an absolute delta less than 15%

[1]. After the above filtering, there are still cases where several put options exist for one specific date for the same company. To alleviate the concern of a liquidity premium and maturity mismatch against CDSs, we choose the puts with the longest maturity and the highest open interest.

Our data contains CDSs with 1-year, 2-year, 3-year, 5-year, 7-year and 10-year maturities. We use 5-year CDSs for our main analysis as they are the most actively traded, and CDSs with other maturities for robustness tests. In order to obtain a stable holding period for portfolios, we choose the option contracts which have a maturity close to one month and which are close to being at-the-money (ATM). In general, the selected call option has a moneyness ranging from 0.975 to 1.025. The corresponding put option is selected with the same strike and maturity time as those of the call option. After the expiration of the first option contracts, option contracts for the following month are selected with the same criteria.

Panel A of Table 1 lists the summary statistics for CIV, OIV and Z-score. During the 13-year period, the average CIV and OIV are 43.9% and 37.5%, respectively. The CIV has a lower standard deviation (14.4%) than that of the OIV (17.7%). Moreover, the correlation between the CIV and OIV is 35.9%, on average. In total, the dataset comprises 439 firms with 667 weeks of observations.

Table 1 Summary Statistics of data and option portfolios sorted by Z-score

Panel A presents the summary statistics about mean, standard deviation, 10% percentile, 90% percentile, maximum and minimum of CIV, OIV, option maturity, equity, debt, risk free rate, CDS spread(s), correlation coefficients, and option delta. Sample contains 439 companies from Jan 2002 to Dec 2014. Panel B reports the statistics of sorted option portfolios. Portfolios 1 to 5 are obtained by sorting Z-score from bottom to top and equal-weighted. Portfolios N and P are obtained by sorting by the sign of Z-score. Δ, Γ and Υ is the delta, gamma and vega, respectively. The sample includes 439 companies and 168646 pairs of call and put. Period begins with 2002 to 2014.

Panel A: Data summary

Variables	Mean	S.D.	Min	0.25	Median	0.75	Max	Total
# of Firms								439
# of Weeks								667
# of Observations	384.68	206.17	52	192	399	589	667	
Maturity(day)	308.46	261.32	2	80	206	535	969	
E(Millions)	27527.31	47261.01	62.46	4931.34	12152.99	27317.19	525785.64	
D(Millions)	14338.08	63195.21	0.21	1451.90	3532.00	8224.00	916322.00	
r(%)	1.71	1.77	0.09	0.19	1.06	3.16	5.30	
s(%)	1.52	2.41	0.02	0.39	0.75	1.67	139.39	
CIV(%)	43.90	14.42	5.17	35.29	42.83	50.58	295.90	
OIV(%)	37.54	17.70	3.10	25.94	33.35	43.92	240.14	
cor(s,CIV)	47.78	37.70	-54.49	22.60	54.69	79.80	99.76	
cor(CIV,OIV)	25.91	38.02	-87.49	3.07	31.54	52.87	93.60	
Put's delta	-0.10	0.04	-0.15	-0.13	-0.10	-0.07	0.00	

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[1]Note that option returns are computed only for those which are close to being at-the-money (ATM). We use deeply out-of-the-money put options only to compute the Z-score.

Panel B: Option portfolios

	1	2	3	4	5	P	N
Z-score	-1.051	-0.338	0.019	0.373	0.952	0.646	-0.667
CIV	0.396	0.402	0.417	0.436	0.479	0.45	0.398
OIV	0.455	0.386	0.357	0.343	0.328	0.342	0.413
d.civ	-0.004	-0.002	0	0.001	0.003	0.002	-0.002
d.oiv	0.033	0.002	-0.006	-0.012	-0.021	-0.015	0.014
Δ	0.506	0.504	0.504	0.505	0.506	0.506	0.505
Γ	0.131	0.125	0.122	0.118	0.117	0.12	0.128
Υ	5.143	5.598	5.976	6.396	6.59	6.347	5.369

4. Empirical results

The mean-reverting feature in volatility modelling is widely acknowledged, both in academic and in industry. Individual stock volatility has an average autocorrelation near 0.7 and the future implied volatility fluctuates around the level of the historical volatility (Goyl and Saretto, 2009). This mean-reverting feature also exists between the CIV and OIV (Guo, 2016), which are co-integrated for 390 companies (88.84%) in our sample. That is, the short-maturity option implied volatility is likely to move closer to the long-maturity CDS implied volatility. The co-integrated relationship between the CIV and OIV indicates a large deviation will not last long and, if an option is mispriced, the straddle is relatively undervalued when the OIV is lower than the CIV, and vice versa[2].

