International Monetary Review

October 2024, Vol. 11, No. 4

Introduction to the International Monetary Institute (IMI)

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

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

Advisory Board: (in alphabetical order of surname)

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

Editorial Board: (in alphabetical order of surname)

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

Name of Journal: International Monetary Review
Frequency of Publication: Quarterly
Sponsor: International Monetary Institute of Renmin University of China
Publisher: Editorial Office of *International Monetary Review*
Editor-in-Chief: Ben Shenglin
Associate Editors: Song Ke, Qu Qiang, Xia Le
Managing Editor: Herbert Poenisch
Associate Managing Editor: Li Jingyi
Assistant Editors: Zhang Yulan
Editorial Office:
International Monetary Institute, Renmin University of China
Room 605, No. 59 Zhongguancun Avenue, Beijing 100872, China
Tel: 86-10-62516755
Email: imi@ruc.edu.cn
Website: www.imi.ruc.edu.cn/en/

WeChat

We only share the most valuable financial insights

CONTENTS

International Monetary Review
October 2024, Vol. 11, No. 4

Special Column on Creating BRICS Common Currency

Challenges in Creating a Common BRICS Currency*

By HERBERT POENISCH*

On the agenda of the forthcoming BRICS summit in Kazan, Russia, there is among other financial projects, a common currency for the ten BRICS member countries. While it is unlikely that they head for monetary union due to the diversity of countries, a common currency for denomination and settlement of payments is feasible. This will most likely be a wholesale currency for use among financial intermediaries, first and foremost commercial banks, thus replacing the outdated settlement through correspondent accounts. This article will assess the requirements for doing so.

Mr Zhou Xiaochuan was already advocating an alternative global currency to the dollar when he was Governor of the PBoC in 2009. He suggested enhancing wider use of SDR as a first step to creating a new 'supranational' reserve currency. Since then the renminbi has been included in the SDR basket in 2016, but its usage has remained largely in the public domain with highly engineered transfers.

The BRICS proposal is shrouded in mystery, with the ambition of creating a regional common wholesale currency for public as well private use. The Johannesburg Communique of the 2023 summit did not even mention a common currency. In the meantime, countries, which have been sanctioned by the West, such as Russia and Iran push for such a new currency which would exclude the present global currencies, such as dollar, euro, yen and pounds.

Any currency has to fulfil three functions to qualify and serve as such: denomination, transactions and store of value.

1. Denomination currency

Creating a basket of currencies, with weights allocated to each of the 10 constituent currencies, renminbi with GDP weights is likely to have 63%. This result will be baskets like SDR or ECU, but with a dominant partner, China. Using GDP 2022 weights the following composition of a BRICS basket would emerge:

	GDP 2022 in bn USD	Weight in %
Bazil Real	1920	6.8
Russia Rouble	2244	8.0
India Rupees	3389	11.9
China Renminbi	17886	63.0
South Africa Rand	405	1.4
Saudi Arabia Riyal	1108	3.9
United Emirates Dirham	507	1.8
Egypt Pound	475	1.6
Ethiopia Birr	120	0.4
Iran Rial	346	1.2
Total	28400	100

This basket can be adjusted as new members join. The European Currency Unit (ECU) basket was adjusted several times.

2. Settlement Currency

* Puclished at 23 September 2024.
* Herbert Poenisch, member of IMI International Committee, former senior economist, BIS.

A newly created institution needs to determine the adequate supply of the basket currency, run the settlement system and provide a mechanism for settling imbalances. In case of SDR as from 1969 the IMF took decisions to issue new SDRs, a claim on the IMF. In case of the ECU, created in 1979, the European Monetary Institute (EMI), the forerunner of the European Central Bank took the decision on the issue of ECUs based on the demand for a means of settlement. Participating currencies have to be deposited at EMI. The BIS was nominated the private ECU clearing agent. In case of imbalances, they had to be settled in participating currencies or USD. The EMI issued this common currency for settlement purposes with guidelines for its use.

This common BRICS currency needs to get away from the antiquated correspondent accounts which might be subject to sanctions on banks. The present use of the China Interbank Settlement System (CIPS) is limited as transactions are renminbi only and need to be scanned for not violating China's financial account restrictions. Russia is preparing a payment system with modern technology including CBDC to bypass SWIFT as from mid 2025. This would be similar to the mBridge project developed by the Bank for International Settlements except it would link all existing BRICS CBDC currencies.

The private-public BRICS PAY partnership set up in 2018 offers payment solutions for BRICS countries, including financial messaging (similar to SWIFT), message conversion, settlement in wholesale digital currency CBDC, settlement either through private banks or central banks in participating currencies. It is in the project stage at present waiting for official approval. This is needed as only participating central banks can provide the liquidity support and create trust in the system. Secondly it has no plan for using a common currency.

3. Storage currency

If basket currencies in excess of settlement needs remain, a mechanism for holdings of forex reserves as well for issuing securities in the common currency needs to be established. Holding BRICS common currency as forex reserves will allow BRICS countries to diversify their forex reserves. However, it will have to be accepted by the IMF as reserve currency like SDRs. The opposite side of the coin, borrowing in BRICS has to be addressed. There are examples of issuing in SDR and ECU to reduce the impact of fluctuating exchange rates. These issues have not made a great impact as this market segment was less liquid.

Using CBDCs-the lessons from mBridge project: this project comprising the renminbi, the HK dollar, the Thai baht and the UAE dirham is advanced and offers valuable lessons for harmonising technical and legal standards. A key part of the rationale behind mBridge is the observation that traditional correspondent banking is often slow, expensive and complex. The project aims to solve these problems with its purpose-developed permissioned distributed ledger technology (DLT) called the mBridge ledger, or mBL, that supports instant peer-to-peer and atomic cross-border payments and forex transactions using wholesale CBDC. MBridge recently took an important step forward with the completion of its minimal viable product (MVP) stage and the decision by Saudi Arabia to join the project. The MVP platform can undertake real-value transactions and is compatible with Ethereum Virtual Machine (EVM), a decentralised virtual environment that executes code consistently and securely across all Ethereum nodes. Once operational, this technology can replace SWIFT.

4. Institutional needs

The BRICS countries have shied away from creating new institutions, for example an outdated settlement system resorting to using correspondent accounts. If a common currency were to be created, a core institution like the IMF for the SDR or the EMI for ECU clearing needs to be established. It is clear that major economies will dominate the institution which creates common currency. In case of the SDR this was the USA with a major share in the IMF, however liquidity is shared by all participating central banks. In case of the EMI Germany, the most powerful economy in Europe was the dominant one in the EMI and the ECB today. It even insisted that the ECB was modelled on the Bundesbank. In case of a common BRICS currency, the weight of China in the basket determines the leading role China needs to play. What does this imply: not only privileges in creating and running the necessary institutions but also taking on responsibilities in defending the liquidity and even the existence of the common currency.

In case of the IMF the USA has shown leadership times and again. Because of the limited use of the SDR there was no need to provide liquidity support by the USA. The construction was such that countries which wanted to mobilise their SDR allocations for real purchases, had to find a partner with the IMF as

intermediary who was, perhaps grudgingly willing to perform this operation. Countries with strong currencies had to take on additional SDRs above their allocation and offer forex reserves in return.

In case of the EMI, liquidity in the private ECU market was provided by any of the participating central banks. There was no need for a lender of last resort as most component currencies were strong enough to provide liquidity support. The crunch came much later when the common currency, the euro, already existed. The money supply is managed by the ECB which is allowed to back the currency supply only by buying securities issued by strong fiscal member governments such as Germany. In the absence of a common EU fiscal policy, securities from weak constituent members, such as the PIGS (Portugal, Italy, Greece, Spain) were traded with higher margins as indicators of credit risk. The ECB was confronted with either throwing the weak countries out of the euro or buying their securities, thus in effect watering down the strong backing of the euro. In the end the second alternative was chosen with strict measures to enhance fiscal prudence in the weak countries. This has helped the euro to survive in its present form.

Creating a common BRICS currency will never avoid the contradictions between strong and weak economies and currencies. China as the strongest economy will face these choices. The fate of the Soviet rouble is a case in point. The common currency of the Soviet Union was unilaterally dismantled by Russia in mid 1993 as weak successor states of the Soviet Union just helped themselves to the common currency supported by Russia. The construction of a common BRICS currency should never put China in the same position.

5. The role of China and the renminbi

Bearing in mind the dominant role of the reminbi in the basket, China will have to take on institutional roles as well as lender of last resort to sustain even a simple clearing system in view of likely imbalances. Its CBDC project is most advanced and could serve as benchmark for the others. While China is pursuing internationalisation of renminbi, the backlash for China's domestic monetary policy of such an extended role has to explored. So far there has been no official comment on this dilemma.

Inspite of the political rhetoric there are underlying economic realities which China has to face. With current capital controls in place affecting the ordinary Chinese, will it be acceptable to allow massive capital outflows when China has to step in to support weak economies. With a BRICS common currency it is expected that countries like India, South Africa, Egypt, Ethiopia and Iran will need liquidity support from China.

In addition, the monetary policy implications have to be considered. Will a common currency lead to a looser monetary policy than one based purely on domestic considerations. Presently, the sharp increase in China's money supply serves purely domestic needs to prop up economic growth. Supporting weak BRICS members will come on top of that. The SDR and ECU have been insignificant to affect the monetary policy of the USA or that of Germany. But the magnitudes could be different in case of a BRICS currency.

In order to avoid any unintended consequences, institutions should be set up, such as the BRICS Pay, the CIPS and possibly a Chinese version of the IMF. This is already in the making with swap agreements concluded between China and some 40 partner countries. It could add a BRICS dimension similar to the SDR. There would be an allocation to the BRICS member countries according to their quotas, once established. In case of payment imbalances the deficit countries, such as Ethiopia would swap their BRICS allocation with surplus countries such as the UAE to gain real forex to settle their debts. The beauty of this construction is that the burden of bailing out weak countries would be shared among strong BRICS countries thus alleviating the burden on China.

Conclusion

While there is ample political will to de-dollarise there are no detailed plans how to do it. In the absence of a real currency to replace the dollar among BRICS countries, this will be a patchwork of solutions, one for transactions among BRICS countries using the latest digital technology, and another one for storing the common currency as forex reserves or having it recycled to countries in need. The main obstacles to finding a comprehensive solution are the diversity of BRICS member states and China's obsession with controlling cross border renminbi flows and the offshore renminbi market.

In the case of the dollar this was much easier. Although the dollar was used by all diverse countries, the USA supplied its currency in a benign manner. The US authorities left it up to the foreigners to trade and save its currency on the eurodollar market with hardly any interference. The daily business was left to private global banks, many of them US owned.

Literature used:

Solomon, Robert (1996): Creation and Evolution of the SDR.IMF eLibrary www.imf.org/publications
European Parliament (2024): History of the economic and monetrary union. Fact Sheets on the European Union. www.europarl.europa.eu
Bank for International Settlemments (2023): Experimenting with a multi-CBDC platform for cross-border payments. In: BIS Innovation Hub, October www.bis.org/innovationhub

October 2024
Vol.11, No.4

A BRICS Common Currency and Prospects for the BRICS+ & the Global South

By JAYA JOSIE*

Abstract

At the BRICS Summit in Johannesburg in 2023 Brazil, Russia, India, China and South Africa, the original five members of the BRICS group, decided to expand the group to include six more countries including Argentina, Egypt, Ethiopia, Iran, Saudi Arabia and the United Arab Emirates. Subsequently, Argentina rescinded its application to join the group, and the other five new members confirmed their membership of the BRICS group now called the BRICS +. Before Johannesburg Summit there was much speculation that the Summit would take a decision on establishing a common BRICS currency to facilitate intra-BRICS trade. However, no such decision was taken, instead the group opted to use own currencies for intra-BRICS trade. The BRICS New Development Bank based in Shanghai endorsed this decision and proposed acting as an institution that will support the proposal and broaden its international membership. Notwithstanding, the decision not to establish a BRICS common currency the next BRICS+ Summit in November 2024 in Kazan, Russia is expected to take a decision on the establishment of a BRICS+ currency and/or payment mechanism that will remove BRICS+ members from over exposure to international sanctions and the weaponization of the use of foreign currency in international trade in a global climate fraught with risks for the BRICS+ group. Eurasia, Asia, the Middle East and Africa are most susceptible and vulnerable given their dependence on international trade for development. China, India, Russia, Brazil, have already taken steps to cushion their dependence on foreign currency in international trade. In Africa, South Africa, Egypt and Ethiopia are all in a precarious situation. In this paper we will explore the prospects and limitations of the establishment of a BRICS+ currency and/or payment mechanism that will reduce the risk to using foreign currency in intra-BRICS+ international trade.

Key words: BRICS+, common currency, foreign exchange, dollarization, international trade.

* Dr Jaya Josie, Adjunct Professor, University of the Western Cape (UWC) & University of Venda (UniVen) and Africa Advisor Zhejiang University International Business School (ZIBS).

In 2014, at the BRICS Summit held in Fortaleza, Brazil, the BRICS heads of State adopted the BRICS long-term strategy document that refers to market integration among the BRICS countries in trade, investment and finance. Deepening economic cooperation and possibly creating a BRICS-wide market will involve integration among countries at unequal levels of development, geographically divergent and politically diversified. The addition of more members to the BRICS group is likely to add additional levels of developmental hurdles to market integration with respect to trade, investment and finance. However, it will also add a new dimension to deepening and extending economic cooperation with the strong possibility of creating a BRICS+ wide market. Of course, the question is whether such an initiative could include a currency and/or payment mechanism for international trade and investment that could deepen and strengthen South-South market integration and development in the medium to long term through the BRICS+ currency and/or payment mechanism for international trade and investment. Solving the challenges currently associated with currency and/or payment for intra-BRICS+ trade and investment could be a first step in financial integration and an instrument for trade and industrial policy development not only in the BRICS+ group but also for South-South development integration. A major challenge for the BRICS+ group of countries is their current dependence on the US dollar, the Euro and other foreign currencies for trade, including intra-BRICS+ trade and financial transactions (Gao Bai, 2024).

The World Trade Organization (WTO) data indicated that the five BRICS countries represent almost 3 billion people, about 43% of the world population, with a combined nominal GDP of US$14.9 trillion, which is about 25% of the world's GDP and an estimated US$4 trillion in consolidated foreign reserves and about 11% of the world's foreign direct investment. With the addition of more countries to the group both the population, Gross Domestic Product (GDP), consolidated foreign reserve figures will increase substantially. Notwithstanding this huge potential intra-BRICS+ international trade has been limited by exchange rate volatility and instability in US dollar, Euro and Sterling foreign currency reserves held within the BRICS+ countries. In recent years this challenge has been further complicated by conflicts in Ukraine, the Middle East and the imposition and threat of sanctions against members of the BRICS+ group involved in these conflicts. BRICS+ member countries in the African and Sub-Saharan African region and other emerging BRICS+ economies suffered heavy losses from volatile exchange rate fluctuations following the 2008/9 Global Financial Crisis (GFC) and, the COVID-19 pandemic had further massive negative impacts on economic growth and development of these countries. Both events left these emerging economies with devastating consequences for households and the private and public sectors resulting in high levels of unemployment, rising poverty, inequality and social unrest.

The payment mechanisms and concomitant financial transaction challenges facing the BRICS+ and other emerging economies in Africa, the Middle East, Asia and Eurasia have been given extensive attention in recent research internationally. A research policy report entitled Developing BRICS Multilateral Regional Economic Integration & Promoting Trade and Investment in BRICS with Future Cross-Border Central Bank Digital Currencies (CBDCs) published in 2022 by Ncwadi, Josie, Yuwen Dai, Wu Wen, Chetty, Kolisi raised the question whether there was political will within the BRICS to integrate the five countries' financial systems. Although the question was not answered at the BRICS Summit in 2023, international conflicts and other global events forced the BRICS heads of state to at least consider the possibility of an alternative payment mechanism for intra-BRICS trade. Before the Summit in Johannesburg there was much speculation that the Summit would take a decision on establishing a common BRICS currency to facilitate intra-BRICS trade. However, no such decision was taken, instead the group opted to use own currencies for intra-BRICS trade. Clearly in 2023 the BRICS member countries lacked the political will to support a BRICS+ alternative payment mechanism.

In a recent article, Poenisch (2024), reviews the options for addressing the intra-BRICS+ payment challenges in financial transactions within the group and argues that unlike the BRICS 2023 Summit in Johannesburg the forthcoming 2024 BRICS+ Summit in Kazan, Russia will be ground-breaking because of the major global changes since the last summit. Firstly the original BRICS group has expanded to include five new important members Saudi Arabia, United Arab Emirates, Iran, Egypt and Ethiopia. Of the five new members, Saudi Arabia, the main international supplier of petrol has now joined the Bank of International Settlements' (BIS) digital currency arrangement called the mBridge Project. Saudi Arabia has indicated that it is considering alternatives to the current US dollar based payments system called the Petrodollar for petrol and is open to shifting to China's Renminbi or Yuan for settlements for purchases of petrol as China has become Saudi Arabia's major importer of petrol. The article (Poenisch, 2024) calls this currency the Petroyuan. Secondly, the article suggests that given the international difficulties that

Russia is currently facing as a result of the war in Ukraine it is likely to use the BRICS+ summit in Kazan to push for the adoption of the Petroyuan as an alternative payment system. Aware that Russia has its own mBridge system for financial transactions including the sale and purchase of petrol it is very likely to promote the idea of a common BRICS+ currency as an alternative payment system making the group less dependent on the US dollar.

The article by Poenisch, (2024) argues that using the Petroyuan is not feasible because it does not fulfil all three functions to be a fully-fledged currency. The three functions for a currency are denomination, a means of payment and storage of value. Furthermore, BRICS+ countries will have difficulties in using their own currencies as an alternative to using the US dollar for intra-BRICS+ trade as there are financial imbalances among BRICS+ countries using their own currencies. The use of the Petroyuan, will most likely run into difficulties as most oil importing countries will require enough Renminbi at their disposal however, as a country like India that dos not run current account surpluses with China, they are unlikely to have sufficient Renminbi reserves to pay for oil imports. They will have to consider other channels for acquiring Renminbi. The third function of money is a store of value and oil exporting nations are likely to earn surplus reserves of Renminbi that they will need to recycle through on-lending to countries in need of foreign reserves. Unfortunately, the Renminbi offshore market is tightly controlled by China and any surplus earned has to be spent or traded in China or added to a countries foreign exchange reserves. In the article Poenisch (2024) further argues that while there may be benefits from the enhanced role of the Renminbi, these benefits are more likely to accrue to banks in China as they would profit from the recycling process. Even if non-BRICS financial intermediaries join the banks in China through arbitrage between the dollar-denominated and Renminbi oil markets the introduction of a Petroyuan will likely fragment the global financial system.

To mitigate the challenges that the BRICS+ countries are likely to face in intra-BRICS+ trade and financial transactions Poenisch (2024) proposes the use of the BIS-led Project mBridge as a possible payments system solution. This payments system uses Central Bank Digital Currencies (CBDC) and could replace the older correspondent account settlement system. The mBridge CBDC has been implemented as pilot scheme for settlement among partner central banks in China, Hong Kong, the UAE, Thailand and recently, Saudi Arabia. The benefit of such a system, argues Poenisch is that it is discreet and private and protects the confidentiality of corporate clients as it uses a distributed ledger platform that is operated by central banks in the participating countries. Such a system will safeguard BRICS+ internationally based corporate clients and make them less susceptible and vulnerable to sanctions and ease intra-BRICS+ trade and financial transactions. The use of a CBDC based platform has the added advantage of guarantees from BRICS+ central banks (Poenisch, 2024).

Currently payments for intra-BRICS+ trade and investment financial transactions are encouraging the use of own currencies. At the forthcoming BRICS+ Summit in Kazan, Russia, there is speculation that there will be a concerted effort to move towards an alternative payments system for such transactions. Of the initial five BRICS countries the use of own currencies was feasible with China as their main trading partner because these countries had signed Swap Agreements with China. At the BRICS Summit in Johannesburg a decision was taken to encourage financial transactions in own currencies. As discussed earlier the use of own currencies for the majority of BRICS+ countries is fraught with challenges as many of them do not have full convertibility for the purposes of international transaction. There are, however, at least two exceptions to this limitation. The United Arab Emirates (UAE) and Saudi Arabia have fully convertible currencies. The UAE has no restrictions or regulations on foreign exchange and recently renewed its Swap Agreement with China (Perez & Zhang 2023).

The UAE also aims to facilitate trade and cooperation between the two countries by providing liquidity in UAE Dirhams (DH). The Swap Agreement has a nominal value of DH 18 billion UAE Dirhams which is the equivalent to 35 billion Yuan. As the UAE has no foreign exchange restrictions or regulations financial transactions may be undertaken freely

[China Briefing 2023, https://www.china-briefing.com/news/china-united-arab-emirates-uae-...]. This makes it possible for the UAE to act as a third party conduit for trade invoicing between China and other BRICS+ member countries. In fact China has opened offices and warehouses in the UAE for the import of goods into the UAE. Notwithstanding the fact that the DH has been tied to the US dollar at DH 3.67 to US$ 1 the UAE is still limited by other international agreements with respect to international fraud, Politically Exposed Persons (PEPs),

The agreements on money laundering and terrorist financing could possibly limit the use of third party invoicing for trade. These agreements are related to Enhanced Due Diligence (EDD), the The Financial

Action Task Force (FATF) watchdog list overseeing standards on global money laundering and terrorist financing. So far, the UAE has managed to maintain compliance with all these international agreements.

The limitations discussed above brings us back to considering the prospects of a common BRICS+ currency or an alternative payment system for the group. With the group expanded by five more members with two of them from Africa and three of them from the Middle East what is the prospect of an alternative payment mechanism for intra-BRICS+ trade? In Africa the African Union has formalised the African Continental Free Trade Area (AfCFTA) with the majority of the continent's countries, including, South Africa, Egypt and Ethiopia signed up to the group. As the group faces similar cross-border payment limitations for intra-African trade as the BRICS+ group. To address these limitations African countries are introducing an alternative payment mechanism much like the BIS mBridge System pilot discussed earlier. The mechanism is called the Pan-African Payment and Settlement System (PAPSS) and is likely to transform financial transactions across Africa.

The PAPSS initiative, led by African Export-Import Bank (Afreximbank), has the objective of streamlining and harmonizing payment systems for financial transactions, promoting financial inclusion, boosting intra-African trade and economic integration. Afreximbank has four classes of shares – A, B, C and D: "Class A" shares are held by African Governments/States, their public institutions or their designated institutions, including continental, regional, and sub-regional financial institutions; "Class B" shares are held by African national financial institutions and African private investors; "Class C" shares are held by non-African international financial institutions and economic organizations, as well as non-regional financial institutions and non-African private investors; while "Class D" shares can be held by any person and are structured to be freely transferrable – the Bank's "Class D" shares are currently issued as depositary receipts, which are listed on the Stock Exchange of Mauritius (SEM). As China is already a leader in using CBDC payment systems domestically, one of its banks, the Eximbank, is a major non-African Class C shareholder and playing a leading role in Afrixembank. As more banks from China show interest in investing in Afrixembank the CBDC technology will likely make the PAPSS a useful alternative mBridge payment system for the AfCFTA. Today China is the undisputed leader in FinTech technology which gave birth to its current operational CBDC technology. It is expected that African central banks will of necessity buy into CBDC technology and make the PAPSS a reality in Africa. This policy relationship will be imperative if African countries wish to promote AfCFTA, intra-African trade and economic integration in the continent.