4.1 Option Portfolio Formation

The Z-score is calculated following Guo (2016) and Balvers, Wu and Gilliland (2000). On each date t_0, we firstly calculate the series of $\varepsilon_{i,t}$ as $CIV_{i,t} = \beta_i * OIV_{i,t} + \varepsilon_{i,t}, i = [1,2,...N]$ for each CDS, i. Then, the standard deviation, σ_i, and average mean, μ_i, of $\varepsilon_{i,t}$ are calculated up to t_0. Finally, we estimate the Z-score as $\frac{\varepsilon_{i,t} - \mu_i}{\sigma_i}$.

We calculate the straddle returns for each firm and construct two types of equal-weighted option portfolios by sorting the Z-scores of the firms. We group equity options into five portfolios, from bottom to top, based on the value of the Z-score. The bottom (1st) option portfolio has the lowest average Z-score, while the top (5th) option portfolio has the highest Z-score. Hence, if volatility mispricing exists and implied volatility follows a mean-reverting process around the CIV, the bottom straddle option portfolio will be underpriced, while the top straddle option portfolio will be overpriced. We also separate option portfolios into two parts, based on the negative and positive Z-score. On average, 88 companies with 90 monthly observations are in each quintile of option portfolios, while the positive/negative (P/N) option portfolio has on average of 220 companies with 90 monthly observations.

Panel B of Table 1 presents the summary statistics of equal-weighted option portfolios. The patterns of OIV and CIV in the quintile portfolios are different. The OIV decreases from 0.455 (bottom portfolio) to 0.328 (top portfolio). The opposite pattern exists for CIV, whereby it

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[2]On average, the half-life of the decay is equal to 1.2 months, which measures the expected time it takes for the spread to revert to half its initial deviation from the mean. This determines the optimal holding period for a mean-reverting position.

increases from 0.396 (bottom portfolio) to 0.479 (top portfolio). The variation in OIV is higher than that of CIV, as the difference in the CIV of the top and bottom portfolios is 0.083, while it is 0.127 for the OIV. The Greeks for the selected ATM options are delta, gamma and vega. The delta of the call is invariant among the different quintiles and for P/N portfolios. Gamma decreases from the bottom to top quintiles with values ranging from 0.131 to 0.117, while vega increases from bottom to top, with values ranging from 5.143 to 6.590.

4.2 Option portfolio returns

Since our interest in this paper is to examine the subsequent straddle returns based only on volatility characteristics, in this section, we test the performance of our portfolios sorted by the Z-scores as described in the previous section. Specifically, we hold the grouped portfolios for one month and estimate each group's out-of-sample returns as well as the long-short neutral portfolio returns.

We select the Wednesday data due to its high liquidity among the weekdays. On each Wednesday, we compute the trading signal (Z-score) and then execute the trading strategies using the closing price on the same day. A straddle return is calculated as the difference between the final payoff and the beginning value. Here, the beginning value is the sum of the average of bid and ask quote prices for call and put options and the final payoff is max(S-K, K-S). We then compute portfolio returns for each equal weighted quintile or P/N portfolio.

Table 2 reports the option portfolio returns sorted by Z-score, including the five quintile portfolios and the P/N portfolios. The 5-1 portfolio is constructed by going long on the 5th quintile portfolio and short selling the 1st quintile portfolio. The P/N portfolio is a combination of a long portfolio with positive Z-score and a short selling portfolio with negative Z-score. Both the five quintile and P/N portfolios show insignificant returns. Nevertheless, the straddle return increases from -2.25% to 4.54%, spanning from the bottom to top portfolios. The positive straddle portfolio earns a higher return than the negative straddle portfolio at 1.82%, as opposed to the -2.93% for the negative portfolio. The long-short portfolios show significant and positive returns: the 5-1 straddle has a monthly return of 6.96% with a Newey-West adjusted t-statistic of 2.8864. The P-N straddle (positive minus negative portfolio) has a monthly return of 4.75% with an adjusted t-statistic of 2.8979. Both are significant at the 1% significance level.

Table 2 Returns of option portfolios sorted by Z-score

Option price is calculated as the average of closing bid and closing ask price. The terminal payoff of call option is max(S_T-K, 0) while that of put option is max(K-S_T, 0). K is the strike price and S_T is the stock price at maturity time. The Straddle portfolios are equal-weighted. T-statistics is corrected by the Newey and West (1987). The sample includes 439 companies and 168646 pairs of call and put. Period begins with 2002 to 2014.

	Straddle Returns								
	1(low)	2	3	4	5(high)	P	N	5-1	P - N
mean	-0.0225	-0.0212	-0.0327	0.0029	0.0454	0.0182	-0.0293	0.0696***	0.0475***
t-value	-0.9840	-0.8109	-1.2636	0.1093	1.4066	0.6902	-1.1875	2.8864	2.8979
p-value	0.3255	0.4177	0.2068	0.9130	0.1600	0.4903	0.2355	0.0040	0.0039

4.3 Controlling for risk and stock characteristics

In this section, we analyze the contribution of option portfolio returns. We follow the method in Goyal and Saretto (2009) by running a multi-factor regression with option returns on traditional

stock factors. We investigate whether these traditional stock factors can explain the abnormal return obtained in the last section. Then, we test the option portfolio returns with a double sorting method on Z-score and firm characteristics.

4.3.1 Traditional risk factors

We run a regression of 5-1 and P/N straddle option returns on various risk factors, including the Fama-French three-factor model, the Carhart four-factor model and the excess return of the zero-beta ATM systematic straddle (ZB-STRAD-Rf). We use the excess return of the zero-beta ATM S&P 500 straddle index by Coval and Shumway (2001) to control for the systematic straddle risk. We calculate daily ZB-STRAD-Rf and cumulate it to attain a monthly factor. This can be represented as follows:

$$R_{p,t} = \alpha_p + \beta_p * F_t + \varepsilon_{p,t}$$

(10)

where $R_{p,t}$ is the return of a straddle option portfolio and F are the risk factors. The linear risk-factor model cannot handle and explain all risk premiums in asset pricing (Goyal and Sarreto, 2009). Therefore, this regression is only used to test whether the return of the straddle option portfolio is related to the systematic risk factors.

Table 3 reports the regression results. The loadings on SMB, HML and MoM are all insignificant at the 10% significance level. Moreover, the loading on ZB-STRAD-Rf is also insignificant for all regressions, indicating our straddle option portfolios, sorted by the Z-score, are not related to systematic volatility risk. The market factor is the only significant variable and has negative loadings for both the 5-1 and P/N straddle portfolios, which is evidenced by the beta value shown in Table 1, which decreases from 1.29 to 1.05 from the 1st to the 5th portfolio. A similar observation applies for the P/N straddle option portfolios. The alpha is strongly significant at the 1% confidence level and is between 5.10% to 7.90%, which is even larger than the raw return reported in Table 2, which suggests that traditional stock risk factors do not explain our straddle returns.

Table 3 Risk-adjusted option return

This table presents the regression results of returns the portfolio 5-1 and portfolio P-N: $R_{p,t} = \alpha_p + \beta_p * F_t + \varepsilon_{p,t}$ The risk factors include the Fama and French(1993) three factors (MKT-Rf, SMB, HML), Carhart(1994) momentum factor(MoM), and the Covol and Shumway(2001) excess zero-beta S&P 500 straddle factor (ZB-STRAD-Rf). The first row is for the regression coefficients and the second row is the corresponding t-statistics corrected by the Newey and West(1987).

	Straddles			
	5-1		P-N	
	(1)	(2)	(3)	(4)
Alpha	0.079***	0.076***	0.052***	0.051***
	3.210	3.082	3.424	3.130
MKT-Rf	-1.461***	-1.231**	-0.719	-0.584
	-2.992	-2.226	-1.638	-1.166

SMB		1.361		0.899
		1.593		1.337
HML		-0.346		-0.787
		-0.456		-1.157
MoM		0.550		0.114
		1.292		0.277
ZB-STRAD-Rf	0.031	0.060	0.012	0.028
	0.382	0.821	0.201	0.501
Adj R^2	0.030	0.039	0.011	0.018

4.3.2 Stock characteristics

We run a cross-sectional regression of abnormal return on lagged stock characteristics to examine their relationships. The specific model setting follows that of Brennan, Chordia and Subrahmanyam (1998) and Goyal and Sarreto (2009). Specifically, we define

$$R_{i,t} - \widehat{\beta}_i * F_t = \alpha_{0,t} + \gamma_{1,t} * Z_{i,t-1} + \epsilon_{i,t} \tag{11}$$

where $R_{i,t}$ is the return of the individual straddle option and Z represents the stock characteristics. The $\widehat{\beta}_i$ is obtained by running the multi-factor pricing model with F factors, as described in section 4.3.1. Z factors include the Z-score and stock characteristics.