A major benefit of the PAPSS is that it will ensure discrete, confidential and almost immediate transfers of financial transactions between the originator of the payment in one African country and the beneficiary in another. The initial originator issues a payment instruction to their bank or financial institution in their local currency and the instruction is sent to PAPSS. As the real payment process must be done speedily PAPSS has to guarantee that there are available funds to complete the transaction before effecting the movement of debits between the participants in the transaction. This implies that before hand the participants have a pre-funding agreement with PAPSS. The rest of the process is a normal banking operation in which PAPSS credits the Direct Participants(DP) clearing account and the DPs integrate directly with PAPSS and the real-time gross settlement systems (RTGS) of their central banks in the pre-funding step. The PAPSS is also able to accommodate participants without an RTGS account, called Indirect Participants (IP), by allowing the IPs to fund or defund their clearing accounts on PAPSS with the assistance of a DP providing the required liquidity. PAPSS must ensure prompt settlement within 24 hours and net settlements across all participating central banks takes place at the same time at 11 UTC each day. Through the BIS approved ISO 20022 messaging standard notifications are ensured for PAPSS, the Participants and RTGS of the status of every stage of the transaction. The Afreximbank credits/debits the central bank's hard currency settlement account held in Afreximbank and confirms to PAPSS. "All PAPSS core services and other services are provided by the PAPSS instant payment system (PIP™), and supports wholesale and retail real-time payments and the connectivity of banks and payment service providers." [See PAPSS Pan African Payment & Settlement System https://papss.com/network/ for details of other services offered by PAPSS]

The PAPSS uses the same blockchain technology that developed a Distributed Ledger Technology (DLT) in much the same way that the BIS-led Project mBridge was developed for cross-border payments and foreign exchange transactions using wholesale Central Bank Digital Currencies (CBDC). Blockchain

technology is a digital ledger of financial transactions shared across a global network of supercomputers using cryptography that allows each participant on the network to add to the ledger in a secure manner with no need for a central authority. Every time a digital transaction is made to the ledger, all computers on the network recognise and verifies the transaction immediately using open-source software. All the transactional information is stored in a unit designated a block where each block is digitally chronologically stacked in a chain one next to the other. The People's Bank of China adapted the technology for the development of a CBDC to be used nationally. The BIS-led Project mBridge also adapted the blockchain technology for use in the mBridge pilot for China, Hong Kong, Thailand and the UAE. The diagram below illustrates how trade finance could operate using CBDC technology.

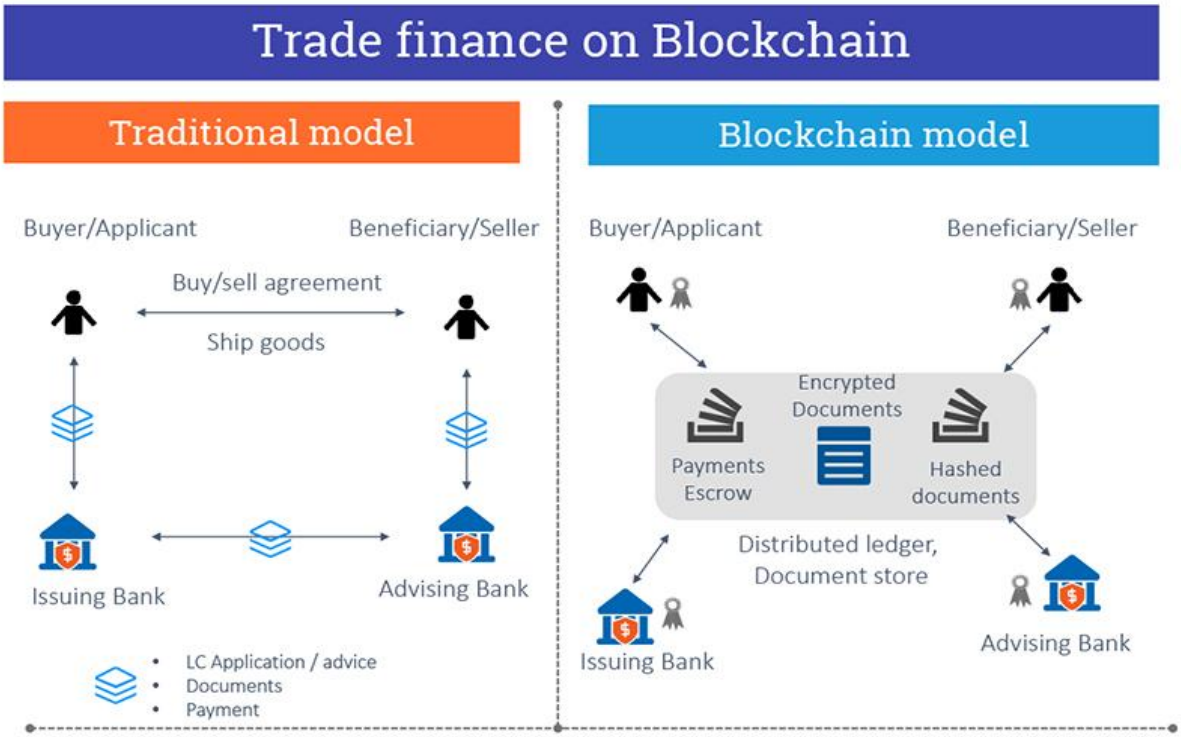


Figure 1: Architecture Trade Finance Comparing Blockchain and Traditional Models

In 2022, after the crisis of the Covid-19 Pandemic and, the lifting of the lockdowns, Ncwadi, Josie et al (2022) published their policy research report. Each BRICS country is testing or about to launch a CBDC based on research of the country's needs. The Central Bank of Brazil announced guidelines for adopting a CBDC in May 2021.The Brazilian model seeks to break the cash dependence in the country, where 60% of the population uses cash more frequently than any other payment channel. In Russia, the Bank of Russia launched a pilot digital Ruble CBDC, hoping to promote a seamless transition from the traditional fiat currency to the digital version. The currency is being tested by twelve local banks. India has also announced a phased implementation plan for a CBDC to launch where the Reserve Bank of India collaborated to develop the framework for the currency and identified four major use cases: programmable payments, cross-border remittances, retail payments and lending for micro, small and medium enterprises. China has made the most progress in implementing a CBDC when it launched the digital Yuan in four cities and is used for local payments and used during the Winter Olympics in 2022. The trade finance cycle for using a blockchain system of payments is illustrated in the figure below.

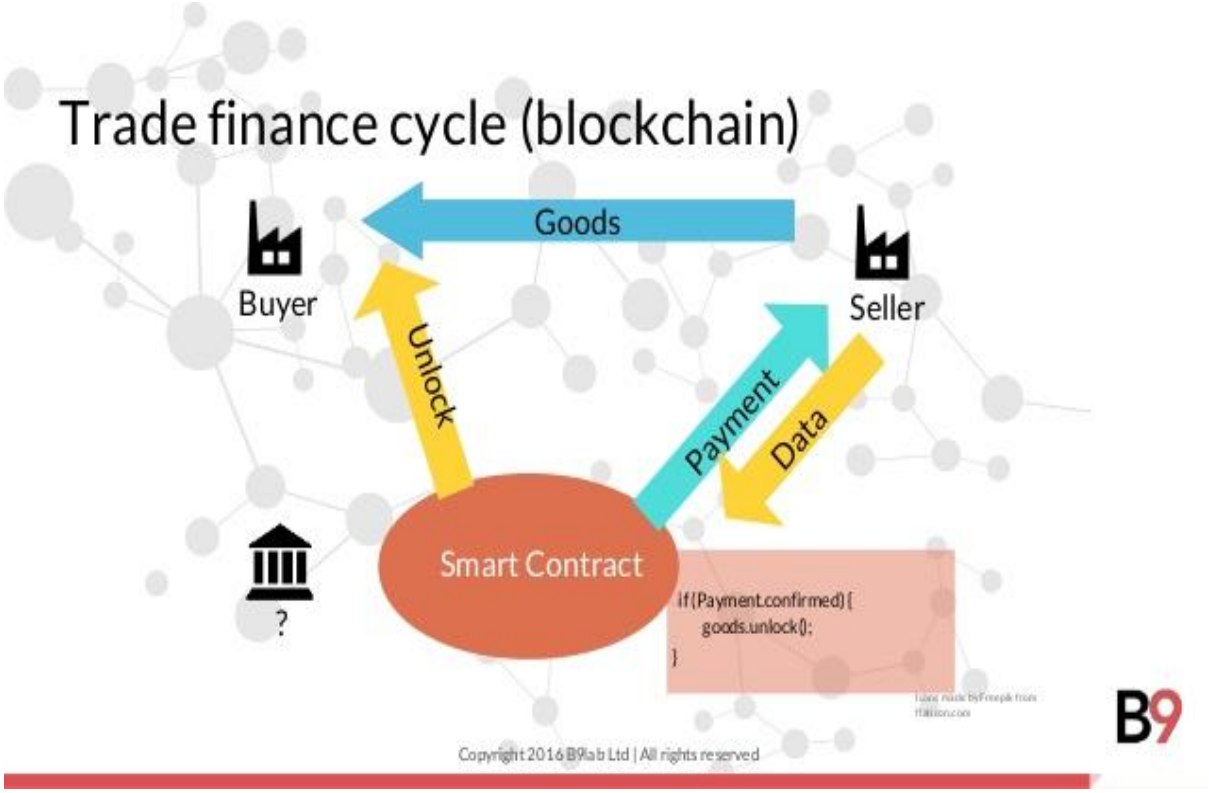


Figure 2: The Blockchain Trade Finance Cycle

South Africa too developed a pilot CBDC project. After four years of research conducted by the South African Reserve Bank (SARB), it has tested a CBDC to facilitate cross- border payments while seeking solutions to overcome the barriers faced in the rollout of legacy infrastructure. In Africa Nigeria launched a CBDC called the eNaira, while Kenya was exploring a version of the CBDC that may use its already developed electronic payment system called mPesa. For BRICS countries, this progress highlights technological expertise shared by the BRICS Central Banks, and that can be exploited to benefit the BRICS+ societies and their regional partners. The BRICS Heads of State have welcomed sharing knowledge about technological advancements, and such ideas are well suited for sharing in the BRICS+ Partnership on the New Fourth Industrial Revolution. In addition, the BRICS Heads of State in 2021 declared their support for using digital technologies to modernise and transform industries, promote seamless global trade and provide a mechanism for the countries to achieve the Sustainable Development Goals (BRICS Heads of State Statement, 2020 para 65, 66). In recognising the broad suite of use cases that promote economic growth and development, and the rapid pace of technological development, new research must include economic inclusion and equal participation, promoting shared economic growth. Financial integration in BRICS+ using mCBDC settlement platforms could become central in international finance and a benefit for economic growth through risk-sharing, improvements in efficiency allocation & reductions in macroeconomic volatility & transaction costs. Currently, China, Thailand, Hong Kong and the UAE have set up a pilot multiple CBDC bridge (mBridge). This pilot is illustrated in the figure below.

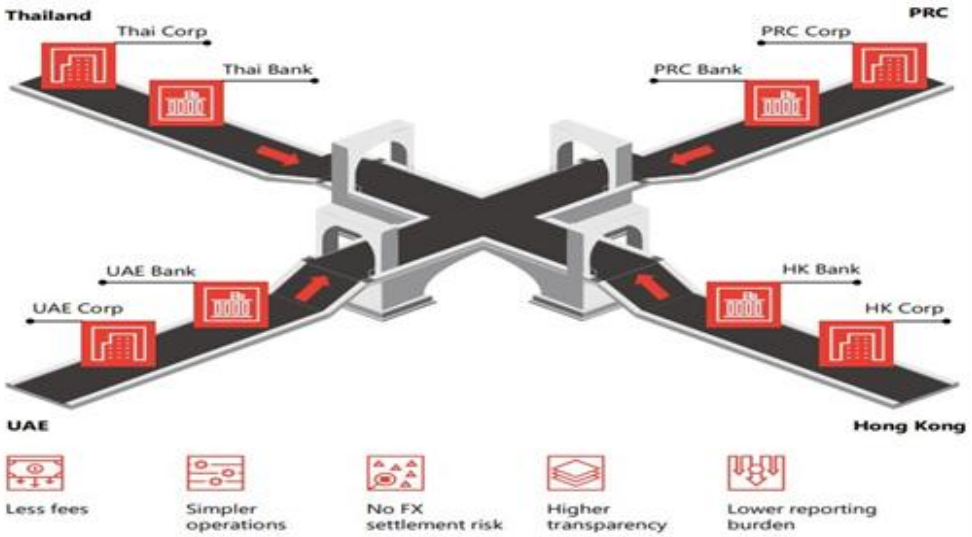


Figure 3: The BIS led mBridge Pilot for China, Thailand, Hong Kong and the United Arab Emirates

In the policy research report (Ncwadi, Josie et al, 2022) developed a set of guidelines for a BRICS CBDC Trade Integration Platform (TIP) based upon the System for CBDC International Settlement and Application (SCISA) that uses a trade platform called Legal Digital Commodity Trust (LDCT) that was previously called the SDR-G. The report observed that the development of technologies together with the evolution of social development has enhanced and increased international trade, business, financial transactions and the complexity of the international relationships. The emergence of private digital currencies and the CBDC have advanced the development of financial digitization and changed the form of money. In such a context the existing financial infrastructure should also evolve concurrently to meet the consequential challenges for regulatory compliance and also take advantage of the emerging improvements in efficiency and reduction in cost that would benefit all economic activities. The BRICS+ countries are now in an enviable position to address the inadequacy of the current financial infrastructure that has hampered intra-BRICS+ and, of course, intra-South-South financial transactions for trade, investment and sustainable economic development. In both instances the inadequacy of the current financial infrastructure is the major stumbling block in the area of international trade.

Amongst the financial infrastructure inadequacies confronting the BRICS+ and the Global South in international trade are the lack of a convenient and cost-effective cross-border payment infrastructure; the challenge of foreign exchange risks that are out of the control of the trading country partner; the lack of support for trade finance-related needs, especially for Small and Medium Enterprises (SMEs), and dependency on the US dollar or other foreign reserve currencies is a major challenge for smaller and developing and emerging economies. With respect to the last challenge developing and emerging economies find themselves in a catch-22 situation. The trading parties, for example, BRICS+ and Global South countries, have complimentary goods and services for cross-border trade but the lack of foreign currency reserves (US dollar and Euro mainly) means many potential trade transactions are not possible. However, if the goods being traded by all parties have values that can be uniquely, efficiently, and securely validated by customs, insurance and banks, using technologies such as blockchain, the internet of things (IoT), big data etc., it is possible to create a composite unit of account that can be used for trade finance and settlement transactions using CBDC. This system can act in the place of fiat currencies such as the US dollar or Euro. This can be achieved using distributed ledger technologies if the trading parties and agents to this scheme, such as logistics, customs, purchasing contracts, finance, and insurance, form a closed loop on a CBDC blockchain platform much as it is proposed in PAPSS system in Africa. The policy research report (Ncwadi & Josie 2022) presented in the figure below shows the possibility of a BRICS+ mBridge platform that may be able to overcome the inadequacies of the existing financial transaction system governing intra-BRICS international trade [NB: a full description of the SCISA Architecture and design of the BRICS mBridge is presented in the final Research Policy Report and is available on Request].

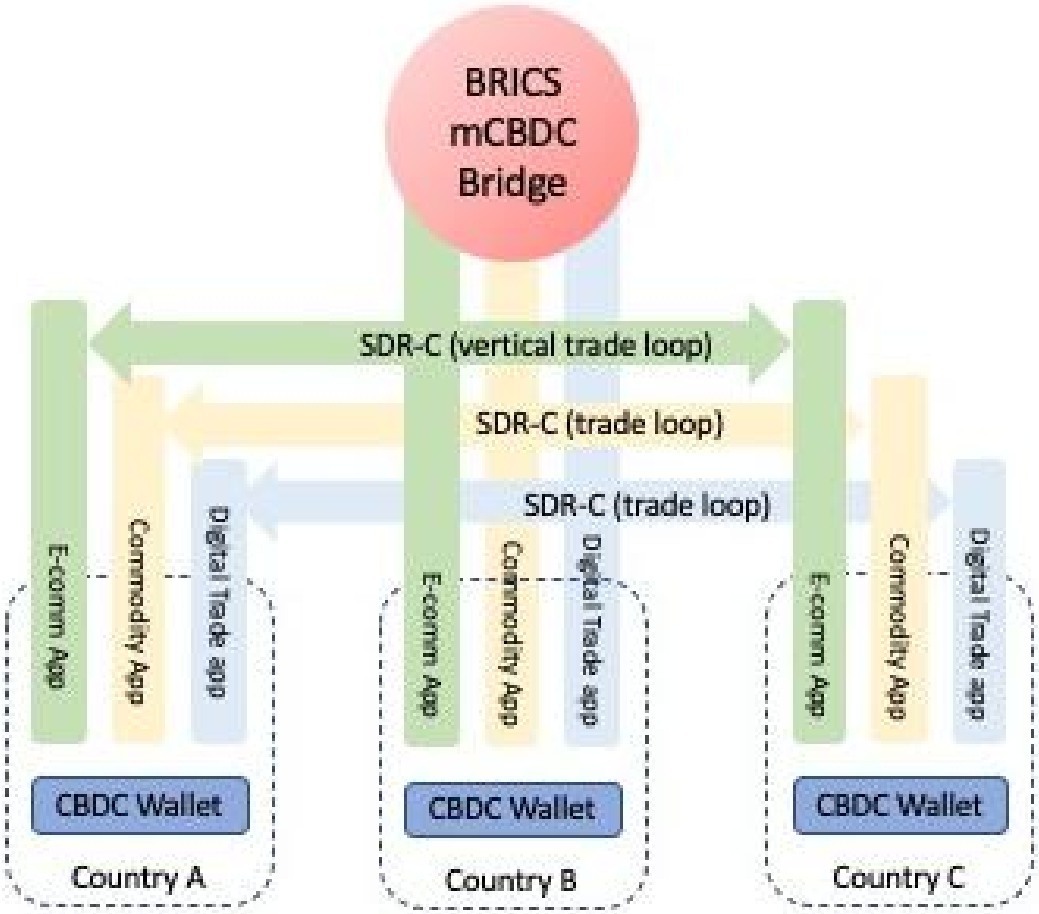


Figure 4 - Using the Architecture of SCISA

As a solution that includes both home financial infrastructure and cross-border ones, illustrated in the figure below it is comprised of three key components:

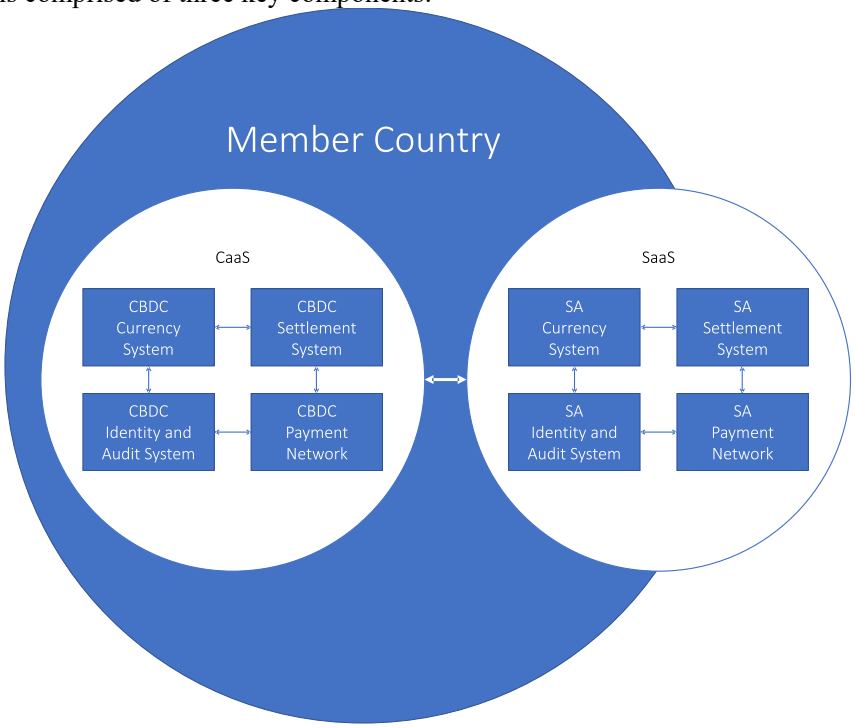


Figure 5: SCISA for a Member Country

While the final outcome of such a system may overcome the inadequacies of the current financial infrastructure for trade and investment in the BRICS+ and the Global South the system will also require an effective and BRICS+ approved regulatory and governance framework. The policy research report (Ncwadi & Josie 2022) makes very specific proposals in respect of a regulatory and governance framework that the BRICS+ may consider for approval. Among others the report proposes that an integrated BRICS+ mCBDC model increases the shared control over governance where all participants are expected to abide by a single rulebook and governance arrangements that informs the structure of the shared ledger. Secondly, a BRICS+ mCBDC has to introduce a set of common standards to ensure that a nation's CBDC can connect to other external systems. In this case the ISO20022 standard as applied by the PAPSS provides the common language for CBDCs. The ISO20022 standard common language for CBDCs according to the BIS also provides the basis for mCBDC interoperability.

With respect to a governance framework the participants in the BRICS+ mCBDC should also have a shared responsibility for the BRICS+ mCBDC Governance Model together with their central banks and the BRICS+ Common Platform. The BRICS+ mCBDC Governance Model is expected to allow the BRICS+ central banks to maintain control and authority over its monetary policy, and permit the BRICS Common Bridging Platform to act as a clearing centre for cross-border transactions and facilitate the management of exchange rate conversion, define communication protocols and set the minimum standards for currency exchange. Nevertheless, while China's central bank has the power to plan, organise, supervise its payment systems and financial infrastructure including monitoring the CBDC issuance exchange and circulation within its borders to address potential money-laundering, regulating authorised operators and commercial institutions, and defining the technical, business, security and operational standards, other BRICS+ central bank participants may not a have similar approach to governance. The report suggests that the BRICS+ standards should supersede the minimum operational standards set by the BRICS+ to allow the BRICS+ central banks a degree of autonomy and flexibility over national monetary policy, providing greater confidence in system resilience and national security. The figure below illustrates the governance model proposed for the BRICS+ mCBDC Governance Model.

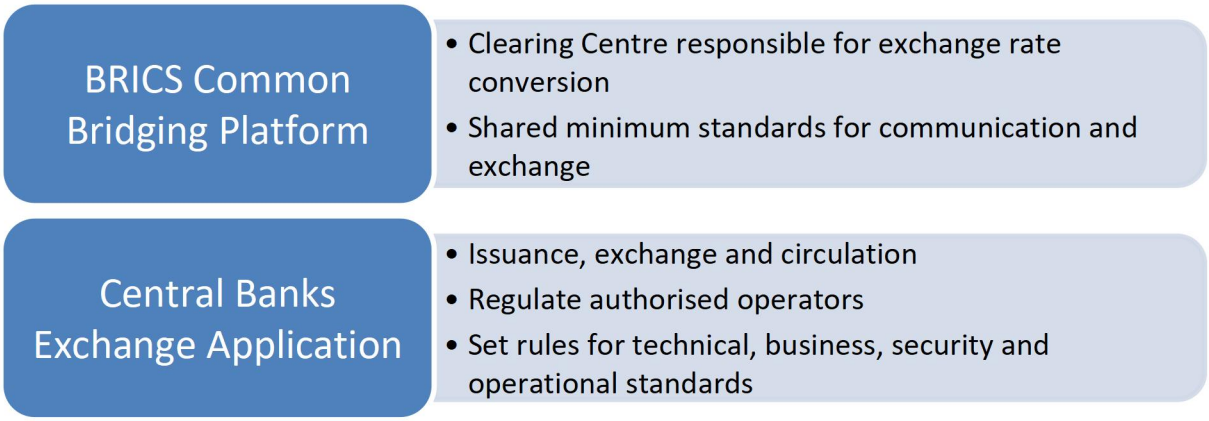


Figure 6: Division of responsibilities between the BRICS Common Bridging Platform and the Central Banks

The report goes on to show how the Vertical Stack Design can enable cross-border trade settlements with specific reference to the role of small and medium enterprises (SMEs) that could use an application to collectively purchase inputs from the platform. With smaller down payments, participating banks may issue a "Special Drawing Rights on Commodity" (SDR-C) that can be traded on the smart-contract-based blockchain platform. The SDR-C will reduce the financing pressure and costs for the importer and ensure the exporter gets paid if the importer changes his mind due to unforeseen reasons, typical in today's individual company-based case. Such a BRICS+ mCBDC transaction infrastructure application could provide all necessary regulatory enforcement using Smart Contract technology and a standard interface to the mCBDC Bridge could be developed to integrate the regulator's requirements.

Following the discussion on the regulatory, governance and stack design the report presents a set of CBDC public policy principles endorsed by G7 group for inclusive economic development of all countries participating in the mCBDC. The principles include fostering financial inclusion; promoting payment platform interoperability and data privacy; promoting carbon neutrality; catalysing digital economy innovations and, to minimise the role of banking intermediaries. Adapting these principles with respect to the socio-political implications of BRICS CBDC integration the report elaborates a further set of principles in keeping with the emerging global concerns. These principles include the long-term minimal exchange rate volatility in BRICS+ economies; the reduction in transaction fees; stricter competition rules for monopolies and, combating illicit financial flows.