The panel regression results on monthly observations are presented in Table 4. We cluster standard errors by both company and time and control for the year fixed effects. The stock characteristics include the CDS slope (5-year CDS spread minus 1-year CDS spread), Dummy (Rating over BBB is 1 and others are 0), s.d of civ and s.d of oiv (standard deviation of CIV and OIV in the last month), Beta (beta between the Portfolio 5-1), d(civ) and d(oiv) (changes in the CIV and OIV over last month), Size (log of market capitalization), B/M ratio (Book to market ratio), MoM (the last 6-month cumulative return), Ret(t-1) (the last month stock return), LEV(debt divided by sum of debt and equity), TO (monthly trading volume divided by total common shares outstanding), IVOL(idiosyncratic volatility measured relative to the Fama and French three factor model), Skew(skewness of the last 1 year daily stock log return), and Kurt(kurtosis of the last 1 year daily stock log return), in order to control for the spread term premium in Han, Subrahmanyam, and Zhou (2017), credit rating, systematic risk, momentum, reversal, etc. Among them, the credit rating, size, B/M ratio, MoM, LEV, TO and IVOL show predictive power on straddle returns. Both the skewness and kurtosis also have predictive power on straddle return but with a small magnitude effect. The Z-score continues to be robustly significant for predicting future straddle returns in each regression.

Table 4 Individual option returns controlling for stock characteristics (Cross-sectional regressions)

We estimate the following cross-sectional regression for individual option returns:

$R_{i,t} - \widehat{\beta}_i * F_t = \alpha_{0,t} + \gamma_{1,t} * Z_{i,t-1} + \epsilon_{i,t}$ Where F are the Fama and French (1993) three factors, the Carhart (1994) momentum factor, and the Covol and Shumway (2001) excess zero-beta S&P 500 straddle factor. The characteristics include Z-score, CDS slope (5-year CDS spread minus 1-

year CDS spread), Dummy (Rating over BBB is 1 and others are 0), s.d of civ and s.d of oiv (standard deviation of CIV and OIV in last month), Beta (beta between Portfolio 5-1), d(civ) and d(oiv) (changes in CIV and OIV over last month), Size (log of market capitalization), B/M ratio (Book to market ratio), MoM (last 6-month cumulative return), Ret(t-1) (last month stock return), LEV(debt divided by sum of debt and equity), TO (monthly trading volume divided by total common shares outstanding), IVOL(idiosyncratic volatility measured relative to the Fama and French three factor model), Skew(skewness of last 1 year daily stock log return), and Kurt(kurtosis of last 1 year daily stock log return). The last row shows the adjusted R^2. All regressions include the year fixed effects and cluster the standard errors by firm and month.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Z-score	0.021***	0.019***	0.039***	0.039***	0.052***	0.039***	0.040***	0.040***	0.042***	0.045***	0.051***	0.049***	0.050***	0.049***
	2.798	2.491	4.683	4.613	7.117	4.732	5.062	4.718	4.822	4.918	6.708	6.322	5.891	6.558
CDS slope		0.878												
		0.837												
Dummy			0.042***											
			4.490											
civ				0.021										
				0.524										
oiv					0.115***									
					2.626									
s.d of civ						-0.024								
						-0.116								
s.d of oiv							0.032							
							0.459							
Beta								-0.472				-0.208		
								-0.929				-0.975		
d(civ)									-0.032					
									-0.175					
d(oiv)										0.131			0.099	
										1.449			1.078	
Size, log(VE)											0.015***	0.013***	0.012***	0.015***
											2.841	2.405	2.347	2.797
B/M ratio											0.295***	0.219***	0.219***	0.294***
											6.665	5.297	5.293	6.741
MoM											0.069***	0.065***	0.066***	0.078***
											3.938	3.880	3.960	4.326
Ret(t − 1)											0.082	-0.023	-0.010	0.100*
											1.504	-0.356	-0.161	1.839
LEV											-0.169***	-0.158***	-0.156***	-0.161***
											-3.870	-3.863	-3.825	-3.826
TO											0.410***	0.459***	0.457***	0.426***
											9.314	10.215	10.208	9.737
IVOL											-0.760***	-0.785***	-0.792***	-0.796***
											-7.321	-7.907	-8.031	-7.533
Skew														-0.034***
														-4.785
Kurt														0.004***
														3.480
Adj R2	0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.026	0.021	0.022	0.028

In order to provide a robust result, we conduct a doubt sort on straddle return with Z-score and stock characteristics. Double sort provides a more robust way than a cross-sectional panel regression, due to lack of imposing linear relationship restriction between return and explanatory variables. We first sort options into quintiles based on stock characteristics and, within each quintile, we sort the options into the 1-5 or P/N quintile based on the Z-score.