In addition to recommendations for greater trade integration and the restructuring of the financial infrastructure to mitigate the impact of exchange rate volatility on BRICS trade transactions the key recommendations of the policy research report (Ncwadi & Josie 2022) speak directly to the possibility of the BRICS and BRICS+ adopting central bank digital currency (CBDC) such as a BRICS+ mBridge Platform to promote intra-BRICS+ trade and seamless financial transactions to counter dependence on dominant foreign exchange and reduce the vulnerability of BRICS+ and countries of Global South. Related recommendations for the adoption of a BRICS+ mBridge Platform include the adoption of the SCISA Model to maximise BRICS and BRICS+ trade integration.

Other related recommendations include standardisation to enable incremental upgrades for use as new CBDC standards and for international clearing systems and payment networks; adopting the SCISA national sovereignty and international group independence principle; agreement to use smart contracts; ensuring security through the use of blockchain technology; moving to high-efficiency through using efficient hardware such as cryptographic computing acceleration cards or supercomputers and, finally sharing mCBDC regulatory and governance powers among BRICS+.

Adopting the recommendations above may not take the BRICS+ towards a common BRICS+ currency, but it will introduce the BRICS+ to a more multilateral and functional payment mechanism for an inclusive development approach to financial transactions and international trade, integrating value chains, and including services that advance intra-BRICS economic cooperation that can serve as an example for the Global South. Multilateral financial cooperation in a time of the present global crisis requires systemic liquidity management tools to deal with extreme episodes of volatility, recession, spiraling inflation, debt management and perhaps another economic crash. The BRICS+ and developing and emerging economies have considered their own currencies for financial transactions. However, as discussed earlier in this paper this option has its own limitations.

Developing and emerging economies are also using own currencies in conjunction with swap arrangements for supporting liquidity to move away from a unipolar currency dominance towards a multi-currency world. As more and more developing and emerging economies are joining the BRICS New Development Bank (NDB) the CRA mechanism and the NDB Bonds are also being considered to shore up their financial transaction across the BRICS+ and the Global South. An option that developing and emerging economies may wish to consider is the adoption of using the RMB as an international reserve currency for financial transactions. However, China is wary of the risk that an international reserve currency may also fall into the trap of the Triffin dilemma. In view of this risk China is seriously considering moving towards using multiple Central Bank Digital Currencies (mCBDC) for international financial transactions. China, India, and Russia have already started piloting retail CBDC platforms for transactions. While this system is being developed, BRICS and developing and emerging markets could deepen financial integration and introduce instruments such as collateralised lending arrangements and credit rating systems to mitigate credit risks.

References

Dezan Shira & Associates 2024 China Briefing 10 May 2024,
[https://www.china-briefing.com/news/china-united-arab-emirates-uae-...]

Gao Bai, 2024; The BRICS and De-Dollarisation: Opportunities and Challenges
(https://thetricontinental.org/wenhua-zongheng-2024-1-brics- dedollarisation-opportunities-challenges-2/)

Ncwadi, Josie, Yuwen Dai, Wu Wen, Chetty, Kolisi; 2022; Developing BRICS Multilateral Regional Economic Integration & Promoting Trade and Investment in BRICS with Future Cross-Border Central

Bank Digital Currencies (CBDCs); Policy Research Report submitted to the South African BRICS Think Tank (SABTT), National Institute for Humanities Social Sciences (NIHSS)

Pan African Payment & Settlement System(PAPSS) https://papss.com/network/

Perez-Saiz, Hector and Ms. Zhang, Longmei 2023; Renminbi Usage in Cross-Border Payments: https://www.elibrary.imf.org/view/journals/001/2023/077/article-A00...
Volume/Issue: Volume2023:Issue077 Publisher: InternationalMonetaryFund ISBN: 9798400235559 ISSN: 1018-5941 Pages: 24 DOI: https://doi.org/10.5089/9798400235559.001

Poenisch, H, (2024); BRICS considering Petroyuan in next de- dollarisation attempt; 23 September 2024, OMFIF (https://www.omfif.org/2024/09/brics-considering-petroyuan-in-next-d.).

IMI International Monetary Review

China's Economy

Chinese Economic Collapse not Happening[*]

By OTTON SOLIS[*]

True, China's current annual rate of economic growth of about 5 percent is low compared with its growth from 1980 to 2010, when it averaged nearly 10 percent. Yet in relation to the rest of the world, especially compared with the major Western economies, China's 5 percent growth is more than impressive.

According to the International Monetary Fund's latest report, the economic growth rates of the United States, Germany and Japan are 2.7, 0.2 and 0.9, respectively. The average for the European Union is 0.7 percent and the G7 countries 1.5 percent. There are some very small economies which are growing faster than China (for example, Palau or Niger), but among large and medium-sized economies, only India (7 percent), the Philippines (6.2 percent) and Vietnam (5.8 percent) are growing at a faster rate than China.

Why the West wants to see China's collapse?

In spite of what a 5 percent economic growth means in the global context, it has become fashionable in the West to raise the alarm over China's economy. What are the reasons behind this?

In the first place, it might be sheer ignorance about the comparative and historical reality, as mentioned above, and the economic cycle that characterizes economies in which the market plays a major role, which is the case with China. There is plenty of evidence pertaining to economic upturns and downturns in the Western economies and those in the Global South, as evidenced from the data on GDP, employment and inflation.

Different from the Great Depression of the 1930s and the 2008 global financial crisis, there have been recurring milder financial upheavals, some lengthier and deeper than others. The best-informed minds have found explanations in overinvestment when demand is growing, for example, due to governments' expansionary policies, sharp increases in productivity and wages or technological revolutions, and the subsequent underutilization of capacity and shrinking of investment that takes place when demand returns to normal.

That does not signify a crisis, let alone a collapse. China may be going through one of those typical downturns of the economic cycle. China has plenty of accumulated knowledge about the fiscal and monetary demand management policies, which could be used to overcome the 5 percent growth rate sustainable in the new era. Beyond that, the Chinese authorities have always been very successful in clearing supply side bottlenecks.

Third plenum suggests how to meet challenges

The third plenary session of the 20th Central Committee of the Communist Party of China has suggested some measures to overcome those challenges.

However, Western enterprises' worries could be genuine because they fear their exports to China might shrink due to China's slowing economic growth rate. China is an important market for a range of products, from electronic slides to construction materials, building machinery, oil, coal, some metals, soybean, cereals and dairy products. As a result, the health of the Chinese economy could have a huge impact on the well-being of millions of people across the globe.

Overall, according to the IMF, if China's growth increases by an additional percentage point, it would add 0.3 percent to global economic growth. This means that if the Chinese economy were growing at its "usual rate" of 10 percent, the global economy's growth rate would be double that of the current rate of 3

---

[*] Puclished on chinadaily at 29 August 2024.

[*] Professor at Instituto Empresarial University in Spain, a senior fellow at the Beijing Club for International Dialogue and was special adviser to the president of Costa Rica from 2018 to 2022. The views don't necessarily represent those of China Daily.

percent. Indeed, the global economy would suffer immensely if either of these two mammoth economies (China and the US) were to fall into recession.

The other concern over China's economic slowdown might be deemed sincere if it stems from the fact that economic slowdown could lead to political instability. While China has been able to overcome political crises in the past, some in the West may argue that the social consequences of economic recession in other countries have endangered peace and development. When facing an internal upheaval, politicians are known to adopt nationalistic and aggressive foreign policies as a way to maintain social harmony.

Zero-sum games lead to wrong measures

Moreover, all those "worries" over and forecasts about China's economic crisis might just be wishful thinking. For those in the West who believe in zero-sum games, the worse the Chinese economy fares the better for them. That's why under the wrong assumption that if China becomes poorer their countries would become richer, protectionist-mercantilist strategies are at the core of the trade policy of the United States and the European Union toward China. Impoverishing China is their goal, and their thinking is based on that. No wonder they claim the Chinese economy is in a deep crisis.

Sure, China needs to make strong decisions to boost its economic growth and overcome some specific problems (that is, unsold housing). But it has three substantive advantages in doing so.

First, China has adopted a pragmatic, result-oriented, non-ideological approach to governance. The Chinese leadership has no qualms in allowing the market to play a leading role in the allocation of resources and private businesses to thrive while taking measures to fix things if and when necessary.

Thanks to its approach, China can implement any measure available in the policy toolkit, be it macroeconomic or microeconomic, to address demand side and/or supply side problems. As such, many of the controversies that arise because of ideological posturing, typical to Western countries and most of the Global South, do not obstruct policy decisions and execution in China.

Second, the rate of savings (43 percent of GDP) in China, much higher than in any other economy in the world, gives the country a substantive advantage in increasing consumption, without posing any danger to the macroeconomic equilibrium and financial stability. The Chinese government could increase consumption by offering fiscal incentives or interest rate subsidies. If China chooses this path, it could increase investment, employment and GDP growth while improving people's wellbeing.

And third, China's development momentum cannot be stopped by fiat. It is the result of decades of high-quality education with emphasis on STEM (science, technology, engineering and mathematics), huge investments in R&D and infrastructure, and adoption of highly productive technologies and clean energy. On the other hand, since protectionism is also opposed by many economists and business leaders in the West as well as multilateral companies, the current protectionist policies of some Western economies might not last long, which would further boost China's growth.

Therefore, China's slowing growth rate does not mean its economy has gone into recession. In fact, a mixture of ignorance, sincere concern and wishful thinking might be behind the alarm over the Chinese economy's slowing growth rate. In any event, with some measures, some of them strong, China can improve its growth rate and realize low-carbon development.

IMI International Monetary Review

A Strong Guarantee is Made to Achieve National Rejuvenation

By CHINA DAILY

The third plenary session of the 20th Central Committee of the Communist Party of China concluded in Beijing October 2023, having charted a new course for the nation's foreseeable future under the guidance of CPC Central Committee General Secretary Xi Jinping.

This pivotal gathering of the leading decision-makers of the country underscored the Party's unwavering commitment to deepening reform and advancing Chinese modernization, and set the stage for the establishment of a prosperous, equitable and sustainable society.

The session reaffirmed the Party's confidence in the nation's development path. The approval of the Resolution of the Central Committee of the Communist Party of China on Further Deepening Reform Comprehensively to Advance Chinese Modernization is a testament to the Party's adaptability and forward-thinking approach to navigating the complexities of the modern world.

As the strategic foresight and determination displayed in the document indicate, the Party's commitment to comprehensive reform and high-standard opening-up, which has been instrumental in steering China through the intricate dynamics of both global and domestic environments in the past, remains unwavering.

At the heart of the session was the recognition that China is at a critical juncture in its journey toward modernization and national rejuvenation and it needs to maintain a delicate balance between development and security, while advancing socialist democracy and the rule of law, and enhancing the welfare of the people and environmental protection.

The approach set out transcends mere economic growth. It is a holistic vision that seeks to harmonize economic development with social progress and environmental stewardship, with deepened reform the cornerstone for Chinese modernization.

It calls for the new development philosophy to steer reform that deepens supply-side structural reform, improves incentive and constraint mechanisms for promoting high-quality development, and strives to create new growth drivers and strengths. All relevant departments are thus to make all-out efforts to improve the institutions and mechanisms to foster new quality productive forces in line with local conditions.

To that end, coordinated efforts are needed to promote integrated reform of institutions and mechanisms pertaining to education, science and technology, and human resources, and improve the new system for mobilizing resources nationwide to make key technological breakthroughs, so as to boost the overall performance of China's innovation system.

Notably, as the document indicates, the Party is clearheaded about the risks and uncertainties the country faces, and relevant departments are called on to implement various measures to prevent and defuse risks stemming from the real estate sector, local government debt and small and medium-sized financial institutions.

Looking ahead, the session outlined a visionary road map through 2035, with goals including the establishment of a high-level socialist market economy, significant advancements in governance, and the basic realization of socialist modernization. By 2029, the 80th anniversary of the People's Republic of China, the Party aims to have accomplished the reform tasks set out in the decision, laying a solid foundation for achieving these long-term objectives. This ambitious timeline underscores the Party's confidence that the country is heading in the right direction.

Essentially, as the session stressed, the CPC Central Committee's authority and its centralized, unified leadership with General Secretary Xi Jinping at the core are the fundamental guarantee for the deepening of reforms. As China continues on its transformative journey, the decisions made at this plenary session will not only play a crucial role in shaping the nation's trajectory in the years to come, but also the shaping of a more harmonious and inclusive world.

October 2024
Vol.11, No.4

China's Service Sector Is an Underutilized Driver of Economic Growth*

By SONALI JAIN-CHANDRA, SIDDHARTH KOTHARI AND NATALIJA NOVTA*

Reforms to rebalance demand toward consumption and further open the service sector can promote sustainable growth and help create jobs

China's economic development over the last several decades has been remarkable amid rapid growth. We project growth will remain resilient at around 5 percent in 2024, despite the continued property sector adjustment.

At the same time, China has relied too much on investment as opposed to consumption. Diminishing productivity and an aging population risk restricting growth, which we expect to slow significantly in coming years, to around 3.3 percent in 2029. Addressing these challenges requires a comprehensive and balanced policy approach.

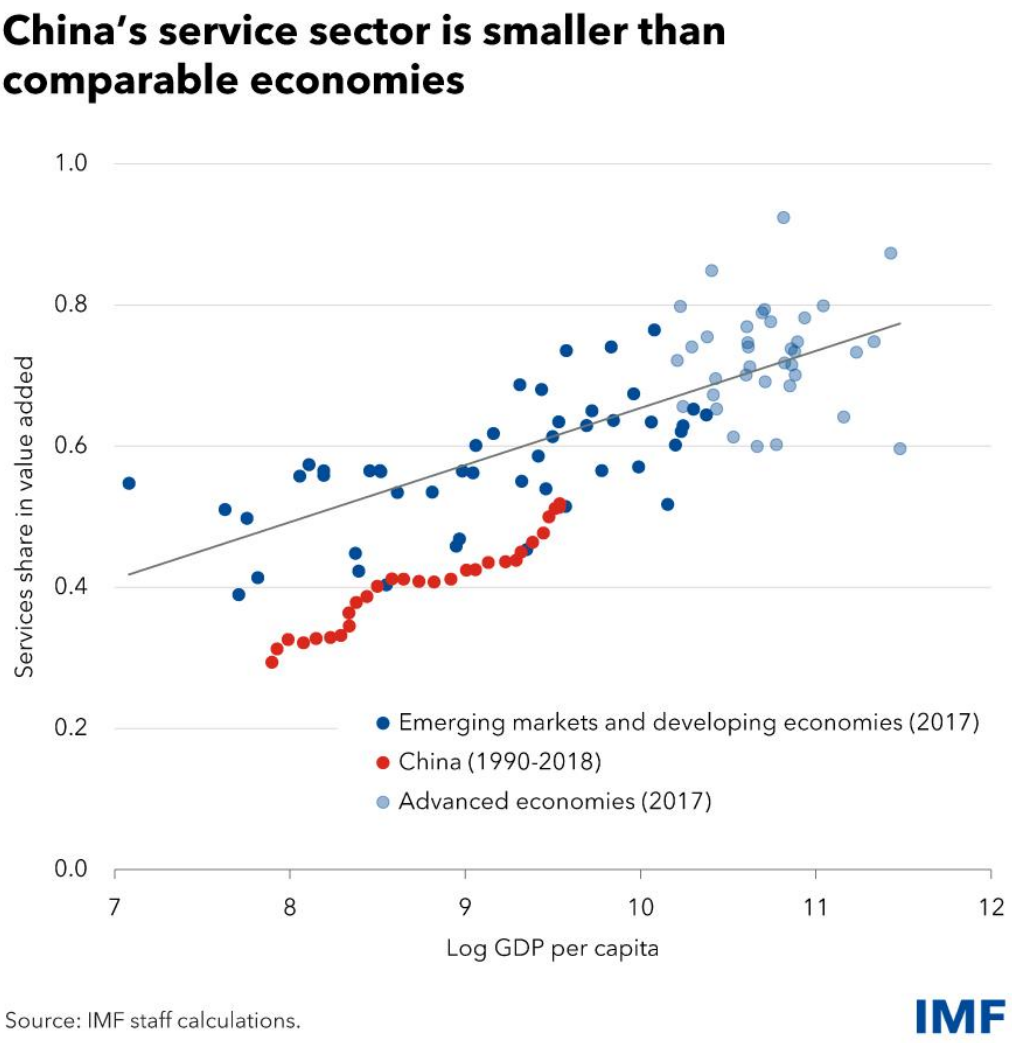
Given these circumstances, the country's service sector is an underexploited driver of growth—which was also recognized at the Third Plenum. Reallocating resources to services has helped boost productivity over the past two decades. And it can continue doing so in the years ahead if supportive reforms are implemented.

Expanding the service sector can also help put more people to work—especially young people, who are disproportionately employed in service sectors like technology and education. Moreover, since emissions are lower in services, expanding the sector would help China reach its climate goals more efficiently.

China does have significant further potential for expanding services, as we show in our latest annual review of the world's second-largest economy. While the sector's share of value-added to the economy has increased in recent years to just over 50 percent, it is still well below the average of about 75 percent for advanced economies.

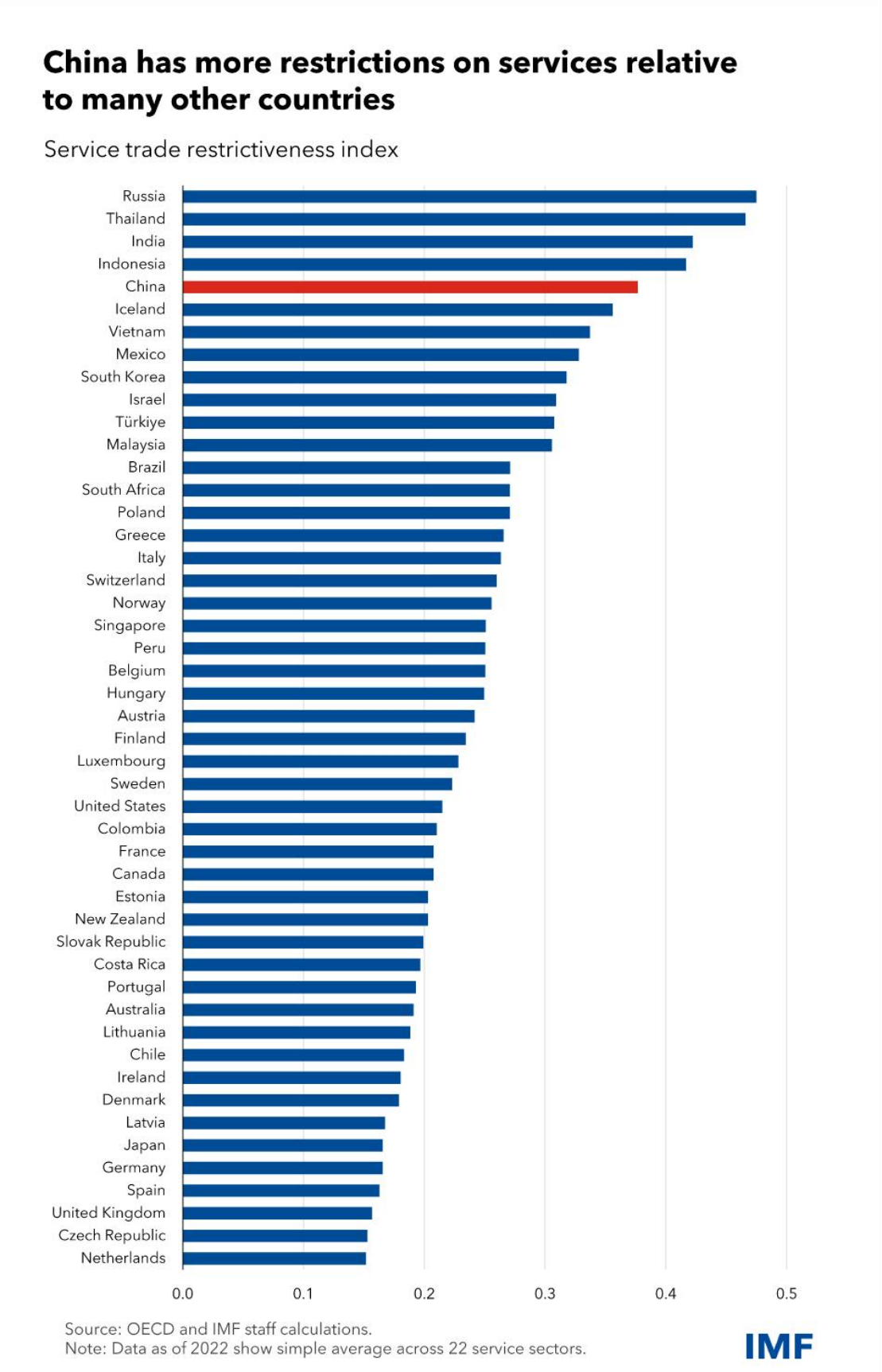
* This article first appeared at China Daily on 2 August, 2024.

* Sonali Jain-Chandra is the IMF mission chief for China. Siddharth Kothari and Natalija Novta are senior economists for China in the Asia and Pacific Department.



Even though service sector firms have been highly innovative in China, company-level data indicate that the allocation of capital and labor across firms has been increasingly less efficient in the sector. This means that highly productive firms have been too small on average, suggesting difficulties attracting new capital and labor, while less productive firms were cornering too large a share of the market.

China should therefore prioritize reforms to improve the allocation of capital and labor in services. The sector remains subject to more onerous regulations compared with members of the Organisation for Economic Co-operation and Development, including restrictions on domestic and foreign entry as well as significant regulatory hurdles. Easing regulatory requirements, further reducing local protectionism, and allowing more businesses to enter and compete in services—including reduced trade and foreign entry restrictions—can boost productivity and support growth.



China should also prioritize rebalancing the economy to strengthen demand for services. Improving social safety nets and making taxes more progressive would reduce the need for precautionary savings,

especially by middle- and lower-income households, and allow greater spending on services. Increased coverage and better unemployment and medical benefits would further boost consumption. In this context, this year's increase in old-age benefits by 19 percent for rural and non-working urban residents is a small but welcome step.

Overall, the service sector can create jobs and drive sustainable growth in China. Ideally, policies to help rebalance demand toward consumption would be combined with reforms that lower barriers to entry and ease other regulatory restrictions that have prevented capital and labor from being efficiently allocated in the past. We estimate that a comprehensive package of market-based structural reforms, enhancements to the social safety net, and pension reforms can raise the GDP by close to 20 percent over the next 15 years relative to the baseline, or about 1 percentage point higher potential growth per year over the medium term.

October 2024
Vol.11, No.4

China Looks Inward for Technology, Investment and Know-how*

By HERBERT POENISCH*

Third plenum heralds major policy shift

China's delayed 2024 third plenum yielded a communique long on intentions and commitments but short on specifics. It listed 'modernisation of the tax system' without explicitly offering a fair fiscal balance between central and local authorities to solve the indebtedness of local governments. It offers no new policy proposals but, nevertheless, a new direction under Xi Jinping's leadership is taking shape, one that is possibly as decisive as previous plenums.

The first third plenum under the leadership of Deng Xiaoping in 1978 marked a departure from Chairman Mao Zedong's inward-looking development based on self-reliance. It opened China to the world economy, inviting technology, know-how and investment. This resulted in China lifting hundreds of millions out of poverty over the last 40 years and becoming the second-biggest economy in the world.

The 2013 third plenum was another important development and the first overseen by President Xi. Markets were given a 'decisive role', producing great expectations in western observers. This was boosted by Xi's commitment to globalisation in 2017 at the World Economic Forum in Davos, contrasting the protectionist stance of US President Donald Trump.

At the time it was seen as the key indicator that China would make strides in opening up economically, especially when Xi stated that the private sector should be treated on the same footing as state-owned enterprises.

Since then, painful experiences with market functioning have led to a re-appraisal of the private sector and the role of markets. First, Xi's commitments pronounced in 2013 damaged the confidence of China's private sector. Second, the financial crises of 2015 led to a sweeping crackdown on fintechs, such as Ant Finance, but also private tutoring and video gaming, sending chills through the industries and sparking a multi-trillion-dollar market wipe-out. China's real estate sector indebtedness is also a market failure but so far there has been no crackdown because of the ramifications for millions of ordinary Chinese people and the state-owned banking sector. All of them got to stay afloat.

Looking inward

However, the new phrase in the 2024 communique is 'better leverage' over the markets. They have to fit into the new priorities of 'further deepening reform comprehensively to advance Chinese modernisation'. This is part of a new development philosophy achieving 'high-quality economic development' and 'all round innovation' based on science and technology.

The decisions of the third plenum summarising the new development philosophy are not new – they have been expressed by Xi on many occasions. This is the principle of pursuing progress while maintaining stability, ensuring both development and security, the dual circulation of domestic and international imperatives, advancing socialist democracy as consultative democracy based on the rule of law, ensuring people's well-being by boosting common prosperity, national security and social stability, developing national defence and the armed forces, advancing work related to Hong Kong, Macao and Taiwan, protecting the environment and, finally, strengthening the governance and leadership of the Chinese Communist Party.

Given the current geopolitical environment and fragmentation of the global economy, these proposals go back to the old Chinese adage 'zili gengsheng', meaning: to rely on your own strength makes you even more resilient. This is much older than Communism and dates back to imperial times.

The bottom line is that, by reducing dependence on foreign technology, funding and know-how, China will mobilise its own resources and come out even stronger. Once it achieves this, the rest of the world will follow. We are already witnessing this as China has become the main trading partner of some 150 countries and is offering leadership in an increasingly fragmented world. A new world order with Chinese characteristics is shaping up.

---

* This article first appeared on 23 July 2024.

* Herbert Poenisch is Senior Fellow, Zhejiang University, and former Senior Economist, Bank for International Settlements.

IMI International Monetary Review

Global Economy

Slower Productivity Growth in the World's Largest Economy Threatens to Reverberate around the Globe

By GITA BHATT

The US economy has a multitrillion-dollar problem. It's the dramatic slowdown in productivity growth over the past couple of decades. Between 1947 and 2005, labor productivity in the US grew at an average annual rate of 2.3 percent. But after 2005, the rate fell to 1.3 percent. Such seemingly small differences have astonishingly large consequences: if economic output for each hour worked had kept expanding at 2.3 percent between 2005 and 2018, the American economy would have produced $11 trillion more in goods and services than it did, according to the US Bureau of Labor Statistics.

This is part of a broad-based trend across advanced economies. Productivity growth in Europe has been even slower than in the US. As a consequence, Europe has fallen significantly behind the US in terms of GDP per capita. Productivity is a key driver of economic expansion. Its anemic performance in the world's largest economy threatens to send ripples around the globe and into developing economies, where growth is key to lifting millions of people out of poverty.

What's behind the stubborn stall in productivity growth in the US and other advanced economies? Research points to two developments. One is that the rapid deployment of advanced information technologies helped big established businesses at the expense of smaller start-up companies. Another is falling population growth and changing demographics, which reduced the speed of new business creation. Together, those factors led to a decline in creative destruction, an important element of innovation as identified by the early 20th century economist Joseph Schumpeter. This sapped dynamism from the US economy.

There are two key measures of productivity growth, which are closely related. The first is labor productivity, or the simple computation of real output per hour of work. The second is total factor productivity (TFP), which also takes into account changes in capital intensity and capacity utilization.

Labor productivity and TFP have evolved in tandem since the 1940s (see Chart 1). Labor productivity gains slowed from the range of 3–3.5 percent a year in the 1960s and 1970s to about 2 percent in the 1980s. In the late 1990s and early 2000s, the US economy experienced a sizable but temporary productivity boom as productivity growth rebounded to 3 percent. Since about 2003, productivity gains have been lackluster, with labor productivity slowing to an average growth rate of less than 1.5 percent in the decade after the Great Recession. Recent economic shocks such as COVID-19 and surging energy prices since the war in Ukraine had a notable impact on employment and inflation dynamics. However, productivity growth has been relatively unaffected and has remained low. Changes in TFP closely mirror the fluctuations in labor productivity growth. While labor productivity growth always exceeds that of TFP because of increases in capital intensity, falling TFP growth drives the decline in labor productivity gains.

Understanding the causes of the slowdown is crucial because of the high economic stakes. It's also vital for determining whether governments and central banks have effective policy tools to address the issue or whether they must prepare for a prolonged period of lower growth.

Creative destruction

Recent research suggests that changes in the process of creative destruction and reallocation across businesses might hold the key to understanding the productivity slowdown. Aggregate TFP reflects the economy's state of technology and the efficiency of resource allocation. Intuitively, aggregate productivity can be low either because the technologies enterprises use are inefficient or because some businesses may have access to productive techniques, but market imperfections prevent them from displacing less efficient competitors. Productivity growth can stem from the arrival of new and better technologies or from reallocation of resources from unproductive to productive companies.

There is growing evidence that the US economy is not as dynamic as it used to be. A key aspect of business dynamism is new business formation. It is often measured by the entry rate, or the share of enterprises that started operating in a given year. The entry rate fell from 13 percent in 1980 to 8 percent in 2018, according to the US Census Bureau. In addition, US enterprises became substantially larger, with the average number of employees rising from 20 in 1980 to 24 by 2018. Older and bigger companies thus account for a much larger share of economic activity than they used to. These trends indicate significantly declining dynamism in the US economy over almost four decades.

This raises two critical questions. First, why does a decline in business dynamism correlate with a slowdown in productivity growth? Second, what are the fundamental factors driving these trends?

Proximate causes

The link between productive churn, business-to-business reallocation, and aggregate growth lies at the heart of Schumpeter's famous concept of creative destruction, in which new enterprises develop innovative technologies aiming to displace incumbent producers and take their market share. Aggregate productivity growth and markers of business dynamism such as churning and turnover at the company level are therefore two sides of the same coin.

From that perspective, the slowing formation of new businesses and the expanding role of older, bigger companies are exactly what one would expect in times of low productivity growth. The falling entry rate is an indication that the arrival of new technologies might be slowing. And given that entrants are of course younger and, on average, smaller than incumbent businesses, a decline in the entry rate naturally leads to an increase in business size and a rise in concentration.

A large and growing body of research provides additional evidence. First, the rise in corporate concentration has been shown to go hand in hand with expanding market power. The average markup by publicly traded US companies surged from about 20 percent in 1980 to 60 percent today. Large incumbent businesses thus seem to be shielded more and more from competition, allowing them to jack up prices and widen profit margins.

A second line of research shows the flip side of rising corporate market power: the weakening of workers' bargaining position. Since 1980, labor's share of the US economy has fallen by about 5 percentage points. The plunge was faster in industries that experienced more concentration, where large superstar firms such as Google, Apple, Amazon, and Walmart grew the most—as documented by the Massachusetts Institute of Technology's David Autor and his research partners.

Third, there has been a secular decline in business-to-business reallocation since the late 1980s, as shown in a series of papers by John Haltiwanger and other researchers. This suggests that the process of workers moving from declining to expanding businesses is not as fluid and dynamic as it once was.

These patterns are consistent with the view that creative destruction has been decreasing and that business dynamism and aggregate productivity growth fell as a consequence. If incumbent businesses face less competition from entrants, they have an easier time building a dominant market position. This allows them to expand markups, profit margins, and (eventually) corporate valuations. Because higher profits cut into the share of output paid to workers, a shrinkage in labor's share of the economy will ensue, especially in the most concentrated industries.

Fundamental causes

Even if one were convinced that the productivity slowdown and the decline in business dynamism were driven by a fall in creative destruction, the main question is, Why? Answering this question is particularly important for policymakers seeking clues as to what they can do to reverse these trends.

Researchers have considered four broad explanations:

1. The advent of information technology and resulting economies of scale
2. Changes in the process of knowledge diffusion
3. Demographics and falling population growth
4. Changes in policies, such as regulatory entry costs or tax incentives for research and development

While these explanations are not mutually exclusive—and presumably are all relevant in the real world—it is useful to discuss them separately.

IT and economies of scale: In discussing the productivity dynamics of the 1980s and 1990s, the advent of IT is the elephant in the room. Could the availability of such technologies have caused the decline in dynamism and the peculiar boom-bust shape of productivity growth? Two recent papers argue that the answer is yes and that economies of scale play an important role. French economist Philippe Aghion and his research collaborators (2023) posit that advanced IT makes it easier for businesses to scale their operations across multiple product markets. The London School of Economics' Maarten De Ridder (2024) argues that IT allows enterprises to reduce their marginal costs of production at the expense of higher fixed costs.

What these explanations have in common is that the adoption of such technologies is particularly valuable for productive companies. This implies that such businesses took advantage of IT developments in the late 1980s and early 1990s, and the economy experienced an initial productivity boom. More surprisingly, the researchers argue that the existence of these megabusinesses can have dynamic costs in the long run. If new businesses (such as a new IT start-up) expect that they will have a hard time competing with existing enterprises that produce at scale (such as Amazon, Microsoft, or Google), their incentives to enter the market shrink. As a result, overall growth and creative destruction can decline, and incumbent companies benefit by charging higher markups.

Changes in knowledge diffusion: A separate strand of research suggests that the process of knowledge diffusion among businesses has changed in fundamental ways. In particular, the argument goes, in recent decades technologically lagging companies had a harder time adopting technologies of competitors at the productivity frontier. This change could be technological in nature: companies such as Google or Apple may be so technologically advanced that adoption simply becomes impossible for smaller rivals. At the same time, it could also have legal origins, as large businesses increasingly engage in defensive patenting to protect their technological lead by creating a dense, overlapping thicket of patents. Consistent with this hypothesis, Ufuk Akcigit and Sina Ates (2023) document a substantial rise in the concentration of patenting among superstar firms and estimate that changes in technological adoption can explain why dynamism has declined, why incumbent enterprises enjoy noncompetitive rents, and why productivity growth has fallen.

Slowing population growth: While those explanations link changes in creative destruction and slower productivity growth firmly to changes in the technological environment, some recent papers advance an entirely different explanation. These researchers argue that both the slowdown in productivity gains and the decline in dynamism reflect falling US population growth.

Expansion of the US population has plunged since the 1960s and has reached a historic low in recent years. That falling population growth should lead to falling productivity growth is the hallmark of most theories of economic expansion. My colleague Conor Walsh and I showed in 2021 that slowing population growth also reduces creative destruction and business dynamism by causing a decline in the entry of new businesses. Other researchers have compiled direct empirical evidence on the relationship between population growth, the rate of new business formation, and the resulting process of business dynamics.

Policy changes: Finally, one could think of many changes in policies that could have triggered a decline in business creation and consequently a decline in growth, creative destruction, and dynamism. Examples are changes in regulation, such as licensing requirements; R&D subsidies that benefit incumbents rather than potential entrants; and changes in corporate taxes.

While such policies might be important for specific industries, it seems unlikely that they would offer a significant explanation at the aggregate level. Recent research shows that the observed changes in such policies cannot quantitatively account for the productivity slowdown and the decline in dynamism. More important, the productivity slowdown and the decline in dynamism are not exclusively US phenomena. They also occurred to varying degrees in most developed economies.

Occam's razor

The 14th century principle of Occam's razor—that the simplest explanation is the most likely—suggests focusing on changes that occurred globally rather than policy changes specific to the US. The development of advanced information technology and declines in population growth fit that bill and are most likely to have played an important role in the drop in business dynamism and the slowdown in productivity growth.

Those developments also highlight the potential for specific policies to counter these trends. With respect to changes in demographics, policymakers around the world are already acutely aware of the rising costs of aging populations. While this debate centers mostly on concerns about fiscal sustainability, the economic consequences could be much more pronounced if falling population growth indeed leads to falling productivity growth. Given the limited success of policies to reverse declining fertility, the main policy lever available in the short to medium term is likely to be immigration policy.

By contrast, the policy options related to the ramifications of the IT boom are more specific and arguably directly related to antitrust enforcement. If information technologies indeed caused the increase in concentration, with adverse consequences for productivity growth, the rise in market power harms consumers not only through higher prices but also through slower innovation and growth. This, of course, raises the stakes of competition policy because how to counter the growth slowdown is, quite literally, a trillion-dollar question for policymakers.

IMI International Monetary Review

Laying Foundation for a Fair and Just World Order*

By RANA MOHAMED*

China-Africa relations are a strong evidence of cooperation and mutual benefit, and an example of the institutionalization of a new type of relationship based on common development. China-Africa relations have the potential to transform the entire Bretton Woods system, and establish a fair, just and truly representative world order based on mutual trust and international values, different from Western values which have long been dividing the world.

A fair, just and truly representative world order can be established only if all countries have the political will to promote common interests and win-win cooperation.

Sino-African relations are distinguished by the breadth and depth of their partnership, including "strategic" and "comprehensive strategic" partnership, across a wide range of sectors. The patterns of Sino-African relations continue to advance, driven by global economic and geopolitical trends.

The economies of China and Africa are complementary, with Africa being rich in natural resources and raw materials and having a huge market, and China being a global leader in manufacturing, and clean energy and green products. The China-proposed Belt and Road Initiative and Chinese investments in African countries have helped improve infrastructure, boost agricultural and industrial production, and create hundreds of thousands of jobs.

Since China has comparative advantages in advanced technology, capital and technical expertise, African countries should focus on how to benefit from China's engagement with the continent and raise their competitiveness in the international markets.

The key difference between China and the United States in their engagement with Africa is that the former has adopted an open approach to its relations with African countries, which has allowed it to better understand the needs of the African people and tailor its cooperation and collaboration with Africa accordingly. This is in stark contrast to the carrot-and-stick approach used by the US and some other Western countries to coerce the African nations into serving the West's interests.

China's approach differs from other countries' approaches due to many reasons. First, unlike Western economies, China does not dictate conditions or set political terms for providing loans or aid for African countries, or for engaging in commercial activities in Africa.

Second, China has honored its promise of establishing "win-win" partnerships with African countries, especially by investing in projects to construct and/or improve infrastructure facilities by building roads, bridges, ports, hospitals and schools. Steadily growing Chinese investments in African countries indicate that the Chinese people are responding to the development needs of African countries.

Third, China-proposed initiatives such as the Belt and Road Initiative, the Global Development Initiative, the Global Security Initiative and the Global Civilization Initiative have been promoting greener, healthier and sustainable development in Africa.

And fourth, China has adopted a unique approach to providing development aid and financing for African countries, as it mixes private grants, interest-free loans (preferential loans), and concessional loans to finance students' higher studies, and improve the agriculture and mining sectors.

The two sides, however, face some challenges, too, with the most prominent being the huge knowledge gap between them. But China has taken actions to bridge the gap by organizing training camps for talents, giving scholarships to promising students, and opening new schools and other educational institutes.

Sino-African relations, in short, are the pillars on which a new, fair and truly representative world order will be built which in turn will help build a global community with a shared future.

---

* This article first appeared at China Daily on 9 September 2024.

* The author is an associate professor of Political Science in a university in Egypt.

October 2024
Vol.11, No.4

FOCAC a Platform for Fruitful Cooperation*

By HANS SEESAGHUR*

Through joint efforts under the frameworks of the Forum on China-Africa Cooperation, the China International Import Expo and the China-Africa Economic and Trade Expo, China and Africa have made continuous and solid progress in fields such as industry, agriculture and health, epitomizing the unique resilience and vitality of African countries and their relations with China.

In 2018, Shanghai Greechain Information Science and Technology Ltd introduced Kenyan avocados at the first China International Import Expo in Shanghai, where the fruit drew a lot of attention. Shortly after, a trade delegation led by Kenya's president signed an agreement with Greechain to export Kenyan agricultural products to China. The whole process was beset with difficulties and it took the company more than half a year to negotiate tariff reductions with Chinese customs, finally getting the tariff reduced from 30 percent to 7 percent. Quarantine was another bottleneck the two sides cleared.

Thus, at the Eighth Ministerial Conference of the Forum on China-Africa Cooperation in November 2021, China announced the establishment of a "green channel" which would allow African countries to export agricultural products to China.

In August 2022, the first shipment of fresh avocados from Kenya was dispatched to China. Today, China accounts for nearly 30 percent of Kenya's avocado exports and the fruitful trade has increased Kenya's foreign exchange earnings and benefited the country's farmers.

China is now the second-largest market for African agricultural exports and Kenya the largest exporter of avocados on the continent. Also, China is determined to cultivate new markets linking China and African countries, especially in agriculture.

Shortly after the third China-Africa Economic and Trade Expo in 2023, Benin's President Patrice Talon paid a visit to China, during which he secured a new agreement granting permission to export the West African country's fresh pineapples to China.

Beninese pineapple was the second African fruit to benefit from the "green channel" proposed in FOCAC 2021. The Benin Sugar Loaf variety made its debut through the 6th China International Import Expo and was majestically welcomed by Chinese consumers since it has almost no acidity in comparison with Asian pineapples.

In 2023, as per Ministry of Commerce data, China's fruit imports amounted to $16.85 billion, up 15 percent year-on-year. African countries have been benefiting from Chinese customers' growing appetite for fruits.

Mauritian Victoria pineapples, benefiting from a zero tax through the Mauritius-China Free Trade Agreement, might make its debut at the forthcoming 7th China International Import Expo if facilitated by the "green channel" proposed at the 8th FOCAC meeting in 2021. This will further show China's commitment to boosting fruitful cooperation with African nations.

With Chinese consumers having a preference for fresh fruits, Mauritius as well as other African countries can increase the production of value-added products such as syrups and powders, which are used in China's popular bubble tea. This can create an opportunity for Chinese investors to invest in the production of pineapples from Mauritius to other countries that have free trade agreements with Mauritius.

As leaders from China and African countries gathered in Beijing for the FOCAC Summit, the event will chart the course for fruitful cooperation among China and African countries, which will improve the well-being of the people in Africa, home to the world's largest number of developing countries.

---

* This article first appeared at China Daily on 7 September 2024.

* The author is former economic and commercial counselor at the embassy of Mauritius in Beijing and former China chief representative at the Mauritius Economic Development Board Representative Office in Shanghai. The views don't necessarily reflect those of China Daily.

IMI International Monetary Review

India at an Inflection Point - Some Thoughts*

By SHAKTIKANTA DAS*

I am happy to be back at the FIBAC annual conference. This conference is special as it brings together industry leaders, financial sector players and regulators on a single platform to discuss vital issues of contemporary relevance. I

The Indian economy is now at a critical juncture. Massive changes are taking shape in various economic sectors and markets; and the country is geared for orbital shifts. Our nation's journey towards becoming an advanced economy is drawing strength from a unique blend of factors: a young and dynamic population, a resilient and diverse economy, a robust democracy, and a rich tradition of entrepreneurship and innovation.

In this background, I have chosen to speak on the topic "India at an Inflection Point: Some Thoughts". I have structured my talk under four major themes. First, I would speak on India's growth prospects and the approach that we need to follow going forward. Second, I would dwell upon recent developments in inflation and monetary policy. Third, I propose to highlight certain issues relating to strengthening our financial sector. Finally, I would spell out certain expectations from the financial sector.

I. Growth Prospects

The Indian economy rebounded strongly from the COVID-19 induced contraction, growing at an impressive annual average rate of 8.3 per cent during the last three years. For the current financial year, the Reserve Bank has projected a growth rate of 7.2 per cent. The IMF has also revised India's GDP growth upwards to 7.0 per cent, citing improved prospects for private consumption, particularly in rural areas. Two days ago, the World Bank has also upgraded India's growth forecast to 7.0 per cent for 2024-25.

The National Statistical Office (NSO) has placed India's GDP growth at 6.7 per cent in Q1 of 2024-25. Notwithstanding the moderation in growth from the previous quarter and below our projection for Q1, the data shows that the fundamental growth drivers are gaining momentum. This gives us confidence to say that the Indian growth story remains intact.

Private consumption, which is the mainstay of aggregate demand with a share of around 56 per cent in GDP, has rebounded to 7.4 per cent growth from a feeble 4 per cent growth in the second half of the previous year. This reconfirms the revival of rural demand. The other important driver of growth, i.e., investment, which accounts for around 35 per cent of GDP, grew at 7.5 per cent, keeping up with its recent momentum. Thus, more than 90 per cent of GDP expanded at a robust pace and materially above 7 per cent. The headline number, however, came lower against the backdrop of muted government expenditure of both the Centre and the States, perhaps due to the Lok Sabha elections. Excluding government consumption expenditure, GDP growth works out to 7.4 per cent.

On the supply side, while agriculture grew modestly at 2 per cent in Q1, it is likely to perform better, going forward, on the back of good progress of monsoon, improved kharif sowing, and good moisture conditions for rabi crops. Industry and services recorded a growth of 7.4 per cent and 7.7 per cent respectively in Q1, underscoring continued strength in economic activity. Construction activity remained robust growing at 10.5 per cent.1

According to the RBI's latest data2, bank credit to agriculture and allied activities remained robust and increased by 18.1 per cent (y-o-y). Credit to industry surged by 10.2 per cent (y-o-y) in July 2024 as compared to 4.6 per cent in July 2023. Within industry, credit to MSMEs also grew at 14.4 per cent (y-o-y). Bank credit to industries such as chemicals and chemical products; food processing; petroleum, coal products and nuclear fuels; and infrastructure has been quite strong in July 2024. The

---

* Inaugural address by Mr Shaktikanta Das, Mumbai, 5 September 2024.

* Shaktikanta Das, Governor of the Reserve Bank of India, at the Annual Financial Institution Benchmarking and Calibration (FIBAC) 2024 Conference, organised jointly by the Federation of Indian Chambers of Commerce and Industry (FICCI) and the Indian Banks' Association (IBA).

enhanced credit flow to industry along with an all-time high-capacity utilisation points to an upturn in the investment cycle, as reflected in the NSO data.

It is evident that India is on a sustained growth path. Consumption and investment demand, the two main drivers of growth, are growing in tandem. Government expenditure of the centre and the states is likely to pick up pace in line with the Budget Estimates in the remaining quarters of the year. Strong balance sheets of banks and corporates have created congenial conditions to further support private capex. Corporate profits (net) have grown by 14.2 per cent in Q1:2024-25.3 Government capex continues to be strong. Overall, the Reserve Bank's projection of GDP growth at 7.2 per cent for 2024-25 does not appear out of place.

As regards growth prospects in the medium to long-term, it is felt that the Indian economy is on the cusp of transformational shifts. The fact that growth is on a rising trend, despite modest global growth and continuing global challenges, shows that structural drivers are playing a bigger role in India's macroeconomic outcomes. These drivers include: policy push on creating robust physical infrastructure; our fast growing digital public infrastructure; innovation and technological advancements across sectors; and critical reforms in key areas.

To realise the aspiration of transitioning from an emerging to an advanced economy by 2047, the Indian economy would need a multi-pronged and a multi-sectoral approach. Our focus should be on employing all engines of growth from both supply and demand sides. The supply side focus must encompass agriculture, industry and services. We should be mindful of the fact that agriculture possesses huge potential in India. Agri-commercial activities in horticulture, edible oils, dairy, poultry, food processing, etc. could be the focus areas. Our approach should be to enhance productivity as well as quality of our produce so that we gain a significant share in world exports, while meeting our domestic requirements.

The potential contribution of manufacturing will be pivotal to generate additional employment. Initiatives such as 'Make in India', 'Start up India', 'One District One Product (ODOP)' and 'Production Linked Incentive (PLI)' scheme, among others, are helping the manufacturing sector gain competitiveness and grow faster. The MSME sector, in particular, holds a lot of promise to step up growth and employment opportunities. Overall, the manufacturing sector must take the lead in niche areas to compete globally.

The services sector, which has remained the mainstay of growth over the last several decades, must explore new vistas of opportunities with focus on higher value-added services. In addition, requisite focus on research and development (R&D) is also vital for productivity and competitiveness. Together with government initiatives, including higher fund allocations for R&D, the private sector may also be an active partner in this field.

As I stated earlier, key demand drivers like consumption, investment and exports of goods and services will have to move in tandem. Higher domestic consumption would help insulate the economy from the vagaries of external uncertainties. Investment remains critical for sustainable growth of the economy and, given the current confluence of favourable factors, it is time for the private corporate sector to come forward in a big way. The potential of external demand can be utilised to our advantage by getting integrated into the global supply chains.

A holistic approach to nurture and accelerate a broad-based growth of the economy would also necessitate preservation of the gains of past reforms and accelerating India's reform journey with more reforms. From an economic perspective, reforms that have imparted paradigm shifts and buttressed our stability and growth story would include: (i) shifting from administered exchange rate of the rupee to a market determined regime; (ii) stoppage of automatic monetisation of budget deficit financing by the Reserve Bank; (iii) enactment of the FRBM Act; (iv) introduction of the flexible inflation targeting framework; (v) enactment of the Insolvency and Bankruptcy Code (IBC); and (vi) implementation of the Goods and Services Tax (GST). Each of these six reforms have yielded long term positive outcomes. These reforms need to be augmented by reforms in land, labour and agricultural markets. While we have made some progress in these areas, lot more needs to be done both at the national and sub-national levels. Improvements in ease of doing business, especially at local levels, will boost our competitiveness.