Table 5 reports the average monthly return for option portfolios and the respective t-statistics corrected by the Newey and West (1987) method for eight characteristics that are significant in Table 4: Size, B/M, MoM, LEV, TO, IVOL, Skew and Kurt. Conducting the double-sort based on the eight characteristics does not change the return pattern in the quintile straddle portfolios. The 1st quintile portfolio has an average monthly return between -2% and -2.7%, while the 5th quintile portfolio has an average monthly return between 3.5% and 5.4%. Moreover, the 5-1 straddle portfolio has an average return between 5.8% and 7.9% and the P-N straddle portfolio has a mean monthly return between 4.6% and 5%. These straddle return results are similar to the results based on the one-way sort using the Z-score, thus providing further evidence that these stock characteristics cannot explain all of the abnormal straddle return.

Table 5 Option Portfolio returns controlling for stock characteristics (double-sort)

We first sort options into quintiles based on stock characteristics and, within each quintile, we sort the options in the 1-5 or P/N portfolios based on Z-score. This table reports the average monthly return and its t-statistics corrected by the Newey and West (1987).

Quintile Portfolio: Straddle Returns

Control	1	2	3	4	5	P	N	5-1	P-N
size	-0.023	-0.024	-0.021	0.011	0.035	0.022	-0.028	0.059	0.050
	-0.982	-0.896	-0.769	0.363	1.124	0.790	-1.129	2.672	2.999
bm	-0.025	-0.001	-0.024	0.004	0.035	0.024	-0.022	0.060	0.046
	-1.031	-0.020	-0.918	0.147	1.108	0.918	-0.887	2.486	2.598
mom	-0.027	-0.031	-0.018	-0.010	0.037	0.014	-0.032	0.064	0.047
	-1.209	-1.293	-0.680	-0.406	1.203	0.558	-1.364	2.632	2.854
lev	-0.022	-0.014	-0.010	-0.010	0.041	0.021	-0.028	0.063	0.049
	-0.898	-0.541	-0.402	-0.356	1.269	0.781	-1.125	2.620	2.981
to	-0.026	-0.031	-0.017	-0.004	0.054	0.021	-0.027	0.079	0.048
	-1.020	-1.306	-0.657	-0.141	1.631	0.780	-1.088	3.276	2.876
ivol	-0.026	-0.010	-0.020	-0.006	0.039	0.022	-0.028	0.065	0.050
	-1.101	-0.360	-0.754	-0.229	1.192	0.813	-1.138	2.643	3.014
skew	-0.024	-0.016	-0.025	0.002	0.036	0.020	-0.028	0.060	0.048
	-1.017	-0.619	-0.861	0.092	1.115	0.748	-1.125	2.512	2.916

kurt	-0.020	-0.024	-0.014	-0.005	0.038	0.021	-0.028	0.058	0.049
	-0.893	-0.894	-0.520	-0.165	1.192	0.758	-1.138	2.459	2.938

4.4 Robustness tests using the Nelson-Siegel model

In this section, we estimate the CIV and OIV using alternative definitions as per the Nelson-Siegel model. This serves to mitigate concerns that our results are driven by the chosen CDS and option maturities. We apply the Nelson-Siegel model on the CDS and option implied volatility term structures to obtain the parameters and re-run all the tests. Specifically, we use the value for β_0 from equation 9 to replace CIV and OIV, and then calculate a new Z-score and produce the straddle return.

Table 6 reports the summary statistics for the parameters estimated using the Nelson-Siegel model for the CDS implied volatility term structure. To fit the model, we use the 1-, 3-, 5-, 7- and 10-year CDSs for the CDS term structure and the 30-, 60-, 91-, 122-, 152-, 182-, 273-, 365-, 547-, and 730-day maturity options obtained from the volatility surface in OptionMetrics for the option term structure. β_0 for the CIV term structure is slightly higher than that for the OIV term structure but has a lower standard deviation. The average correlation coefficient between them is 0.15, with a standard deviation of 0.366.

Table 6 Summary Statistics for parameters in the Nelsen-Siegel model

	mean	st.d	0.25	0.75	max	min	median	Total
# of company								413
# of week								666
observation.civ	361	209	169	565	666	8	370	
observation.oiv	387	203	199	586.5	666	52	405	
civ.b0	0.356	0.119	0.290	0.404	5.968	0.000	0.345	
civ.b1	0.524	0.299	0.378	0.686	15.040	-4.317	0.537	
civ.b2	-0.132	0.387	-0.199	0.001	5.855	-25.551	-0.005	
oiv.b0	0.313	0.131	0.229	0.364	3.342	-0.031	0.284	
oiv.b1	0.017	0.112	-0.044	0.051	2.900	-1.690	-0.003	
oiv.b2	0.004	0.175	-0.073	0.077	7.215	-5.498	0.000	
cor(civ,oiv).b0	0.150	0.366	-0.098	0.395	0.943	-0.929	0.200	
cor(civ,oiv).b1	-0.041	0.205	-0.171	0.083	0.681	-0.646	-0.034	
cor(civ,oiv).b2	0.038	0.129	-0.028	0.119	0.457	-0.628	0.037	

Figure 1 plots the time series of estimated parameters when values are averaged for the 413 companies in the sample. β_0 for CIV fluctuates more than in the original CIV value. In particular, during the 2008 financial crisis period, both the β_0 for CIV and the OIV term structure increase significantly, with the peak time around the beginning of the year 2009.