II. Inflation and Monetary Policy

In early 2022, the flare up in food, commodity and energy prices, following the outbreak of the war in Ukraine, led to a sharp increase in inflationary pressures. This was further compounded by a series of adverse domestic weather shocks. The decisive steps taken by the Reserve Bank, supply side measures from the government and cooling of international commodity prices have led to downward shift in inflation from early 2023-24. Nevertheless, the pace of disinflation is frequently interrupted by volatile and elevated food inflation. It is the headline inflation that matters. It is the headline inflation with food inflation having a weight of 46 per cent that the people understand. With the monsoon progressing well and the healthy kharif sowing raising prospects of better harvest, there is greater optimism that food inflation outlook could become more favourable over the course of the year.

We have to remain watchful of how the forces impacting inflation play out. The balance between inflation and growth is well-poised. We must successfully navigate the last mile of disinflation, and preserve the credibility of the flexible inflation targeting (FIT) framework which is a major structural reform. The best contribution that monetary policy can make for sustainable growth is to maintain price stability.

III. Financial Sector – Strengthening the Foundations for Future

India's financial sector has repeatedly demonstrated its ability to overcome challenges and crises. The financial sector showed remarkable resilience during and in the aftermath of the COVID-19 pandemic. Today, all key indicators of the financial sector demonstrate its robust health4. This resilience, combined with other forces, can act as critical driving forces for India's future.

In this milieu, the financial sector needs to even further deepen financial inclusion, broaden access to credit and other financial products, and support overall inclusive growth. It also needs to drive innovation in digital banking, foster sustainable finance, and build a robust financial ecosystem that can withstand emerging challenges and facilitate a higher trajectory of growth.

With the financial sector now in a strong position, it is our collective responsibility to safeguard this stability, especially in an environment of heightened global uncertainty. Financial institutions must continuously assess and refine their business models, recognise and deal with the emerging risks, and remain focused on capitalising on every new opportunity.

This brings me to the important issue of inclusive growth. While traditional metrics of economic growth like GDP and per capita GDP are important indicators of progress, they alone do not capture the full picture of what it means for a nation to be truly developed.

India has made remarkable5 progress in extricating people out of poverty. A truly developed India must ensure that every citizen, regardless of their socio-economic status, has access to financial services and has the required financial literacy. By expanding access to banking, credit and insurance, and by harnessing the power of digital platforms, the financial sector can drive inclusive growth that extends to the most marginalised sections.

The Priority Sector Lending (PSL) programme remains crucial in addressing credit gaps for underserved segments. Introduction of Business Correspondents (BCs) has further enhanced financial outreach. The Financial Inclusion Index, introduced by the Reserve Bank, has improved from 53.9 in 2021 to 64.2, reflecting the strides made in providing access to financial services. There is, however, still more to be done to improve the usage and quality of these services.

Two more key drivers need to be prioritised: enhancing financial literacy and leveraging technology. The Reserve Bank has engaged in both self-driven and collaborative approaches to promote financial literacy. We run multimedia public awareness campaigns and outreach programmes as well as targeted financial literacy awareness programmes. Collaborating with other financial regulators, the Reserve Bank has assisted in establishment of the National Centre for Financial Education (NCFE) to bolster financial literacy efforts. With the support of banks and NGOs, 2,421 Centres for Financial Literacy have also been set up, covering almost all the blocks in the country.

On the technology front, the Reserve Bank has taken a number of initiatives to facilitate development of digital public infrastructure and innovation. The Unified Payments Interface (UPI) has revolutionised the digital payments space. Other initiatives like the Regulatory Sandbox and the Innovation Hub, have fostered a robust environment for enriching our fintech ecosystem. The commencement of the Reserve Bank's pilot project for frictionless credit, i.e. the end-to-end digital

platform of the Unified Lending Interface (ULI) is expected to revolutionise access to credit, especially for farmers and MSMEs.

IV. Expectations from the Financial Sector

Having spoken about safeguarding financial stability and financial inclusion, I would now like to highlight some specific areas where I believe the financial sector can contribute to India's growth aspirations.

(a) Improving female labour participation

India's female labour force participation remains lower than the global average. This gap underscores the urgent need for targeted initiatives such as improving girls' education, skill development, workplace safety, and addressing societal barriers.

Entrepreneurship is a vital component of economic empowerment; yet in India, less than one fifth of MSMEs are owned by women. Women entrepreneurs often face significant challenges including limited access to capital, restrictive societal norms, and difficulties in accessing affordable finance. The financial sector has a crucial role to play in bridging this gender gap by implementing supportive policies, creating tailored financial products, and leveraging fintech innovations to offer better access to finance. This can be pursued on two fronts – one, by providing higher employment opportunities to women in financial institutions; and two, by supporting women entrepreneurs, through Government sponsored schemes as well as banks' own schemes tailored to suit businesses promoted by women. Banks could also actively explore onboarding larger number of women BCs i.e. 'bank saathis' or 'sakhis', especially from among SHG members.

(b) Supporting MSMEs

With our large young population, we need to fully tap the potential of MSMEs to drive employment and economic development. Despite their importance, many MSMEs remain small-sized and unable to scale up effectively due to various challenges, with access to affordable finance being one of the barriers.

The financial sector may play an active role in supporting MSMEs. Banks and financial institutions may develop tailored financial products and services that cater specifically to the needs of MSMEs. This includes offering flexible credit options, improving access to working capital, and providing financial support that accommodates the unique cash flow cycles and growth stages of MSMEs. This can propel MSMEs to expand, enhance their productivity, and contribute more significantly to job creation.

Conclusion

Let me now conclude. The Indian economy is forging ahead with macroeconomic and financial stability, and a favourable growth-inflation balance. The policy mix pursued in the recent years has strengthened the underlying fundamentals of the economy and augmented the buffers. Consumption, which had been our main driver of growth, has picked up pace, with recovery in rural demand. Investors' confidence is at an all-time high; banks and corporates demonstrate robust balance sheets; and structural reforms are playing a big role in pushing forward our growth frontier.

We are living in a dynamic and uncertain world, and we need to remain vigilant and continue to build stronger buffers. New opportunities are knocking at our doors and when I look at the entrepreneurial zeal and the talent of our younger population, it makes me more confident of India's long-term growth prospects.

---

1 After growing by 9.9 per cent during 2023-24, construction activity continued to grow at a rapid pace of 10.5 per cent in Q1 of 2024-25.

2 Sectoral Deployment of Bank Credit- July 2024 (data released by RBI on August 30, 2024)

3 Net profits of 2,934 listed private non-financial corporates grew by 14.2 per cent in Q1: 2024-25 as against 6.4 per cent in Q4:2023-24. (Performance of Private Corporate Business Sector during Q1:2024-25, released by RBI on August 30, 2024)

4 GNPA ratio of banks was 2.7 per cent at end-June 2024, the lowest since end-March 2011. The annualised slippage ratio, which measures new NPA accretions as a percentage of standard advances, continued to decline to reach at 1.3 per cent at end-June 2024. The provision coverage ratio (PCR) continued to improve to reach at 76.5 per cent by end-June 2024. Capital to risk-weighted assets ratio

(CRAR) stood at 16.8 per cent at end-June 2024, much above the regulatory threshold. The annualized profitability indicators, namely, return on assets (RoA) and return on equity (RoE) stood at 1.4 per cent and 14.2 per cent, respectively, at end-June 2024, showing continued improvement.

5 As per a discussion paper on Multidimensional Poverty in India released by the Niti Aayog, Multidimensional poverty in India was found to decline from 29.17 per cent in 2013-14 to 11.28 per cent in 2022-23 with about 24.82 crore people escaping poverty during this period. Mutlidimensional Poverty in India since 2005-06 - A Discussion Paper By Prof. Ramesh Chand and Dr. Yogesh Suri, Niti Aayog, January 2024.

Finance

Sovereign Index Inclusion will be a 'Game-changer' for EU Bonds*

By BURHAN KHADBAI*

Government bond status would create structural demand for bloc's capital markets borrowing

While the European Union was dealt a blow earlier this year when both Intercontinental Exchange (ICE) and MSCI declined to add the EU to its government bond indices, there is hope that the EU will still achieve sovereign index inclusion sooner rather than later – perhaps as early as 2025. Such a move would have the single biggest impact to the EU's bonds, making it attractive to global investors and increasing its demand, performance and liquidity.

'The major game-changer will be the index inclusion,' said an investor at the OMFIF-EU bonds summit in Singapore. 'If the EU is included in an index, then our investments in EU bonds could be more structural rather than opportunistic'.

At present, the EU is by and large viewed by investors as a 'spread product'. In other words, it is treated as a typical supranational issuer rather than a sovereign or a benchmark for European bonds. Most fixed income investors buy EU bonds on a relative value basis versus their peers or for a pick-up to other European government bonds.

However, inclusion to sovereign indices would completely invert this dynamic. 'I do think that index inclusion really changes the structural demand for the asset class,' said a second investor at the event. If the EU joins a government bond index, it will have a certain weighting of bonds held in that index so investors who link their portfolios to that index will also have the same exposure. Sovereign index inclusion will also open up the possibility to allow other investors who only buy government bonds to start investing in EU bonds.

Even without inclusion to sovereign indexes, some investors are already starting to treat the EU as a rates product, including bank treasuries who are beginning to place EU bonds in their European government bond portfolios. From a trading perspective, EU bonds are also performing well, with the bonds trading through France across most of the curve. However, this is due in part to the risks stemming from the recent French elections and budget.

The sheer size of the EU as the fifth largest issuer in Europe has turned it into a significant component in capital markets, behind only Germany, Italy, France and Spain.

'When the NextGen (NGEU) bond programme was announced, the basic conclusion we had reached was that given the shortage of triple-A assets in the world, this would lead to the evolution of one more asset class that would become really relevant for global investors,' said an investor. 'In any asset class, if it crosses half a trillion in size, it starts to become a real part of an asset allocation strategy.'

The EU is not quite at a trillion in size yet, but it is moving in that direction with total outstanding EU bonds set to surpass € 500bn by the end of 2024 and € 1tn by the end of 2026. There is uncertainty about what lies beyond 2026 when the NGEU funding will end but the expectation is that the EU will remain a permanently large borrower in capital markets.

---

* This article first appeared on 11 September 2024.

* Burhan Khadbai is Head of Content, Sovereign Debt Institute, OMFIF.

As well as continued large borrowing, the EU needs to continue to improve liquidity across the curve to convince market participants and investors that it deserves its place in sovereign indexes. A safe asset does not only need to have low credit risk, but it must also have strong liquidity. The upcoming launch of the EU's repo facility will be an important development as well as a futures market and continued outreach and dialogue with global investors.

The OMFIF-EU bonds summit in Singapore formed the second part of a special series of events for investors to better understand how EU bonds are developing into a global benchmark and safe asset in capital markets. The first event took place in Dubai on 1 May, bringing together the European Commission with leading investors in the Middle East, while the second event took place on 10 September with leading investors in Asia.

October 2024
Vol.11, No.4

IMF News

Managing Director's Remarks: UN's Summit of the Future*

By KRISTALINA GEORGIEVA

When we look into the future, it is important to first recognize where we are today. Let me start with the current state of the global economy. On the positive side, the world economy has proven to be remarkably resilient to the multiple shocks of the last years. Inflation generated by these shocks, and the response to them, is finally receding. Major economies are poised to avoid the recession that many feared would take hold.

But we also see that prospects for growth are at their weakest in decades, which means fewer jobs and lower incomes. We expect global growth of around 3 percent each year over the next five years. This is almost a percentage point lower than in the decades before the pandemic.

Worryingly, these trends are most dramatic for low-income countries. These countries' output is still 7.5 percent below the pre-pandemic growth trajectory. Add to this elevated debt pressures, and we see risks of a low growth-high debt trap.

The political economy environment is also becoming even more complex. In many countries, feelings of unfairness are eroding trust and stoking social unrest. Globally, fragmentation is rising.

And yet, we stand at the cusp of a remarkable transformation fueled by green innovation and technological change. We can harness green growth and create green jobs if policymakers are more focused on reshaping their economies. Technology can provide a much-needed boost to productivity if deployed properly. For instance, IMF analysis suggests that artificial intelligence has the potential to add up to 0.8 percentage point to global growth.

This global backdrop translates into three essential policy recommendations for our member countries: (i) continue to do what works well—implement strong policies and build strong institutions; (ii) remove the obstacles to growth both domestically and internationally; and (iii) resist excessive protectionism, so we can build a stronger global economy together.

The IMF is doing its part, driven by four priorities. First, we will continue to work with our members to help them design sound macroeconomic policies. Second, we will leverage our financial strength to direct more resources to low-income countries. We provided financing of US$370 billion to our members over the past few years, and we are generating more funding for low-income countries through the Poverty Reduction and Growth Trust and the Resilience and Sustainability Trust. Third, we will continue to help countries address debt issues and speed up debt restructuring, including through the Common Framework. We established, jointly with the World Bank, the Global Sovereign Debt Roundtable and we modified our debt policies to ensure that we can provide financing to countries more quickly. Finally, we will continue to work to become more representative. Our membership agreed to create a third chair for Sub-Saharan Africa on our Executive Board to improve the region's voice and representation. We are also working with our membership towards a new quota formula.

My message today is simple: together we are stronger. Let us work together to lift our ambition now, in this decade, to build a better future for all.

* This article appeared on September 22, 2024.

IMI International Monetary Review

The IMF Holds the Key to Argentina's Cage*

By HECTOR TORRES*

Will Javier Milei use it?

Since Javier Milei took office on 10 December 2023, Argentina's central bank has been diligently buying reserves. However, this trend has now reversed. In June – a month typically favourable for reserve accumulation – the government faced its first run against the peso, forcing the Banco Central de la República Argentina to shed some of the reserves it had accumulated since May.

The trigger may have been the BCRA's eagerness to 'deflate' its liabilities by pushing interest rates into negative territory. However, after decades of struggling with inflation, Argentines have developed agile defences. Savings moved quickly into dollars, widening the gap between the official and the 'free' (market) exchange rates to close to 60%. Argentina's country risk premium rose from 1,200 basis points to 1,500, signalling a looming balance-of-payments crisis.

The government responded to these warning signs by digging in its heels. It ruled out any changes to the official exchange rate policy, committing to a monthly 'crawling peg' depreciation of 2% – a rate that is only a fraction of the country's falling, yet still high, inflation. It also refrained from outlining a roadmap for the elimination of multiple currency practices despite the International Monetary Fund's recommendation to do both.

Rather, in a joint press conference held on the evening of 5 July (Friday evenings are normally used to announce important changes in economic policy), the minister of economy, Luis 'Toto' Caputo, and the president of the central bank, Santiago Bausili, formally declared the initiation of the 'second stage' of the economic programme.

More noise than substance

Their grand announcement boiled down to transferring the central bank's short-term liabilities with commercial banks to the Treasury. Moving liabilities from one pocket to another strengthens central bank balance by weakening the Treasury's. Markets were disappointed and with good reason.

Commercial banks value central bank debt more highly than Treasury debt – the BCRA has never defaulted while the Treasury has a history of nine defaults. Consequently, banks will most likely demand higher compensation, making it even more difficult for the government to meet its zero overall fiscal target.

Despite the announcements, markets remained jittery, prompting another grand announcement from Caputo on 13 July. The central bank would no longer issue pesos to buy dollars. Instead, after buying dollars from exporters (who are obliged to surrender their hard currency to the central bank) it will 'sterilise' the newly printed banknotes by selling as many dollars as necessary at the market exchange rate. This half-disguised intervention in the foreign exchange market will force the central bank to give up almost two-thirds of the dollars it had previously bought from exporters at the lower official exchange rate.

Not surprisingly the unofficial exchange rate dropped, but this came at the cost of increasing Argentina's risk premium.

So far, the government has successfully focused on keeping inflation on a downward trend, and these half-backed measures clearly indicate that combatting inflation remains the government's number one priority. Milei has also achieved two significant legislative accomplishments. Despite holding only a small minority in the low chamber (38 of 257 seats) and in the Senate (7 of 72), he managed to get approved two significant pieces of legislation: the 'Ley de Bases' and a tax package.

The 'Ley de bases' includes some structural reforms, such as adding flexibility to labour contracts, removing obstacles for competition and creating incentives for large investments – more than $200m. The fiscal reform includes exceptional tax and asset regularisation regimes and the reimposition of

---

* This article appeared on 26 July, 2024.

* Hector Torres is Senior Fellow at the Centre for International Governance Innovation and a former Executive Director at the International Monetary Fund.

income tax for high salaries, a measure eliminated by the former government with Milei's enthusiastic support.

However, the government needs to get the economy out of its rut. A contraction of about 4% is projected for 2024, making it a third consecutive year of decline, and fiscal revenues are falling accordingly, dropping by 14% in June in real terms.

Argentina desperately needs to entice private investment. Yet before investors pour their dollars into the country, the government must remove the web of red tape that restricts capital and dividend remittances.

The government is taking baby-steps in that direction, but clings to its 2% monthly crawling peg out of fear that, with reserves still in negative territory, adding foreign exchange flexibility (as the IMF suggests) could trigger a run on the peso and rekindle inflation.

Where could dollars come from?

Milei is shopping for credits. He is getting some encouragement from the billionaires he courts. He is also knocking at the IMF's door.

Both the government and the IMF are ready for a new programme. However, they are approaching the subject from different angles. While the IMF wants to support Milei's efforts to reform the country, it is not keen to front-load financial support that Bausili could freely use to arm-twist the market – as Caputo attempted during his tenure at the central bank, when Mauricio Macri and Donald Trump were both in office.

Argentines believe that the IMF is not much more than a US agency and Milei is lighting candles for Trump. Yet, even if Trump gets elected, he would only take office in January 2025 and it could take a few more weeks before his administration becomes fully operational – a long time for Argentina. Moreover, the IMF prides itself for having a 'learning culture'. Would it want to step on the same stone again.

IMI International Monetary Review

Emerging Markets Hold Both the Reins of Future Growth and the Keys to the Future of Multilateralism

By AQIB ASLAM AND PETYA KOEVA BROOKS*

As advanced economies turn increasingly inward, emerging markets have an important stake in the defense against global economic fragmentation.

Having grown in both size and global economic stature — on the back of greater integration and hard-won reforms — emerging markets are not only a permanent fixture on the global economic stage but also expected to be natural champions of the multilateral approach.

Given their expanded global footprint, it might seem unusual that the concept of "emerging markets" is still in use. Until 1980, the IMF divided economies into two groups: a small clutch of "grown-up" wealthy, capital-rich "industrial countries" and a majority of "still-growing" poorer, labor-rich "developing countries." In 1981, an enterprising employee at the International Finance Corporation, Antoine van Agtmael, devised the term "emerging market" to drum up interest in a new equity fund of 10 up-and-coming developing economies.

This label — evoking dynamism, potential, and promise — stuck. And it spawned a distinct asset class and numerous indices — such as the MSCI Emerging Markets Equity Index, introduced in 1988, and JP Morgan's Emerging Markets Bond Index, created in 1991. These socialized investors to the new middle children of the global economy as they navigated growing pains and external shocks and faced currency crises, financial contagion, sudden stops, and growth accelerations.

However, many emerging markets are outgrowing both the term and the stereotype, given their global influence and greater policy credibility and sophistication. This raises questions: What does it take for markets to have finally emerged? And does it have any bearing on their place in the global economy?

Greater global sway

Perceptions of emerging markets are inevitably anchored in their economic and political origin stories, which are not only relatively turbulent but also more recent. Following the turmoil of the 1970s and 1980s, China's accession to the World Trade Organization in 2001 ushered in a period of remarkable growth for emerging markets, until the global financial crisis. China's development accelerated globalization and unleashed a commodity supercycle, which lifted global activity and enriched commodity-exporting emerging markets.

The tables turned after 2010 for emerging markets — notably commodity exporters. In China alone, annual GDP growth slowed by 4.6 percentage points between 2010 and 2019 and is expected to decelerate to just over 3 percent by 2029. Add to this the global fallout from the pandemic, fresh conflicts, commodity price shocks, the retrenchment of global capital, and escalating geopolitical tensions.

However, emerging markets are not the unwilling hostages to global developments they once were. On the contrary, recent IMF research highlights how emerging markets now are increasingly influential both locally and globally. Growth spillovers from domestic shocks in these economies have not only increased over the past two decades but are now comparable to those from advanced economies.

Emerging markets are not the hostages to global developments they once were.

As a result, emerging markets are very much in the driver's seat when it comes to global growth — both the highs and the lows. The performance of emerging market members of the Group of Twenty (G20) accounted for almost two-thirds of global growth last year. Fading prospects for these same economies have also driven more than half of the almost 2 percentage point decline in medium-term growth prospects since the global financial crisis. This weight will likely only increase.

* Aqib Aslam is a division chief in the IMF's Research Department.
Petya Koeva Brooks is a deputy director in the IMF's Research Department.

Furthermore, despite China's continued global economic heft, emerging markets are increasingly less reliant on its prospects. Their recent resilience can also be traced to an overall improvement in fundamentals — for instance, improved current account balances, lower dollar-denominated debt, and higher reserves — and better monetary and fiscal policy frameworks. And with the climate transition highlighting the gap between demand and supply for critical minerals such as copper and nickel, trade fragmentation and postpandemic diversification mean that the importance of emerging markets in global supply chains is set to grow.

Converging to advanced

Despite their expanding global influence and the increases in incomes and wealth they have secured for their populations, graduation to the "A(dvanced)-list" has remained elusive for all but a handful of emerging markets. To be an emerging market is to be left waiting with no clear end to the (emergence) process and somewhat overlooked on the global stage.

The IMF added "advanced economy" to its lexicon in the May 1997 World Economic Outlook. It grouped the four newly industrialized economies in East Asia and Israel with the existing 23 "industrial countries" of the time, based loosely on comparable per capita income levels, well-developed financial markets, a high degree of financial intermediation, diversified economic structures with relatively large and rapidly growing service sectors, and a declining share of employment in manufacturing. Since then, only 13 more economies have joined their ranks—all from Europe, except for Macao SAR and Puerto Rico —while the group as a whole has seen its share of global activity decline from 75 percent to 60 percent.

How did these countries make it? Two paradigms emerge. The first is that of the "Asian Tigers," which pursued rapid export-oriented industrialization — as in Japan — through state intervention to develop comparative advantages in certain sectors (such as textiles in Hong Kong SAR and heavy and chemical industries in Korea). The second is the central and eastern European example of broad institutional reforms anchored by accession to the European Union and foreign capital inflows. In that setting, the extra step of joining the euro area by meeting the four economic convergence criteria also guaranteed an automatic invite to the A-list.

And here's the problem (in both cases): to have emerged is to have converged. To do so—even by building comparative advantage in just one link of global value chains—requires large amounts of capital either from domestic or foreign savings, underpinned by a coherent policy framework that can survive the political cycle. In theory, emerging market and developing economies should be a magnet for external flows, as their smaller capital bases and strong growth potential translate into attractive real returns. In practice, we have the so-called Lucas paradox, the observation that capital does not flow from rich to poor countries. Instead, convergence requires funding domestically, unless there are Marshall Plan–scale capital injections at hand. As the latter are not so easy to come by, many emerging market and developing economies are at the mercy of fickle international capital flows amid weak governance and underdeveloped financial systems.

Multilateral mantle

But even if emerging markets still fall short of advanced economy standards, carving up economies into these two categories seems increasingly irrelevant in recent years. The growing depth of emerging markets' integration into the global economy and their sheer size—both in terms of GDP and population—and diversity mean they are now just as significant and just as systemic as most advanced economies. That several advanced economies are reverting to inward-looking policies reinforces this prerogative: emerging markets are no longer bystanders but have a vested interest in the success of the multilateral approach. After all, globalization, cooperation, and the uninterrupted flow of goods, services, capital, and know-how have been — and will remain — instrumental to their growth, productivity, innovation, and poverty reduction.

Of course, some of the largest emerging markets have already been exercising their global economic rights as part of the G20—the only capital G group of countries indifferent to the emerging-advanced dichotomy. With 7 of the 10 recent presidencies held by emerging markets—with South Africa set to take up the torch in 2025—they have been able to promote issues they see as domestic and global macro-critical priorities: for example, inclusivity and investment (Türkiye 2015); innovation and technology diffusion (China 2016); the future of work, infrastructure, and sustainable food (Argentina 2018); female and youth empowerment (Saudi Arabia 2020); productivity and resilience (Indonesia 2022); green development and

digital public infrastructure (India 2023); and inequality, revenue mobilization, and global governance (Brazil 2024).

However, just as emerging markets are stepping up, so too must international organizations engage further with them in the global interest. The IMF, for instance, must continue to tailor policy advice to country-specific circumstances. This requires even greater understanding of emerging markets and stronger expertise in their issues. The IMF must also review its resources and lending facilities — active and precautionary, financial and nonfinancial—to ensure an adequately funded global financial safety net and a suite of fit-for-purpose tools for systemically important emerging markets. And their growing importance should be legitimized in global governance.

Despite the label, emerging markets are now at the heart of global policymaking and global growth. At a time of growing uncertainty over the global economic environment and increasingly selective policies, international organizations can lean more heavily on these natural allies, which have a growing stake in keeping the flame of multilateralism lit, to overcome the immense global challenges we face.

October 2024
Vol.11, No.4

Digital technology

The Macroeconomic Impact of CBDC: Why Model Predictions may be Wrong*

By ULRICH BINDSEIL AND RICHARD SENNER*

CBDC facilitates preservation of balance between private and public payment means

The digitalisation of large parts of everyday life and of the economy also extends to payment transactions. In the euro area, for example, the share of cash payments at the point-of-sale (i.e. in physical shops) declined from 79% to 59% between 2016 and 2022, mainly for the benefit of card payments. If this trend continues or even accelerates, the role of cash and thus central bank money would decrease significantly for the benefit of private payment service providers. This also raises concerns about insufficient competition, inclusiveness, privacy protection as well as strategic autonomy of sovereign states.

Against this backdrop, a heated debate about retail digital money issued by central banks – central bank digital currency – began in 2016. Due to the growing number of papers that present macroeconomic models examining CBDC and, on the other hand, quite detailed plans by central banks to issue CBDC, the question is to what extent the assumptions and scenarios contained in these macroeconomic models of CBDC correspond to the objectives and emerging design choices communicated by central banks.

What central banks have announced on CBDC

All central banks working on CBDC have announced that CBDC would not be remunerated, that holdings would be limited, and that CBDC issuance would aim to preserve the roles of central bank money in retail payments in a digitalised world. Another set of key features announced for CBDCs are those that allow to somewhat decouple the store of value from the means of payments function of CBDC and that facilitate the preservation of a single pool of money for citizens. For example, the European Central Bank announced a so-called 'reverse waterfall' so that users would not have to prefund a digital euro account before making payments because the digital euro account can be linked to a commercial bank account. Last but not least, central banks have announced access restrictions for CBDC. For example, the ECB plans to only allow natural persons who are permanent residents of the euro area (or possibly of the European Union), and temporary residents (e.g. travelers) to be able to hold digital euro within the limits.

Gaps and fallacies in the macroeconomic literature on CBDC

Our paper identifies in particular the following issues which future research on the macroeconomics of CBDC should address.

First, the modelling in all the papers assumes that the decision to issue CBDC hits a static monetary and financial system. But the decision to issue CBDC is a 'conservative' response to profound changes of the monetary system relating to digitalisation. In other words, the macroeconomic effects of not issuing CBDC are likely to be more relevant than the ones of issuing it. Overlooking this means very likely ending with wrong conclusions.

Second, many papers do not consider the design features of possible CBDCs as outlined more recently by central banks. Most papers assume remunerated CBDC, or that CBDC is of considerable volume.

Third, as real-world CBDCs are expected to be unremunerated, it is difficult to specify a clear difference between CBDC and cash in macroeconomic models. None of the papers develops this difference in a way that could imply macroeconomic consequences.

---

* This article first appeared on 12 September 2024.
* Ulrich Bindseil is Director General of Market Infrastructure and Payments at the European Central Bank and Richard Senner was working at the Directorate General, Macroprudential Policy and Financial Stability at the European Central Bank at time of writing.

Fourth, and relating to previous points, the papers generally tend to assume, in line with earlier narratives, that the issuance of CBDC will considerably increase the amount of central bank money in circulation. But it is more likely that the combined decline of banknotes in circulation (relating to their lesser use) and the announced CBDC design features will lead to a declining volume of central bank money in circulation, even if CBDC is issued.

The way forward on understanding the impact of CBDC

Under the assumption of ever-progressing digitalisation of society, the macroeconomic effects of issuing CBDC should be identified starting from the counterfactual. If retail payments are exclusively left to the private sector and central bank money would be marginalised, then the amount of central bank money in circulation will significantly shrink, the length of central bank balance sheets would decline and the banks would benefit from deposit inflows, payment costs will increase (due to increasing market power of the successful firms), monetary and financial stability will be weakened (as the unifying convertibility test of all private moneys, i.e. to be exchangeable at sight against central bank money, will have become remote or inexistent), and strategic autonomy. In this sense, the issuance of CBDC aims at preserving economic efficiency and stability by preserving the current role of central bank money – a genuine public good.

Of course, it cannot be excluded that some central banks and legislators will, in the future, design CBDCs which better match the assumptions taken in the macro models reviewed. For this reason, the models remain useful for future scenarios. Moreover, macroeconomic researchers could review the macroeconomic predictions of the models for CBDCs designed as in recent central bank communications.

October 2024
Vol.11, No.4

Emerging Technologies in Financial Services - Opportunities and Challenges*

By DENIS BEAU*

I would like to thank the organizers for providing me with the opportunity to speak about a major topic for Central Banks and Supervisors today, that is: emerging technologies, their opportunities for the financial sector and the challenges they represent for us all. I would like to focus my remarks on two emerging technologies, which I believe may transform deeply financial services: tokenisation (i) and artificial intelligence (ii).

1. Tokenisation of assets and payment services

In the financial sector, the emergence of crypto-assets has paved the way for the tokenisation of finance. It allows the issuing, recording and exchange of financial assets in the form of digital tokens on DLT such as blockchain. Such tokenisation has the potential to drive deep changes in the way our financial system works.

These potential changes present opportunities for market participants and the general public, as they could bring greater simplicity, transparency, effectiveness and speed while also lowering transaction costs of financial transactions.

But they also raise challenges, especially for institutions such as the Banque de France and RBI, whose mandate includes preserving financial stability. In this respect, we are, at the Banque de France, guided by two convictions:

1. Confidence requires a regulatory framework that is suitable, clear, sufficiently demanding and fair;

2. Central bank money (CeBM) must remain at the heart of settlements between financial intermediaries, which are the most sensitive from a systemic perspective.

As regards regulation, France blazed a trail in crypto-assets with the adoption in 2019 of the PACTE Act, which created the classification of digital asset services provider. Europe's lawmakers have drawn heavily on the French framework. In 2023, the European Union adopted its Markets in Crypto-Assets (MiCA) Regulation, a specific regulatory framework covering the issuance of crypto-assets and stablecoins and the provision of related services. MiCA's goal is to address the major risks to market integrity and provide greater protection to users.

While MiCA represents a vital regulatory step forward, it will need to be built on in the coming years. For example, it only partially tackles the concentration of crypto-asset service activities within crypto-conglomerates. By virtue of its decentralised nature, the so-called DeFi ecosystem likewise raises regulatory challenges that will need to be addressed.

With this in mind, the ACPR, the French supervisor backed by the Banque de France, has begun identifying potential avenues of regulation. They include: (1) preserving the resilience of public and private DLT infrastructure via security standards; (2) certifying smart contracts and (3) regulating DeFi entry points to protect investors against the risks of abuse.

Our second conviction is that, in order to have a framework that inspires trust in the development of the tokenisation of finance, CeBM needs to be maintained as the primary settlement asset for financial intermediaries, which are the most sensitive in terms of systemic consequences in the event of problems. It ensures confidence between financial intermediaries and so decisively contributes to the stability of the financial system. In a DLT environment, the use of stablecoins is growing, even though these private settlement assets are riskier. It is therefore important that financial intermediaries have access to a trusted settlement asset when operating in a DLT environment. To achieve this goal, central banks need to adapt the form and provision of CeBM to reflect the characteristics of transactions in tokenised assets to ensure that CeBM can be issued, recorded and used for settlement of DLT transactions.

This conviction spurred the Banque de France to become the first central bank to launch an ambitious experimental programme on wholesale central bank digital currency (CBDC) for large-value payments in 2020. This work is continuing at the Eurosystem level and includes several dozen on going PoC and live

* Speech by Mr Denis Beau, at the at the RBI@90 Global Conference on "Digital Public Infrastructure and Emerging Technologies", Bengaluru, 26 August 2024.
* Denis Beau, First Deputy Governor of the Bank of France.

experiments. The Banque de France is directly involved in these Eurosystem further exploratory work to determine the best way of making CeBM available to private players. At the same time, the Banque de France is also involved in international works such as the Agorá project, which is exploring the concept of unified ledger that could bring together all types of tokenised assets and allow the system to operate more efficiently on a DLT.

2. Artificial intelligence in the financial sector

I now turn to the second innovation, artificial intelligence (AI), which could lead to real economic disruption, especially in the financial sector. AI has been an important driver of transformation in recent years. Today, AI is used in all segments of the value chain in finance: to improve the "user experience", to automate and optimize a number of internal processes and to monitor or mitigate risk, as illustrated by its success in use cases relating to anti-money laundering. The advent of generative AI is expected to further accelerate this trend, not only by increasing users' adoption of AI tools, but also by structurally accelerating the pace of innovation.

However, these significant developments raise a number of questions, including for us central bankers and supervisors: I would like to share some of these with you, before expressing my views about how we should tackle them.

A first issue is that, despite recent progress, the underlying AI technology does not yet appear to be fully mature, particularly as regards generative AI (GenAI). There are still a number of unanswered questions on this subject.

For example, the question of general-purpose AI (GPAI) models: how will they perform in a whole range of tasks relevant to the financial sector? If large GPAI models be introduced in all areas, we run a high risk of ending up in a natural monopoly or oligopoly, adding to the already largely oligopolistic nature of the cloud market.

A second issue I would like to mention is the vulnerabilities of AI systems, with new risks adding to existing cyber risks, such as the dangers of so-called "indirect prompt injection" and the possibility to use AI to develop new attack techniques. Our ability to adequately secure AI systems will have a major influence on the ability of different actors to make extensive use of this technology.

Even though AI technologies are not yet fully mature, it seems to me that central banks and financial supervisors should embrace them without delay, for at least three reasons.

First, to continue to carry out our missions effectively, by doing more and doing it better and offering new capabilities to employees. AI can of course help us become more efficient, by increasing the level of automation.

Second, to develop critical expertise in AI. Using AI for our own purposes allows us to gradually acquire a good command of the technology, and is a very effective way of properly understanding its benefits and risks.

Finally, to drive the financial ecosystem, by sending a signal to the market that it too can – or must – take the plunge, but in a controlled way.

So, while it is clear to me that central banks and supervisors must seize the opportunities offered by AI, the question is: How do we do that?

It seems to me that we must first lay down a fundamental principle of governance: AI must be at the service of humanity and society, and not the other way around. This calls for the adoption of a minimum set of safeguards which central banks could support, to channel the development of AI use cases. From this perspective, even if it does not solve all the problems, the recent adoption of the European AI Act, the world's first binding text laying down the principles of "trustworthy AI", is from my perspective a welcome step.

This governance principle should be supplemented by three operational principles as far as our own usage of AI is concerned.

First, using AI proportionately and progressively. With a simple rule: the more critical the use case for our activity, the more we have to do it ourselves.

Second, experimenting without delay, even with simple use cases, to find the right way of integrating AI into our activity, the tasks performed by our staffs. In my view, it should be done so as to mostly support them, leading to an "augmented agent" rather than a "substituted agent" vision of its impact on staff contribution. Indeed, we can expect AI to significantly reshape the patterns of human-machine interactions. Finding the right combinations will encourage the adoption of the new tools, by winning the buy-in of users, which is a crucial issue.

Third, collaborate with others, to share best operational practices and to build a coherent AI supervision framework. In this field, cooperation should be cross-sectoral: we need to cooperate with authorities in other sectors, especially competition, cyber security, fundamental rights and even the green transition, as AI-related concerns are largely interconnected. Cooperation should also be, of course, international, because AI-related issues are by their very nature global. In this area, while there may be nuances in terms of how to proceed, I note above all that many jurisdictions are expressing similar concerns, which should enable international cooperation to move forward.

In my view, these different forms of cooperation are an essential condition if we are to contribute to the emergence of the most relevant and resilient technologies in the financial sector, in the direction of the general interest.

IMI International Monetary Review

AI is Driving ESG Integration in Emerging Markets*

By ATIYAH CURMALLY*

Artificial intelligence can help institutional investors and asset managers align their emerging market investment strategies with the United Nations' sustainable development goals. AI can leapfrog gaps in environmental, social and governance data disclosures and reshape business models to drive economic growth and societal progress.

EMs offer attractive investment opportunities to achieve financial returns and impact. ESG-integrated assets under management are expected to increase from $18.4tn in 2021 to $33.9tn by 2026 in EMs.

Although they still lag developed markets, ESG disclosure requirements have grown exponentially in EMs. For example, of the 62 EMs with sustainable bond issuances in 2023, 51% had ESG and climate disclosure requirements. The International Financial Reporting Standards' framework on sustainability and climate-related disclosures will help to drive an increase in reporting.

Many EM regulators, like Brazil's Comissão de Valores Mobiliários, are already signalling their intent to require companies to disclose information according to these requirements. Regulators are also mandating domestic ESG disclosure requirements such as the Securities and Exchange Board of India's Business Responsibility and Sustainability Reporting framework for the top 1,000 Indian-listed companies to disclose quantitative and standardised ESG information.

Turning to AI

As investment opportunities and disclosures increase, so do the demands of asset managers and industry for solutions that efficiently structure information to measure, track and validate climate and other ESG risks. Unsurprisingly, there is growing interest in the role AI-powered solutions can play to increase the speed and efficiency of the ESG disclosure process, especially in the post-ChatGPT world.

Use cases range from corporate reporting to investor analysis to regulatory oversight. AI-enabled providers span companies that provide ESG data, analytical services and software-as-a-service solutions. Such solutions help both issuers and investors comply with and track regulatory requirements. Investor-focused providers also offer solutions for company analysis, risk management, portfolio management and issuer engagement. For regulators, solutions centre on enabling oversight with a focus on understanding assurance and the type of disclosure framework in use.

While nearly all providers integrate AI into operations to provide services, for some companies like Risk Insights, inhouse AI, machine learning and big data analysis are central to their approach to developing ESG ratings and analysis. With a sub-Saharan Africa focus, Risk Insights provides analysis on all companies listed on major exchanges, such as in South Africa, Nigeria and Kenya.

RepRisk is another example of a company that has strategically combined AI, advanced machine learning and data science capabilities with human intelligence to identify material ESG risks for companies, real assets and countries in developed economies and EMs. The company uses data science and advanced machine learning alongside highly trained analysts to develop insights for users. RepRisk has made its methodology and data science models available for use by others.

Experiments with machine learning and data science

In December 2023 the World Bank's first AI as a service, MALENA, was released for use publicly. The result of the International Finance Corporation's inhouse experimentation with machine learning and advanced data science, MALENA is a suite of AI-powered solutions designed for EMs. The solution has been trained using IFC's many decades of sustainability and impact data and ESG expertise.

Using natural language processing, MALENA can read text, identify over 1,000 climate, gender and ESG terms, and generate insights from sentiment analysis. While general-purpose AI models have been criticised for failing to understand ESG context, MALENA's training on domain-specific vocabulary and data has led to high performance and accuracy of results. Users like asset managers are screening target issuers and portfolio companies with MALENA.

---

* This article featured in the Sustainable Policy Institute Journal, Q3 2024 edition.

* Atiyah Curmally is Principal Environmental Scientist, International Finance Corporation.

However, it has been the recent advances in large language models that have taken the world by storm. Open AI’s GPT suite, Meta’s Llama family and Mistral AI have really ignited the imagination. These solutions provide better quality text summarisation and content interpretation and analysis. For instance, with model prompt refinements and retrieval-augmented generation techniques, these models are very effective at finding answers to questions.

Inhouse experiments with finding answers from company disclosures to ESG-domain questionnaires have seen steady improvements in AI model accuracy and better-quality answers. Not only can users quickly receive answers to tailored questionnaires, but importantly such applications can highlight what information companies have not disclosed (that could be material to their sector) as well as errors or anomalies.

For regulators and investors such applications speed up the approach to scoring companies, developing engagement strategies and peer-to-peer benchmarking. This in turn leads to faster and more efficient reviews, quicker project approvals and better resource management.

IMI International Monetary Review

Cross-border Payments - Unlocking New Frontiers*

By AGUSTÍN CARSTENS*

Let me take this opportunity to congratulate the Reserve Bank of India (RBI) on its 90th anniversary. This is a significant milestone for the institution and one that is worth celebrating.

India's economy has evolved tremendously over the past nine decades. Throughout this time, the RBI's commitment to safeguarding monetary and financial stability has helped to lay the foundation for the country's economic growth and development.

To remain relevant and effective over many decades amid rapid change, institutions must be able to adapt. The RBI – and other central banks throughout the world – have repeatedly shown their ability and willingness to adjust their operations and tools in response to changing economic and financial circumstances.

The need to move with the times applies even to one of the most fundamental central banking activities – the provision of money. Central bank money represents the trusted core of the entire financial system, ensuring finality of payments and the singleness of money. As society and the economy evolve, individuals and businesses will naturally demand that the money that they use comes in a form, and has features, that meet their changing needs. If central banks and trusted financial institutions do not provide money and payment services that meet these demands, individuals and businesses will look elsewhere. It is imperative for central banks to understand these changing demands, to prepare for them and, ultimately, to provide money in a form that is relevant for society. The RBI has led the way in this regard, through its highly successful retail and wholesale CDBC pilots.

In this light, it is clear that the theme of today's conference – digital public infrastructure and emerging technologies – is an important one that is central to the mission of both the RBI and the Bank for International Settlements.

India stands at the forefront of digital public infrastructure development, and its experiences offer many lessons for other policymakers.

The rapid deployment of infrastructure such as Aadhar and the Unified Payments Interface (UPI) has delivered substantial advances in financial inclusion and payments efficiency. It has shown how public authorities, by thinking big, acting fast and embracing cutting-edge technology, can deliver transformative change and unlock the full creative potential of the private sector for the benefit of all. This last element – the involvement of the private sector – deserves special emphasis. It is key to today's two-tier monetary system, and it will remain crucial as the monetary and financial system continues to evolve into the future, both in India and globally.

We should bear India's experience in mind as we think about how public authorities can encourage the efficient and safe deployment of new financial market infrastructures, including emerging technologies such as tokenisation and artificial intelligence (AI), in the context of a more efficient and secure financial system.

These lessons are not only relevant for individual jurisdictions. They are also relevant in thinking about how to enhance the global financial system.

This brings me to the main theme of my remarks today: enhancing the efficiency of cross-border payments.

The topic is critical. It has long been recognised that increased integration of global economies and financial markets creates a heightened need for businesses and individuals to move money across borders. At the same time, more efficient cross-border payment systems would also promote global economic integration.

Cross-border payments typically lag domestic ones in terms of cost, speed, access and transparency. To an extent, this is to be expected, as the transactions are necessarily more complex, often involving multiple participants, time zones, jurisdictions and regulations.

---

* Address by Mr Agustín Carstens to the Reserve Bank of India Global Conference on "Digital Public Infrastructure and Emerging Technologies", 27 August 2024.

* Agustín Carstens, General Manager of the BIS.

Yet the shortcomings of international payment systems exceed these unavoidable technical frictions. And, in some jurisdictions, the availability and cost of international payments has deteriorated over time, in part due to the well documented shrinking of correspondent banking links. This matters because correspondent banking still plays an important role for many workers living and working overseas in sending remittances home.

It was in part to address these shortcomings that the G20 launched its Roadmap for Enhancing Cross-border Payments in 2020. The BIS, through its Committee on Payments and Market Infrastructures and Innovation Hub, has played an active role in delivering on the roadmap.

Significant focus and resources have been devoted to this end, but much remains to be done.

The good news is that the technology to deliver a vastly improved cross-border payment system exists. And, increasingly, this is being matched by the will and cooperation needed to do so.

Let me discuss two areas where great practical innovation is taking place.

Central banks and other public authorities are playing a catalytic role in both. They are setting the rules of the game, providing key infrastructure and working productively with the private sector to deliver a better system for all participants. They are also ensuring that measures to secure the integrity of the financial system – including compliance with international sanctions, as well as anti-money laundering and know-your-customer regulations – continue to be adhered to, but with less cost and greater rigour than in today's system.

The first area I would like to highlight is the linking of fast payment systems – like India's UPI system – across borders. These systems leverage on the existing infrastructure that delivers instantaneous, high-volume, low-value payments domestically to facilitate similar payments in a cross-border context. As most instant payment systems (IPS) process domestic payments within 30 seconds, interlinking these systems could conceivably allow cross-border payments to flow in 60 seconds or less – a vast improvement on traditional approaches.

Several countries have already linked their fast payment systems on a bilateral basis. A link exists between the UPI here in India and the PayNow system in Singapore.

These bilateral channels are a good start. But we should aim higher. Bilateral links are hard to scale. Since every IPS has different technical standards, business processes and regulatory requirements, each bilateral link requires a new negotiation and harmonisation of technological and regulatory practices. As the number of participating jurisdictions increases, the number of bilateral links needed to complete the network rises exponentially.

To make progress at a global scale, a multilateral approach is required.

This is what Project Nexus – a joint venture between six central banks and payment system operators and the BIS Innovation Hub's Singapore Centre – seeks to achieve.

Nexus is a multilateral scheme that provides a standard blueprint for domestic instant payment systems to communicate with each other. All they need to do is make a single connection into the network and they can be linked with all other participants.

I am delighted that the RBI has signed up to be a full participant in stage 4 of the project, alongside the central banks and instant payment system operators of Malaysia, the Philippines, Singapore and Thailand. In this phase of the project, the BIS will support the participating central banks and IPS as they work towards live implementation of Nexus. Once it is operational, Nexus will enable almost 1.5 billion people to make cross-currency transfers at the click of a button. And it would pave the way for other interested jurisdictions to join this multilateral network in due course.

The second novel approach to improving cross-border payments that I would like to discuss involves applying new technology to enhance the effectiveness of the correspondent banking system. The adoption of tokenised commercial bank deposits is a key advance here. They provide three key benefits. First, they enable the pre-programming of financial integrity controls, greatly lowering the costs for financial institutions of providing cross-border payment services. Second, when brought together on a unified ledger, they can help to streamline clearing and settlement, enabling faster, less risky and more secure payments. Thirdly, through smart contracts, they can facilitate entirely new, more flexible, contingent payments.

The benefits of tokenised commercial bank deposits as a tool for cross-border payments could be even greater if combined with tokenised wholesale central bank money, to be used as a settlement asset. This approach could also facilitate high-value wholesale payments, which cannot feasibly be sent through IPS.

The BIS Innovation Hub recently launched Project Agorá together with seven central banks. In partnership with a large group of private financial firms convened by the Institute for International Finance, this project will examine the feasibility and use cases of the basic structure I have laid out.

The two approaches to improving cross-border payment systems that I have described are intrinsically worthwhile. They also feed into a broader vision of how the financial system should work in the future.

Recently, Nandan Nilekani and I proposed the concept of the Finternet as a way to articulate this vision. What we have in mind is a system where the combination of a sound economic architecture and application of advanced technologies within a robust regulatory and governance structure will enable individuals and businesses to transfer any financial asset, in any amount, at any time, using any device, to anyone else, anywhere in the world.

To realise that vision, we need to deploy novel technologies – including tokenised assets, unified ledgers and fast payment systems – in an integrated way.

The aim is not to use technology for its own sake, but rather to address major pain points and inefficiencies in the current system. This will deliver faster, more secure and cheaper transactions, providing more choice and better services for users of financial services, and bolstering financial inclusion.

Improving cross-border payments would certainly resolve a significant pain point in today's financial system. And doing so by interlinking fast payment systems and bolstering the correspondent banking system through the use of tokenised deposits and wholesale central bank money would also help to strengthen the integration and technological advancement of the financial system as a whole.