Figure1. Time series of parameters fitting by the Nelsen-Siegel model in CIV and OIV term structure.

The first one is for CIV, the second one is for OIV and the last one shows the changes for beta0 of CIV and OIV between 2002 and 2014.
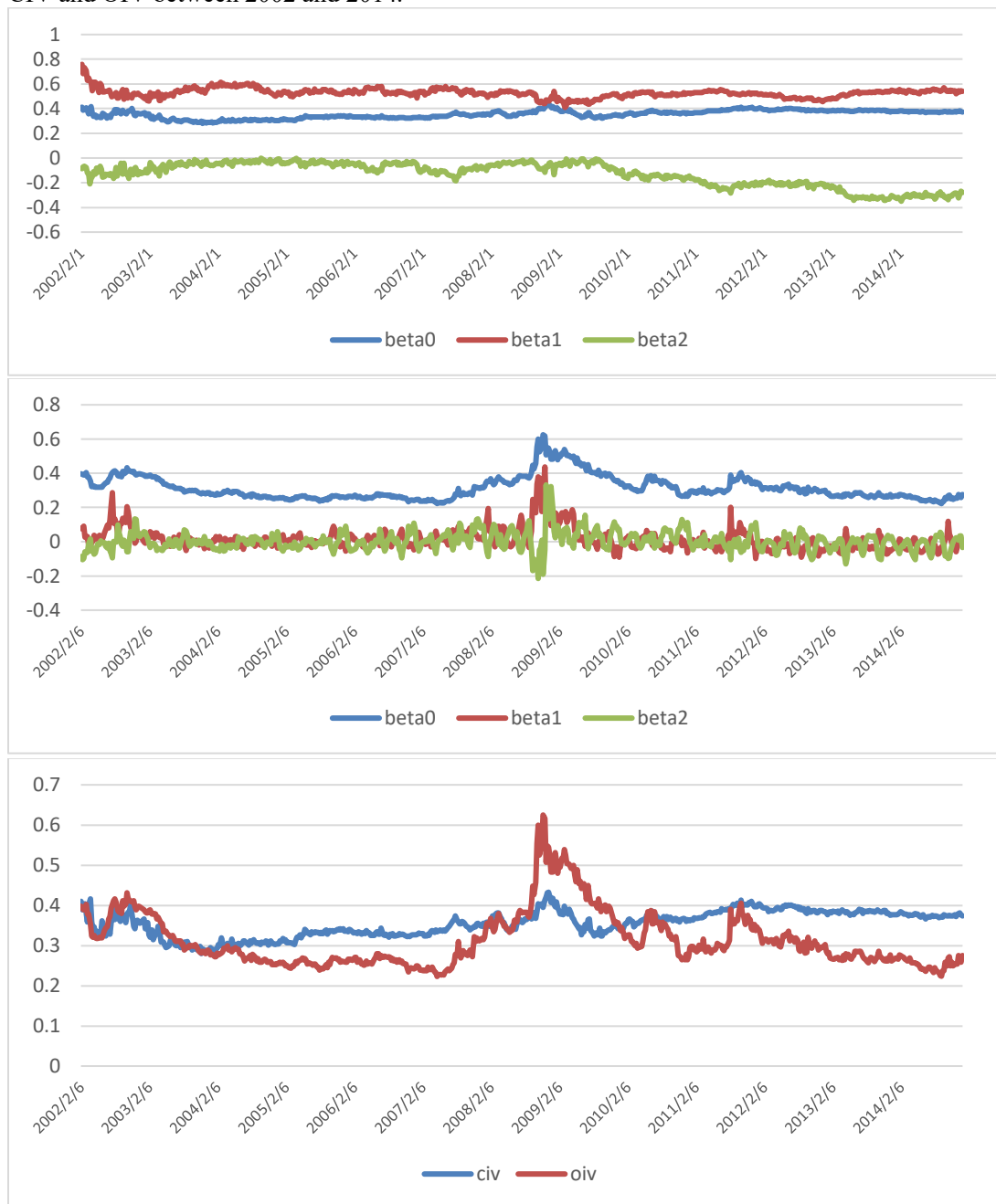

Table 7 presents the returns of the option portfolios constructed using the Z-score based on β_0. The results in Table 7 show a similar pattern as in Table 2. Specifically, the quintile straddle portfolio returns have an increasing pattern from bottom to top, ranging from -6.1% to 1.6% per

month. The 5-1 straddle return is 7.8% per month, and the P/N straddle portfolio return is 6.2%. The performance for the 5-1 or P/N straddle portfolios is somewhat higher than for the previous portfolios, as presented in Table 2.