Thank you for your time. I wish you an insightful and worthwhile conference, and the RBI many more years of monetary and financial stability.

October 2024
Vol.11, No.4

Monetary Policy

The Role of the ECB Monetary Policy in Achieving a Soft Landing in the Euro Area*

By YANNIS STOURNARAS*

Introduction

I would like to thank my friend Spyros Pappas for inviting me to discuss the role of the monetary policy of the European Central Bank (ECB) in achieving a soft landing in the euro area.

As you know, in the past few years, the Governing Council of the ECB has followed a meeting-by-meeting, data dependent approach to monetary policy.

I will start with a brief overview of recent economic developments that have paved the way for entering the "dialling back" phase of our monetary policy. I will then explain the rationale behind our recent monetary policy decisions. Finally, I will touch upon the challenges faced by the monetary policy of the Eurosystem (which includes the ECB and the national central banks of the euro area).

My speech comprises seven sections:

1. Inflation outlook in the euro area

Inflation in the euro area has fallen sharply since hitting a peak of 10.6 per cent in October 2022, to stand at 2.5% last June.

At the same time, core inflation also decelerated substantially from its March 2023 peak, when it had reached 7.5% as measured by the HICP excluding energy and unprocessed food.1

Since our last rate hike in September 2023, we have seen a stronger-than-anticipated decline in inflationary pressures.

Consider the following:

Inflation declined from 5.2% last August (the month immediately prior to the last rate hike at the September meeting on monetary policy), to 2.5% in June 2024.

Underlying inflation has also eased, reinforcing the signs that price pressures have weakened.

Core inflation has sharply decreased from 6.2%.2 in August 2023 to 2.9% in June 2024.3.

In June, the highest contribution to the inflation rate came from services. Services inflation remains elevated, but it has followed a broadly declining path since last summer (from 5.5% last August to 4.1% in June 2024).

Inflation expectations have declined at all horizons. Longer term market-based measures of inflation compensation have come down notably, from an average of 2.7% last August to 2.3% in June 2024.

Our June 2024 projections show inflation coming down towards our 2% target over the second half of next year, as inflationary pressures are expected to subside. Headline inflation is projected to average 2.5% in 2024, 2.2% in 2025 and to fall below our target, to 1.9%, in 2026.

Over the coming quarters, inflation is expected to fluctuate around current levels, due, inter alia, to energy-related base effects.

In fact, excluding these base effects, a decline in inflation would have materialised over the respective period.

Base effects are expected to fade out at the beginning of 2025, while, at the same time, fiscal support measures are unwound.

Wage developments are also important, as they are a key driver of inflation at the current juncture.

---

* Speech by Mr Yannis Stournaras at the Brussels Hellenic Network, Argo, in honour of new MPEs for Greece and Cyprus, Brussels, 10 July 2024.

* Yannis Stournaras, Governor of the Bank of Greece.

The latest data, pointing to an increase in negotiated wage growth to 4.7% in the first quarter of 2024, from 4.5% in the fourth quarter of 2023, have surprised on the upside.

Still, one-off payments in the public sector in Germany, have largely affected this outcome, whereas developments in other euro area countries are more encouraging.

The German public sector wage increase reflects the fact that negotiated wages in that sector had not been raised since 2021.

Wage growth is expected to remain elevated in 2024, and to show a bumpy profile. These developments reflect the staggered nature of the wage adjustment process as workers continue to recoup real wage losses from past price shocks.

However, leading indicators suggest that data on wages earlier this year may have been the peak, and that wage growth will ease during the remainder of 2024.

According to the ECB wage tracker data for the first few months of the year, when most agreements take place, negotiated wage pressures are moderating. This is supported by other indicators of wage pressures such as the Indeed wage tracker4 based on job postings, which has materially decelerated in recent months (from a peak of 5.4% in October 2022 to 3.7% in June 2024.)

The impact of higher wages on price pressures depends on the rate of labour productivity growth. A recovery in productivity growth should support the moderation in labour cost pressures.

An ongoing decline in profit margins also reinforces the confidence that domestic inflation will continue to normalise, effectively "buffering" the pass-through of wages to prices.

Overall, the disinflation process is proceeding. Our latest projections reinforce our confidence that we are getting consistently closer to our inflation target. Although the process may be slow and bumpy, these fluctuations should not affect the projected disinflation.

Economic activity

The euro area economy grew by 0.3% in the first quarter of 2024, after five quarters of stagnation.

Incoming information suggests continued growth in the short run, at a somewhat higher pace than previously foreseen.

Specifically, according to the June projections, economic growth is expected to rise to 0.9% in 2024, 1.4% in 2025 and 1.6% in 2026.

Nevertheless, the recovery remains fragile.

There are several reasons why I am cautious about the growth outlook.

First, global developments and geopolitical tensions are weighing on confidence and economic activity.

Second, monetary policy affects the economy with long and variable lags. The impact of past policy tightening continues to be transmitted strongly to broader financing conditions and the real economy.

The restrictive policy stance at a given point in time continues to affect inflation and output about one to two years after that. In this regard, a significant dampening effect on growth and inflation is still in the pipeline from past monetary policy tightening.

This explains why credit dynamics remain weak and will remain so for some time to come.

I will now turn to our monetary policy response during the last couple of years.

2. Monetary policy response

In the past few years, we faced an unprecedented series of supply-side shocks – the kind of shocks not easily amenable to monetary policy measures – and we succeeded in bringing inflation down to near our objective within 18 months of the peak inflation, while avoiding putting the economy into a contractionary territory.

We raised interest rates to sufficiently high levels to tame inflation without inducing a recession – which was the first arm of our policies – while, at the same time, we adopted a gradual approach to reducing the size of our balance sheet – the second arm of our policy toolbox.

Our monetary policy response has proved to be pragmatic, flexible and highly effective.

As inflation approaches the 2% target, while economic recovery and credit growth remain weak, we decided that some layers of restriction are no longer appropriate. As you know, at last month's Governing Council meeting we took the first step to lowering rates from their all-time highs.

We cut the key ECB interest rates for the first time in almost five years (since September 2019).

However, our monetary policy remains in restrictive territory, and it will continue to be restrictive for some time into the future.

Financing conditions, especially at the long end, have tightened significantly since the beginning of the year, and will remain tight even after several rate cuts.

The ongoing decline in our balance sheet, i.e. the aggregate balance sheet of the central banks that comprise the Eurosystem, due to the run-off in our asset purchase programmes and the repayment of TLTROs over the course of this year, will also represent an additional tightening of financing conditions.

The challenge ahead is to ensure that inflation continues to fall and approaches our objective in a timely way, while at the same time growth strengthens to reach sustainable levels ensuring full employment.

In these circumstances, the Governing Council faces a balancing act:

We want to bring inflation to our objective by the end of next year. This will call for policy restraint in the months ahead.

But we don't want to undermine the incipient economic recovery and risk bringing inflation to levels below our 2% target.

Indeed, according to the June projections, inflation is expected to undershoot our target in every quarter of 2026.

I will not comment on possible further rate cuts this year other than to say that, first, we need to wait and see how the data develop and, second, even with additional rate cuts, monetary policy will remain well in restrictive territory.

In this journey, maintaining gradualism and flexibility will remain key in mitigating unwarranted economic volatility and financial stability risks, while ensuring the efficiency and proportionality of monetary policy measures and preserving our credibility.

We will continue to be data-dependent, assessing all incoming information in each of the forthcoming monetary policy meetings. Amid elevated economic and geopolitical uncertainty, we will remain cautious and vigilant to adjust our policy stance in stepwise cuts of our interest rates as warranted.

3. Global uncertainty challenges and geopolitical developments

No one could have predicted the series of supply shocks that struck the euro area economy in the past few years. Therefore, no one could have predicted – and no one did before the fact – the rise in inflation that followed.

Some 40 years ago, Nobel Laureate James Tobin said that we know little about predicting inflation. That remains true today. In a world prone to supply disruptions and susceptible to political uncertainties, monetary policy can only try to buffer the effects of external shocks on the real economy and on inflation.

The past two years have seen an escalation of violence, with Russia's unjustified war against Ukraine and the unfolding of the Middle East crisis last autumn.

2024 is a year of increased electoral activity.

There are five months to go to US elections, the outcome of which could alter the course of the global economy.

Nationalist parties made major gains across the euro area in the European Parliament elections, challenging leaders in Germany but also France, where snap elections have been called.

Monetary policy has navigated in the turbulent waters of heightened uncertainty in the past several years. It will continue to navigate in those turbulent waters in the period ahead.

4. Climate change challenges

At the ECB we have a very clear mandate, which is enshrined in the Treaty and has a focus on price stability.

We also have an important role to play in addressing the challenge of climate change, always within the limits of our mandate.

Physical and transition risks can threaten price stability, but also become a source of instability and vulnerability for the financial system, thereby also affecting the transmission of monetary policy.

At the same time, in addition to the risks created by climate change, adapting to climate change can bring opportunities, as required investment will bring new, more efficient and more sustainable forms of development, towards a more resilient and green economy.

The financing of these investments is also an opportunity for the financial system and the more efficient use of the savings of European citizens.

At the ECB we have different sets of actions, from risk management to better macroeconomic modelling and to including climate change risks and mitigation measures in many aspects of our work.

5. Policy challenges related to recent political developments

Monetary policy has a single anchor in price stability, and that anchor is immune to political influence.

As an independent institution, the ECB will continue to conduct its monetary policy to attain its price stability objective. The ECB has earned its credibility by focusing on this objective, and not being diverted by political pressures. It will continue to be led by its mandate in the future.

The economic agenda of some of political parties is disconcerting, because it includes such policies as increased protectionism and highly expansionary fiscal policies.

We have learned over the years – and sometimes the hard way – that to maximise our citizens' welfare we need free trade policies and a sustainable fiscal stance.

6. Decoupling between the ECB and FED monetary policy decisions

The euro area monetary policy stance needs to be differentiated from that in the U.S.

The two economies are at divergent positions, with inflation falling faster in the euro area.

Two reasons why inflation has fallen faster in the euro area than in the U.S. are: (1) the U.S. inflation cycle was mainly demand driven, whereas the euro area has been hit more severely by supply side shocks (the energy prices surge and Russia's invasion of Ukraine) and (2) the U.S. fiscal stance since 2020 has been highly expansionary.

In particular, the U.S. fiscal deficit stood at 8.8% of GDP in 2023, up from 4% in the previous year, after having reached about 14% in 2020 and 11% in 2021. By contrast, in the euro area the fiscal deficit stabilised at around 3.5% of GDP in the previous two years, from 7% in 2020.

On the other hand, economic growth in the euro area is more sluggish and fragile than in the U.S.

Due to the differing macroeconomic situation, the monetary policy actions of the Fed and the ECB might turn out to be different.

The way forward for the Eurosystem should only have to be based on what serves our price stability mandate and our domestic economy.

We need to focus firmly on domestic conditions, taking into account any impact from the expected path of U.S. interest rates. Domestic conditions provide the guideposts on our decisions.

Furthermore, as Philip Lane, Chief Economist of the ECB, said in a recent interview with the Financial Times,5 delays in the expected timing of Fed rate cuts have pushed up U.S. bond yields and this has also lifted long-term yields of European bonds, creating some extra tightening from the U.S. conditions". Philip indicated that the ECB might have to offset this with extra cuts to its policy rates.

Of course, a divergence of interest rate paths of the euro area and the largest economy in the world could impact on the exchange rate and on trade. These effects are difficult to predict. Our gradual and data-driven approach will allow us to respond to any undesirable developments.

7. The forecasting performance of the ECB

Although the accuracy of the ECB's economic forecasts diminished in the past few years, forecasting performance worsened to a comparable degree in other central banks and by private sector forecasters.

The decline in forecasting performance reflected a series of shocks, including the pandemic, along with the economic and policy consequences of those shocks (e.g. the enormous fiscal expansion in the U.S. beginning in 2020), the sharp rises in oil, gas, and other commodity prices which were exacerbated following Russia's invasion of Ukraine, and the sustained disruption of global supply chains during and after the pandemic.

The deficiencies experienced in the forecasting performance of the ECB were characteristic of the central banking community in general and have also been emphasised in Ben Bernanke's report on forecasting at the Bank of England. No forecaster could have foreseen the outbreak of Covid-19 or the war in Ukraine.

We appear to have entered a new period of higher uncertainty, with shocks originating from both the demand and supply sides. Our models need to be reviewed and further upgraded to account for this uncertainty. This has also been the finding of the Bernanke Report.

We constantly assess the status of our forecasting and modelling infrastructure, and strive to improve on it in close co-operation within the Eurosystem.

We will never be able to accurately forecast the outbreak of epidemics and wars, but we should ensure that our models are able to detect those shocks soon after they occur, and to predict their effects as accurately as possible.

Our projections are very useful and comprehensive tool that analyses the data that we receive and helps to make decisions.

Having said that, it is also important to point out that no central bank is entirely model-dependent. In our projections, the staff always incorporates a good amount of judgement, so that forecasts better guide our assessments of the most recent economic and geopolitical developments.

In concluding, I would like to highlight the following factors which, in my view, explain the success of the ECB's monetary policy, so far, in bringing inflation back very close to the 2% target, despite a series of

shocks, mainly on the supply side, but also on the demand side, which started with the pandemic and continued with Russia's unjustified and violent invasion of Ukraine.

First, the institutional independence of the ECB and the national central banks comprising the Eurosystem.

Second, the commitment to the 2% inflation target, using key interest rates as the primary monetary policy tool, together with non-standard measures, when required by macroeconomic and monetary conditions.

Third, a pragmatic, flexible and gradual approach, in an environment of heightened uncertainty.

Fourth, clear and effective communication from the ECB.

---

1 Core inflation as measured by the HICP excluding energy, food, alcohol and tobacco had peaked at 5.7 per cent in March 2023.

2 As measured by the HICP excluding energy and unprocessed food; core inflation as measured by the HICP excluding energy, food, alcohol and tobacco stood at 5.3 per cent in August 2023.

3 Based on the flash estimate by EUROSTAT, released on July 2nd, 2024.

4 The Indeed tracker is a monthly wage growth tracker, developed by the Central Bank of Ireland (CBI) in collaboration with the Indeed online platform, and examines trends in wages posted in online job ads. It is based on data from millions of online job postings on the Indeed platform across France, Germany, Ireland, Italy, the Netherlands, Spain and the U.K.

5 Interview with Financial Times on 24 May 2024.

IMI International Monetary Review

Climate Policy and Green Finance

Tackling Inequality through Green Transition?*

By MASATSUGU ASAKAWA*

The Asia and Pacific region stands at a critical juncture, positioned both as a significant contributor to global greenhouse gas emissions and a potential leader in transformative climate action. The Asian Development Bank, alongside its member countries, is steering the region toward a sustainable future through support for a just transition. Our (the ADB's) vision is to reorient economic and social frameworks to foster low-carbon, climate-resilient growth that enhances prosperity and inclusion.

The need for a just transition, one that puts people at the center of the shift to net zero, cannot be overstated. Asia and the Pacific account for more than half of the world's annual greenhouse gas emissions, driven by its dependence on fossil fuels. At the same time, more than 200 million people in the region are impoverished, with many lacking access to basic electricity and relying on traditional biomass for cooking and heating. Women are particularly affected, and often face disproportionate impacts.

As Asia and the Pacific's climate bank, the ADB prioritizes an inclusive approach to ensure that the costs and benefits of the transition to net zero are fairly distributed. Achieving net zero requires us to restructure our economies and change the way we live and work. It is paramount that in this process, the burden of change is not imposed on the most vulnerable section of society and that the benefits of a low-carbon economy are both maximized and shared equitably. Ensuring that all segments of society, including women, share in these benefits is critical to the success of our just transition efforts.

To create opportunities for inclusive and sustainable growth, the ADB works with partners to implement robust policy frameworks, enhance institutional capacities and engage stakeholders through participatory processes. These just transition efforts align with global commitments such as the Paris Agreement, and at the country level we support ADB's developing member countries in crafting policies and programs that respond to their unique climate challenges and development needs.

At COP27(27th UN Climate Change Conference), the ADB launched a "Just Transition Support Platform" to facilitate a just transition within our developing member countries. The platform focuses on supporting countries to incorporate just transition into their institutional and policy frameworks and identify innovative financing approaches that attract public and private capital for a just transition. The platform also supports the mainstreaming of just transition in the ADB's operations.

Moreover, at COP28, the ADB launched an inclusive process to design a "Just Transition Finance Facility" that will provide targeted finance to address the socioeconomic challenges of the transition to net zero. It will help countries realize the economic and social benefits of the transition and ensure these benefits are inclusive and widespread, ultimately supporting a robust and equitable shift to low-carbon and climate-resilient economies.

Just transition is also a core part of the ADB's "Energy Transition Mechanism".Developed in partnership with ADB member countries, the ETM is a scalable initiative that has the potential to be one of the largest carbon-reduction programs in the world. Under it, public and private investments — from governments, multilateral banks, private sector investors, philanthropists and other long-term investors — finance country-specific ETM funds. These funds are designed to retire or repurpose coal power assets on an earlier schedule compared with a business-as-usual timeline.

Just transition principles are a cornerstone of the ETM's implementation, helping us to ensure that potential negative socioeconomic impacts are minimized through policies and programs. For example,

---

* This article was first published in the OECD Development Co-operation Report 2024 under the heading: "Finance for net-zero transition must maximise and share benefits equally."

* The author is president of the Asian Development Bank.

retraining and re-skilling programs provide new opportunities in emerging industries for women and vulnerable workers.

The importance of managing the social impacts associated with the transition to net zero can be seen through the ADB's work on the Cirebon 1 coal-fired power station in Indonesia. This plant serves as an ETM pilot, for which the ADB completed a preliminary just transition assessment earlier this year — the first of its kind for the ADB and for the region. The assessment utilized a comprehensive methodology to identify impacts along the coal value chain and within the community and surrounding areas. It also established a process to further assess and develop a plan to deal with the impacts at the right project stages.

Just transition offers a compelling vision for green and inclusive development across Asia and the Pacific. Its promise lies not only in avoiding the worst impacts of climate change, but also in creating a more equitable social order that values people's well-being and gender equality, provides decent work, and ensures sustainable economic growth.

We must encourage optimism and all sectors of society should make a concerted effort to embrace the principles of justice and inclusivity that will be needed to build a low-carbon, climate-resilient future. This journey faces challenges but is also filled with opportunities for transformative change that can forge a healthier, more equitable and prosperous world. The path we chart now will determine the climate legacy we leave for future generations.

IMI International Monetary Review

Banking Supervision

Ten Years of the Single Supervisory Mechanism: Key Aspects of Modern Banking Supervision*

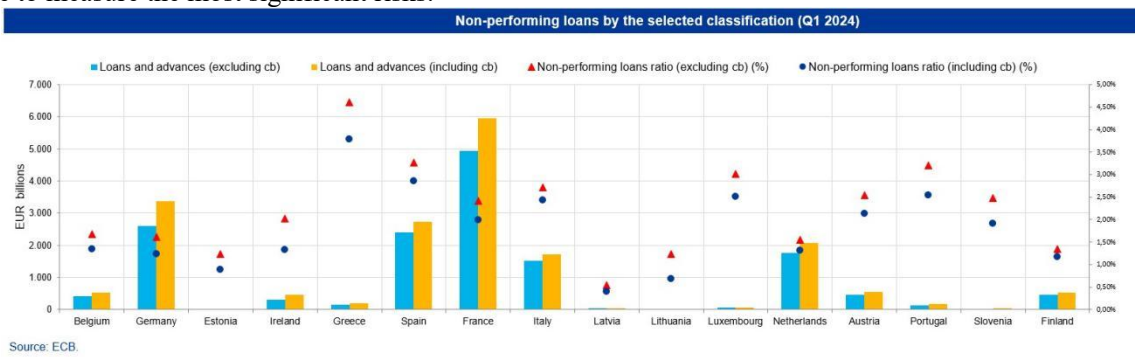
By MARGARITA DELGADO*

Welcome to this celebration of the tenth anniversary of the Single Supervisory Mechanism (SSM). This is a landmark occasion: a chance to, first of all, cast our eyes back and look at what has happened in the banking sector over the last ten years and, second, reflect on what the near future may hold for us in supervision.

This anniversary represents, then, an opportunity to take stock of the current situation of the banking sector, how it has been affected by the new supervisory model implemented a decade ago and, above all, what lessons can we learn to continue improving, thereby strengthening our financial system?

I will divide my speech today into three parts. I will begin by considering the current situation of the banking sector under direct SSM supervision, before looking back at what has been achieved in these ten years and then finishing with my perspective on the challenges facing supervision in the future.

First, we must acknowledge that the banking sector is in generally good health, as indicated by the main ratios we use to measure the most significant risks.



Beginning with credit risk, the non-performing loans (NPL) ratio stood at 2.31%[1] in 2024 Q1, according to the latest report by the European Central Bank (ECB), with NPLs amounting to €354.8 billion, which was a slight increase, of 1 basis point (bp), over the previous quarter, although it remains at a low level historically speaking, as we will see later.

These figures are the Eurosystem average but, as usual, vary across countries.

Thus, for example, NPL ratios in the large economies range from 3.26% in Spain to 1.55% in the Netherlands. The extremes are found in Greece (4.60%) and Latvia (0.54%). The range narrows if analysed by business model, with ratios between 3.07%, for banks deemed to be diversified lenders, and 1.17%, for custodian banks.

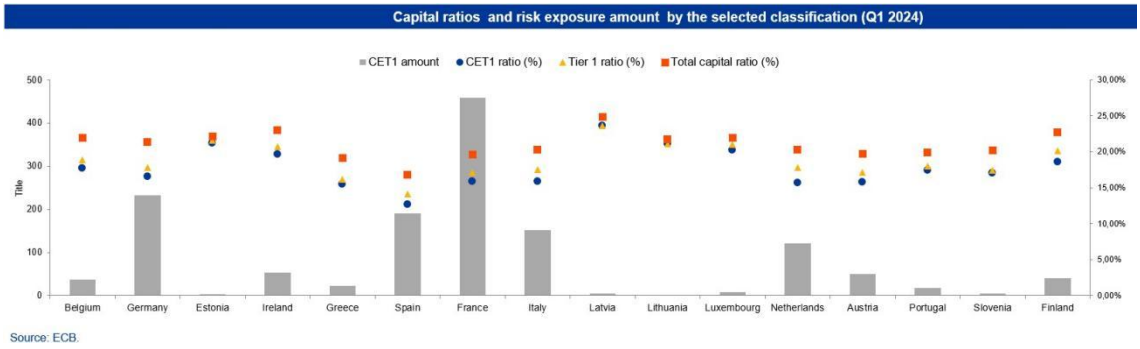
French and German banks have the largest NPL portfolios by volume, which is understandable given their joint weights in the banking system as a whole. Indeed, French banks hold 34.8% of all loans by euro area significant institutions, far ahead of German banks (in second place, with 16.6%) and Spanish banks (in third place, with 15.3%).

---

* This article first appeared on 24 July 2024.

* Acting Governor., Bank of Spain

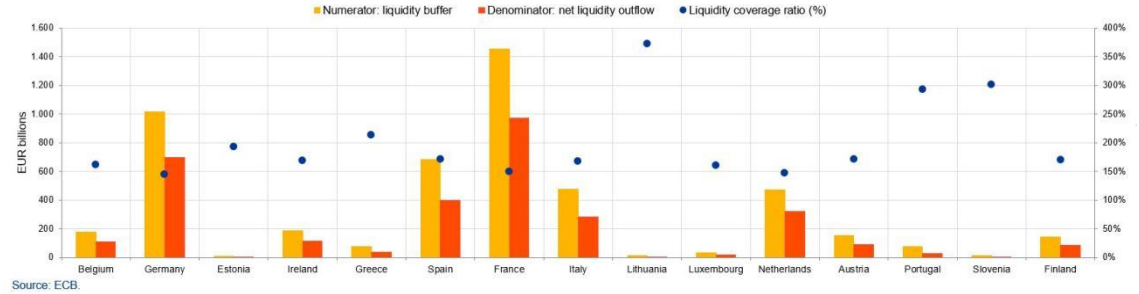
1 Excluding central bank exposures.