Table 7 Returns of option portfolios sorted by Z-score (the Nelsen-Siegel model)

All option portfolio construction follows the Table 3. T-statistics is corrected by the Newey and West(1987).

	1(low)	2	3	4	5(high)	P	N	5-1	P - N
								Straddle Returns	
mean	-0.061***	-0.026	-0.034	-0.006	0.016	0.017	-0.044*	0.078**	0.062**
t-value	-2.547	-1.001	-1.210	-0.241	0.587	0.671	-1.739	3.934	4.032
p-value	0.011	0.317	0.227	0.810	0.557	0.503	0.083	0.000	0.000

In summary, our conclusions are further supported by the robustness tests, whereby a Nelsen-Siegel model is fit, with variable maturities, and all tests are re-run. This further indicates that the abnormal straddle returns achieved based on the Z-score are unlikely to be driven by a certain maturity.

4.5 Transaction costs: bid-ask spreads

In the above tests, we take the mid-price as the trading price. However, in reality, an asset can only be bought at the ask price and can only be sold at the bid price. Literature shows evidence that the real bid-ask spread is smaller than the quoted bid-ask spread, but it is still significant (De Fontnouvelle et al, 2003; Mayhew, 2002; Goyal and Saretto, 2009). In this section, we follow the process of Goyal and Saretto (2009) and consider the prices at the 25%, 50%, 75%, 100% range of the quoted bid-ask spread in trading straddles.

We also group option portfolios by liquidity to address concerns about the impact of liquidity risk. In addition, we compute two different measures to access liquidity. The first measure is the average bid-ask spread of all options traded in the previous month for the firm and the second measure is the average daily trading volume of options traded in the previous month for the firm. We first sort options into quintile portfolios based on the Z-scores. Then, in each quintile straddle portfolio, we sort options into two portfolios with low and high liquidity. The returns of the 5-1 and P/N portfolios are subsequently computed for each portfolio.

Table 8 reports the long-short portfolios under different efficient bid-ask spreads. Accounting for transaction costs leads to a deterioration in the performance of the long-short strategy. Without transaction costs, the 5-1 portfolio earns 6.96% monthly raw return. However, this return decreases dramatically to -4.5% per month under the condition of a 100% efficient bid-ask spread. The P/N portfolios exhibit the same effect, whereby raw returns fall from 4.7% per month to -6.5% per month. However, De Fontnouvelle, Fisher, and Harris (2003) and Mayhew (2002) report that the effective-to-quoted spread ratio is lower than 50%. Thus, it is interesting to note that, under the 25% quoted bid-ask spread condition, both the alpha and raw return in the 5-1 or P/N portfolios are positive and significant at the 10% significance level. Raw returns and alphas are 4.2% and 4.8%, respectively, for the 5-1 portfolio and 2% and 2.3%, respectively, for the P/N portfolio.

Option liquidity also influences the performance of the long-short strategy. The low liquidity portfolio performs better than the high liquidity portfolio. For the 5-1 portfolios, the return of the low liquidity portfolio decreases from 10.3% to 0.2%. However, this return is still significant at the 5% significance level under the 50% quoted spread condition, with a monthly return of 5.4%. By contrast, the return of the high liquidity portfolio decreases from 3.8% to -9.6%. For the P/N portfolios, the low liquidity portfolio decreases from 7.5% to -2.3%, but this return is significant at the 1% level based on the 25% quoted spread, with a monthly return of 5.1%. The return of the high liquidity portfolio decreases dramatically from 2.5% to -10.8%. If the other measure of liquidity based on the average trading volume of options is applied, returns exhibit similar patterns.

We conclude that transaction cost dramatically decreases the trading performance of this long-short strategy. Both the raw returns and alphas become weaker as the effective-to-quoted spread ratios become larger. Nevertheless, they are still significant when the ratio is at 25% or less. In addition, returns are more significant for less liquid options.

Table 8 Impact of Liquidity and transaction costs

Option portfolios are sorted into two groups based on option liquidity. Average bid-ask spread means the average bid-ask spread of all the options traded in the last month of a firm; average trading volume means the average of the daily option trading volume of the firm. MidP is the price at the middle of bid and ask; ESPR is the effective spread while QSPR is the quoted spread. The first row is the average return and the second row is its t-statistics.

	5-1					P-N				
			ESPR/QSPR					ESPR/QSPR		
	MidP	25%	50%	75%	100%	MidP	25%	50%	75%	100%
All	0.070***	0.042***	0.012	-0.015	-0.045***	0.047***	0.020*	-0.010	-0.036***	-0.065***
	4.867	2.925	0.798	-1.081	-3.116	4.508	1.888	-0.872	-3.370	-5.960
Alpha	0.076***	0.048***	0.017	-0.010	-0.040***	0.051***	0.023**	-0.007	-0.034***	-0.063***
	5.434	3.420	1.214	-0.720	-2.833	4.834	2.158	-0.654	-3.186	-5.809
					Based on average bid-ask spread of options					
Small	0.038**	0.006	-0.032	-0.059***	-0.096***	0.025*	-0.006	-0.045***	-0.072***	-0.108***
	1.967	0.323	-1.518	-2.948	-4.650	1.724	-0.431	-2.599	-4.493	-6.332
Large	0.103***	0.079***	0.054**	0.029	0.002	0.075***	0.051***	0.027	0.002	-0.023
	4.271	3.280	2.267	1.221	0.103	4.330	2.957	1.567	0.146	-1.355
					Based on average trading volume of options					
Low	0.094***	0.061***	0.024	-0.004	-0.041*	0.067***	0.035**	0.000	-0.028*	-0.061***
	3.859	2.551	0.979	-0.178	-1.684	4.094	2.189	-0.004	-1.754	-3.836
High	0.050***	0.028	0.006	-0.017	-0.042**	0.036**	0.013	-0.011	-0.036*	-0.064***
	2.578	1.440	0.289	-0.886	-2.113	2.085	0.714	-0.620	-1.895	-3.078

4.6   Subsample analysis around the Global Financial Crisis (GFC)

In this section, we conduct a robustness test using sample periods around the GFC. In particular, we compute the option straddle portfolio returns during the year 2007-2009 in order to examine whether our results are driven by certain turbulent years. Table 9 reports the option portfolios returns sorted by Z-score. The straddle return increases from -1.31% to 9.15% for the bottom and top portfolios. The positive straddle portfolio earns a higher return than the negative straddle portfolio at 8.13% and 2.13%, respectively. Both the long-short 5-1 and P/N portfolios show significant returns at the 10% significance level. Compared with the results for the whole sample in Table 2, the straddle returns become large but less significant, due to the volatile market. Hence, despite the increasing standard deviation of sorted portfolio returns, our findings remain robust.

Table 9 Straddle returns during the 2008 financial crisis period

Option price is calculated as the average of closing bid and closing ask price. The terminal payoff of call option is max(S_T-K, 0) while that of put option is max(K-S_T, 0). K is the strike price and S_T is the stock price at maturity time. The Straddle portfolios are equal-weighted. T-statistics is corrected by the Newey and West (1987). The sample period is from 2007 to 2009.

	1(low)	2	3	4	5(high)	P	N	5-1	P-N
mean	-0.0131	0.0250	0.0558	0.1048	0.0915	0.0813	0.0213	0.1046*	0.0600*
t-value	-0.1536	0.2382	0.5300	1.0099	0.7295	0.7257	0.2059	1.7847	1.7206
p-value	0.8783	0.8123	0.5974	0.3152	0.4675	0.4698	0.8373	0.0776	0.0887

5. Conclusion

We document a positive relation between the Z-score and straddle returns in the cross section, where Z-score is computed as the normalized spread between the CDS and option implied volatilities. We rank stocks according to the Z-score and investigate the subsequent one-month straddle returns. We sort straddle options into 5 quintiles of equally-weighted portfolios and construct a zero-cost trading strategy that is long (short) in the portfolio with the largest (smallest) Z-score. The strategy generates a significant average raw monthly return of 6.96%, with a t-statistic of 2.89.

The achievement of abnormal returns when portfolios are sorted by Z-score cannot be fully explained by traditional stock risk factors, nor by stock characteristics. The alphas of the long-short straddle portfolios remain significant, irrespective of whether the Fama-French three-factor model, the Carhart four-factor model, or the excess return of the zero-beta ATM S&P 500 index systematic straddle factor by Coval and Shumway (2001) is applied as a benchmark. Double sorts confirm the predictive power of the Z-score and the returns hold for alternative definitions of the Z-score. Transaction costs do reduce the profits. Nevertheless, the profits are still significant when the effective-to-quoted spread ratio is at 25% or less, especially for less liquid options. Our results are important to option market traders, who should consider the information content of the CDS market when making investment decisions.

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