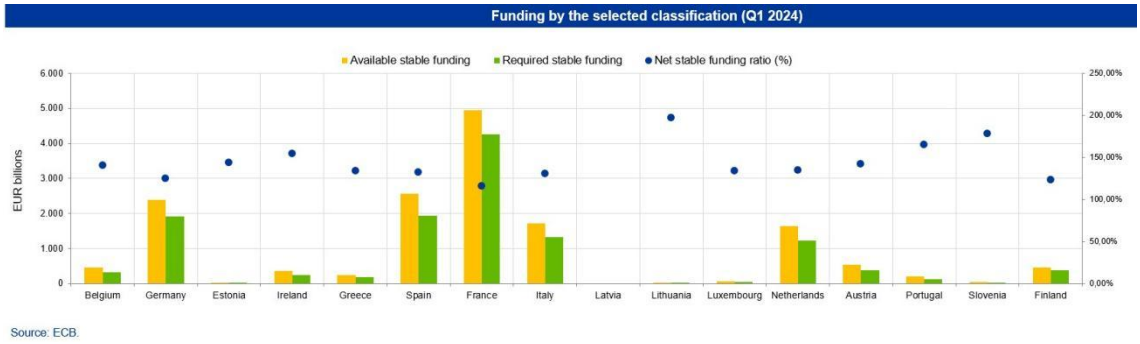
Turning to solvency, the CET1 ratio stood at 15.74% in 2024 Q1, with the total capital ratio at 19.81%, figures similar to those of the previous quarter. Similary to credit quality, the differences across areas and business models are even starker in the case of solvency. The CET1 ratio varies between 14.14% among global systemically important institutions and 33.68% among development and promotional banks. The most robust CET1 ratios in the large economies range between 16.52% in Germany and 12.66% in Spain, with the latter having the lowest rate in the euro area. As we have often noted, the predominant business model of Spanish banks revolves around international activities that generate recurring revenue, but which also lock up larger amounts of capital in risk-weighted assets (RWAs).

As also mentioned in the past, internal models (normally linked to lower capital requirements) are less commonly used by Spanish banks. 51% of credit RWAs in Spain are reported under the standardised approach, compared with 43% in Italy, 37% in France, 29% in Germany and 13% in the Netherlands. The average leverage ratio in the European Union is 5.71%.

At 158%, the average liquidity coverage ratio (LCR) remains well above the legal minimum.[2] The situation is comfortable in all countries, given that this ratio drops no lower than 145.2% (in Germany), and the same can be said if we group by business model.

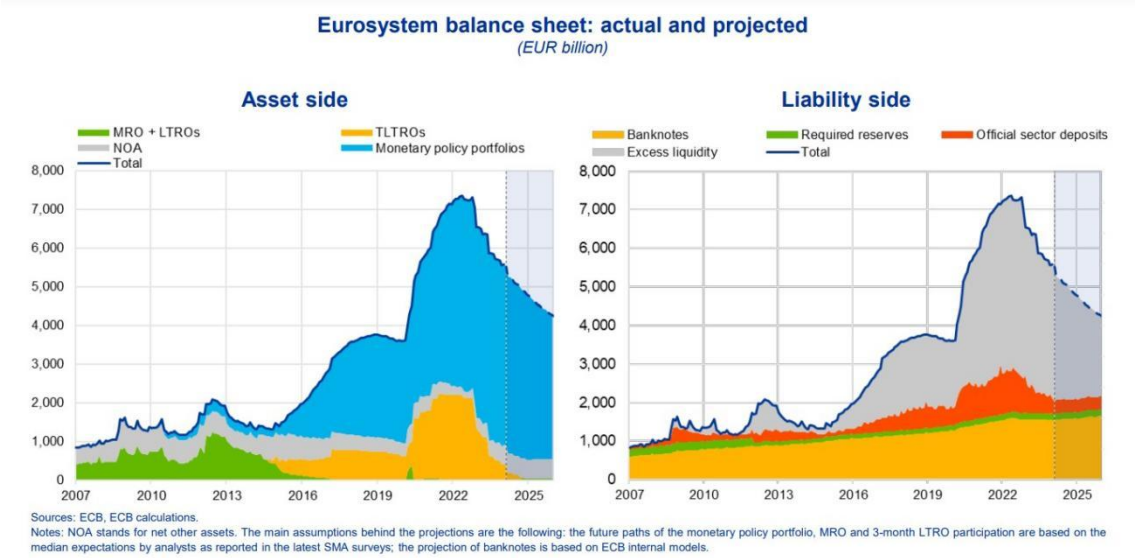


The same is true for the net stable funding ratio, which, at 126.8% in 2024 Q1, is also well above its regulatory minimum.

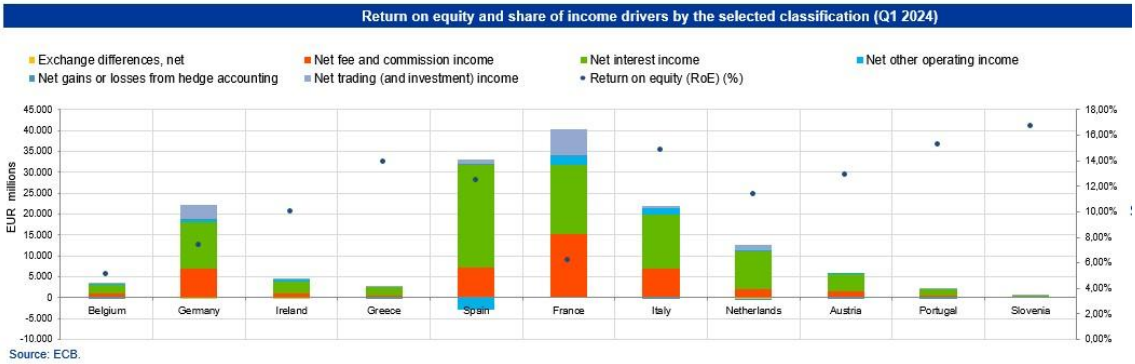


This shows that the system still has a high level of liquidity despite the ECB's gradual reduction of its balance sheet and the repayment of the targeted longer-term refinancing operations.

[2] The legal minimum LCR is 100%.



This comfortable level of liquidity in the system is one of the reasons why banks have not had to raise remuneration rates on retail deposits as forcefully as policy interest rates have increased. As a result, strong net interest income has led to broad-based growth in return on equity, which reached an average of 9.67% in 2024 Q1 (12.43% in Spain), 36 bp above its level at end-2023. Net interest income reached 1.62% (2.90% in Spain), with low levels for the cost of risk, at 0.50% (1.15% in Spain). These developments ought to be seen against the backdrop of weak credit among banks supervised by the SSM. Indeed, the amount of loans to households increased by just 0.1% in the last quarter and by 0.6% over the past year. Lending to firms rose by 0.3% in the last quarter and remained stable over the last year.



Spanish significant institutions also continued to improve their profitability as the increase in net interest income offset both the growth in operating costs and credit impairments and the outlay of the bank levy. Net interest income was mainly driven by the price effect as lending volumes remained somewhat subdued. On the other hand, net fee and commission income grew at an annual rate of 9.6%, mainly among international banks. Notably, there was a 34% increase in the bank levy, to €1,652 million (from €1,236 million in 2023) owing to growth in the base used to calculate the levy (net interest and fee and commission income). Naturally, domestic banks were relatively more affected. Moreover, overhead costs increased above inflation (7.7% year-on-year), driven by staff costs (up by 10.9%).

These figures must be understood in the context of a European banking system that is generally traditional in nature, with loans constituting the bulk of the balance sheet (60.8%), followed by cash and balances at central banks (12.3%). Loans are principally concentrated in lending to households (37.9% of loans) and firms (34.9%). In turn, Spanish banks subject to SSM supervision operate with an even higher share of retail customers, who constitute a higher share of lending (65.5% of the total balance sheet), centred around credit to households (48.2% of all loans).

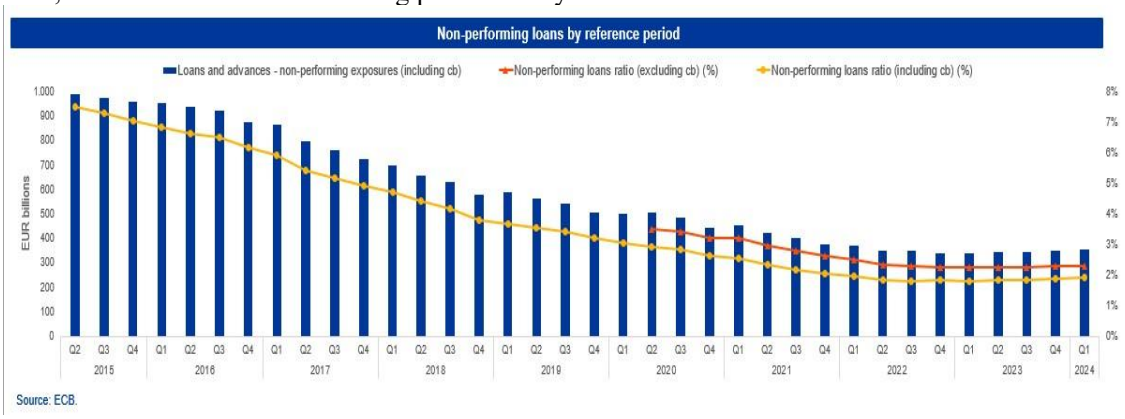
By business type, global systemically important institutions account for 44% of assets, while universal banks account for 34.3%.

Following this overview of the current context of the most significant banks in Europe, let us now look back at the path trodden. Over the past ten years, this road has not been easy and we should acknowledge that banks have proven resilient to recent exogenous shocks, from the COVID-19 crisis to the economic tensions brought about by bottlenecks, inflation driven by energy price rises as a result of the war in Ukraine and the various banking crises in

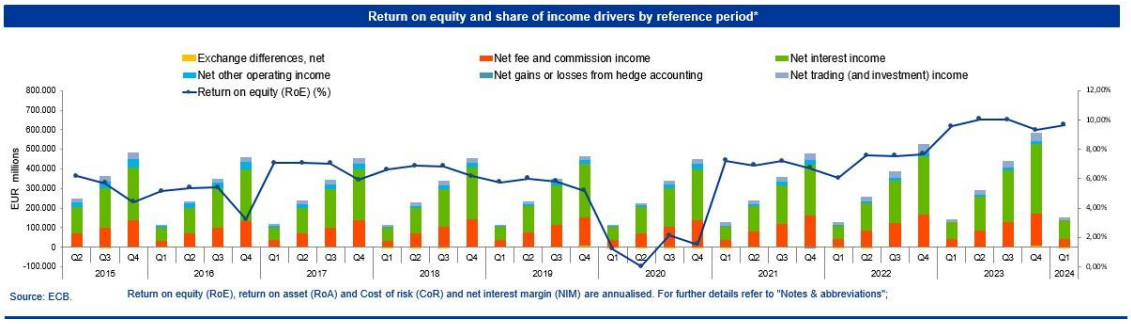
2023, to give just some examples. This is undoubtedly the fruit of our work to strengthen solvency, governance and, in many cases, also adapt business models to a historically low interest rate environment that lasted for years.

We should remember that the SSM was created at a very complicated time, when the consequences of the great financial crisis could still very much be felt, some countries' sovereign debt was coming under scrutiny and parts of the banking system were undergoing critical moments. I would like to highlight four key aspects of the last ten years:

First, the balance sheet restructuring performed by banks.

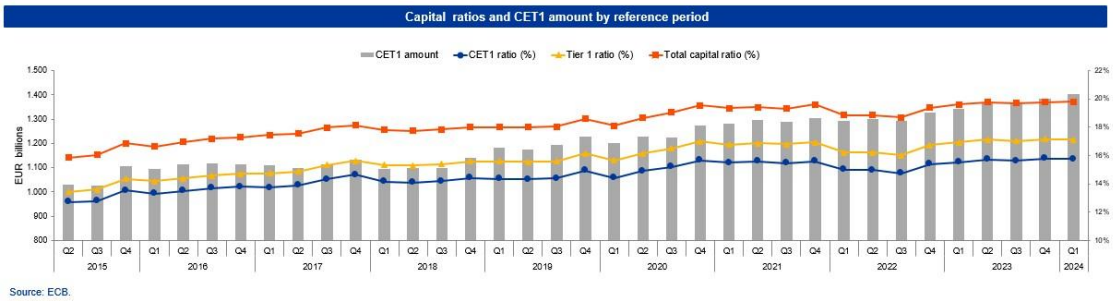


This has seen NPLs fall from nearly €1 trillion (€989 billion) to slightly less than €355 billion today. NPL ratios have dropped from 7.48% to 1.91%.[3] One contributor to this process was supervisory pressure to improve balance sheet quality, which weighed on banks' profitability over a number of years when interest rates were even negative. This was particularly significant in some areas that were severely affected by the build-up of portfolios with high NPL ratios. Other contributory factors were banks' improved credit management policies and a more favourable macroeconomic environment.



The outcome of this exercise, and of containing other costs, was that banking profitability remained at between 5% and 6%, in spite of such an adverse interest rate environment. As we have pointed out before, the normalisation of monetary policy has strongly driven bank profitability in the last two years.

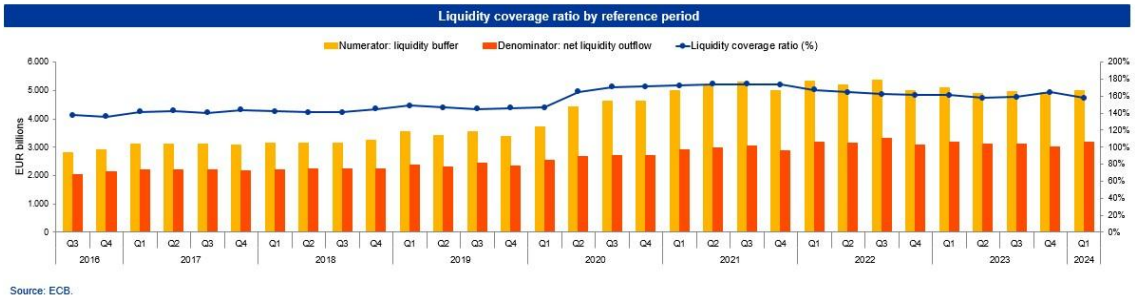
Second, and as a result of the above, European banking solvency has also been strengthened over the last decade.



The CET1 ratio rose from 12.7% in 2015 Q2 to 15.7% in 2024 Q1. The regulatory changes to the solvency framework made in the light of the great financial crisis drove this significant increase. Nevertheless, the leverage ratio saw a more modest rise, from 5.04% at end-2016 to 5.71% in 2024 Q2.

The third aspect to consider is liquidity. Here, banks have also strengthened their liquidity positions, with the LCR rising from 138% in 2015 to 158% at present.

[3] Including amounts held by central banks.



Source: ECB.

At a time when accommodative monetary policy – with high liquidity indices in the system – is becoming tighter, liquidity management has taken on particular significance, and despite there still being comfortable liquidity levels, it is an area that will need closer monitoring and management. Moreover, the markets are more sensitive in these times of geopolitical turmoil and uncertainty and, therefore, susceptible to volatilities that have an impact on liquidity.

The final aspect I would mention, and perhaps the most important one, is improving governance and risk management. This has been, and continues to be, a supervisory priority, because we are convinced that the first line of defence for a strong, profitable and efficient banking system is a well-defined, robust and professional governance structure and a solid and prudent risk management framework. This is a message often repeated by supervisors, but reality shows that banks with weak risk management systems or governance frameworks can find themselves in situations that jeopardise their own existence or financial system stability, as we saw last year with the US banking crises. Although numerous supervisory activities focused on governance have been conducted over the last decade (from strengthening the fit and proper procedures to reviewing data management and aggregation systems, among many other tasks), in the past three years they have centred more on aspects related to organisational structures, management bodies and risk management functions. Since the SSM was created, 8,735 governance related findings (accounting for nearly 14% of the total) have been detected, of which 1,624 currently remain open. In addition, a higher percentage of governance-related findings have been closed than those related to other risks. As a result of all this, banks are much better managed today than a decade ago. However, as I have mentioned, this is an area that is and will continue to be a supervisory priority in the future owing to its extraordinary importance.

The progress made over the last decade can therefore be clearly appreciated. In a relatively short period of time, we have been able to integrate different supervisory cultures and sensitivities into a single mechanism capable of supervising banks with a wide variety of profiles and activities. There has also been a successful drive towards more prudent and efficient risk management, which has simultaneously reinforced banks' positions in aspects as diverse as solvency, liquidity and governance.

But the supervisor must not fall into complacency, and it is precisely at this point that I would like to reflect on the future of supervision and the changes we need to implement to adapt it to the new age. Back in September 2022 the ECB considered it necessary to assess the functioning of the SSM, and appointed a group of independent external parties to prepare a report with proposed improvements. Published in April 2023,[4] the report contains a wide range of proposals, and reforms to supervisory tasks have since begun to be implemented.

The most noteworthy reform aims to establish a more risk-based approach to supervision. This means that the inspection teams will have more flexibility in flagging the areas of focus for their supervisory activity. The aim is not to conduct a global and comprehensive review of the banks every year, but rather to focus resources on the most significant risks at each bank. This will help make more efficient use of the ever-scarce resources available. Although this new approach will entail risk-taking by the supervisor (as some areas will be left outside the supervisory perimeter for some time), it is a risk we must take if we are to become more efficient, focused and, at the same time, more flexible.

Flexibility and agility are essential in such turbulent and evolving times, and we must be able to react swiftly to any new scenarios that could affect the financial system. Although the events of recent years have demonstrated how, as supervisory authorities, we have been able to adapt our activity, priorities and procedures to the circumstances of any given moment, this quality needs to be reinforced and incorporated more explicitly into our methodology.

In this respect, I consider that the suptech tools we currently have and the ones we will develop over time will prove to be highly efficient in the early detection of weaknesses and areas for improvement in banks' management and their risk profiles. This will improve the efficiency of supervision.

Another key element we need to reinforce is the implementation of supervisory measures. Unless the corrective measures are duly complied with, any problems or shortcomings detected will not be properly addressed. This is

[4] https://www.bankingsupervision.europa.eu/ecb/pub/pdf/annex/ssm.pr230417_annex.en.pdf.

another lesson learned from the crisis at mid-sized US banks in spring 2023. Such tools should be governed by the principle of proportionality and able to adapt to the seriousness of the shortcomings they seek to address. Moreover, the deadlines set for implementing the corrective measures should also be reasonable and commensurate with their complexity and the severity of the deficiencies, establishing intermediate milestones where applicable. To this end, an escalation ladder has been designed, which specifically seeks to strengthen the corrective measures process following these criteria. There are a wide variety of tools available to the SSM in this respect, and this new escalation ladder will allow adaptation to the specific circumstances in each case. Corrective measures can range from quantitative and qualitative requirements to periodic penalty payments or other types of sanctions in the event of a serious breach of any ECB decision or regulation.

But not all shortcomings can be addressed with quantitative measures. Matters related to governance or business models, for example, can only be mitigated through qualitative measures. Perhaps we have put too much focus on capital requirements over the years, at the expense of these other measures. This is why we need to strengthen this other aspect because, as I have pointed out, governance is key to strengthening the banking system.

For instance, we have found that there are still numerous shortcomings related to data governance that have not been adequately addressed in a proper and timely manner. Therefore, we need to recognise the importance of qualitative measures and ensure that they are sufficiently clear and specific, that they have fixed deadlines and that noncompliance would in any event entail other more forceful measures within the escalation system I mentioned earlier.

In increasingly digital environments where data management is key and will become even more so in the future, proper data governance is a cornerstone for the sound management of banks.

This is why I believe that supervision over the coming years will increasingly target aspects related to digitalisation and new technological environments, such as operational resilience frameworks, the management of external providers and the adaptation of business models to new customer needs, new operators and new products.

The results of the recent cyber resilience stress tests will be announced in the coming days. This exercise, which focused more on qualitative aspects, has been very useful in understanding banks' responsiveness to such events, as these will doubtless become an increasing priority, against which banks must establish safeguards.

Nor can we forget other emerging risks, such as those posed by climate change. The materialisation and management of such risks are and will continue to be subject to supervision, which will no doubt evolve in step with regulatory requirements.

Lastly and again looking to the future, I would like to recall that the banking union is incomplete. We have not yet finished the work we began ten years ago. Although the single supervisory and resolution mechanisms are fully operational, the European Deposit Insurance Scheme (EDIS) is still pending. In the absence of political consensus, work is currently under way on an intermediate solution, namely the Bank Crisis Management and Deposit Insurance Framework (CMDI). Last June[5] the Council of the EU agreed on a joint position with the European Parliament, which has to be ratified. Without going into detail, I firmly advocate aiming for the creation of this common framework, in order for the banking union to have true substance.

In conclusion, the uncertain and changing environments in which banks operate today require that supervisory processes also be adapted so as to quickly and flexibly capture all elements related to their risk profile and be able to establish timely corrective and mitigating measures.

Supervision needs to be more efficient, targeted and transparent, both now and in the future. As with the world around us, supervision also has to evolve, if it is to fulfil its purpose: ensure a robust and stable financial system that provides the real economy with the resources it needs for its activity.

Banks' ability to react to unexpected shocks, and the existence of operational frameworks that strengthen their resilience in vulnerable digital environments with unforeseen or deliberate failures, will be key elements of tomorrow's supervisory agenda. Nor must the other aspects I have mentioned be neglected, such as governance, climate risk management and liquidity. If it is to be efficient, supervision needs to evolve in step with changes that impact the financial system.

---

[5] https://www.consilium.europa.eu/en/press/press-releases/2024/06/19/bank-crisis-management-and-depositinsurance-framework-council-agrees-on-its-position/.

IMI International Monetary Review

Liquidity, Supervision, and Regulatory Reform*

By MICHELLE W. BOWMAN*

Earlier this year, we passed the one-year anniversary of the failures of Silicon Valley Bank (SVB) and Signature Bank. The failure of these banks, and the subsequent failure of First Republic Bank, prompted a discussion of the regulatory framework. These failures have also frequently been cited as the basis for a number of matters on the current regulatory reform agenda. Over time, this agenda has expanded to include bank capital regulation, the role of supervision, the potential vulnerabilities to the banking system created by bank-fintech partnerships, and bank liquidity and funding, among other topics.

This conference covers a number of important issues that touch on many aspects of this regulatory reform agenda. Earlier today, panelists discussed the 2023 regional banking stress, the history of financial crises, and deposit insurance reform. Tomorrow we will hear about the discount window and a discussion on the future of contingent liquidity. A further panel will consider what may be next in terms of regulatory reforms.

In considering this last topic, conferences like this serve an important role—encouraging us to pause and reflect upon these efforts, and providing an opportunity to share thoughts in full public view about what is working and not working within the bank regulatory framework. These discussions also allow us to consider a range of options to both enhance banking system resiliency and to better prepare for future stress in the system. I am especially pleased that we have an opportunity to publicly confront difficult questions, like probing the link between last year's banking stress and elements of the reform agenda purportedly aimed at addressing identified deficiencies.

As we think about reform of the bank regulatory framework, including changes designed to maintain a robust and responsive approach, what are the principles that should guide our thinking? What lessons should we take from past financial crises in terms of the causality and related bank management and supervisory lessons learned? Were those reforms responsive, successful, and durable over time? When we consider the Federal Reserve's operational infrastructure, including Fedwire and discount window lending, were its tools effective and complementary to other funding sources (including Federal Home Loan Bank (FHLB) funding) during times of stress, and if not, how could they be improved?

My hope is that in discussing these issues we can develop a better and deeper understanding about sources of bank funding, financial stability, and the future of the banking system. This complex set of issues can be open to interpretation, and as a result, can lead policymakers to different policy prescriptions for how to make the banking system more resilient, and the regulatory response to financial stress more effective.

Conversations like those that we are having today and tomorrow can help us find consensus both in identifying the risks to the financial system and coming to agreement on policy reforms to address them, if needed. As the discussions continue following this conference, it is essential that we include the experience and perspective of state bank commissioners. I look forward to the opportunity to engage with them more fully on these issues. As a former bank commissioner, I greatly value this perspective.

I am hopeful that all of these conversations can help us to understand differing perspectives and enable us to examine the full extent of the underlying issues before we implement reforms that do not address identified problems or do not adequately consider the underlying risks and unintended consequences.

When I think about regulatory reform and the future of the banking system, I begin with the foundational elements that promote accountability in banking regulation: a deep understanding of the banking system; a thorough analysis of the underlying facts; a careful identification of how elements of the banking system interact and perform over time, especially during stress; and a commitment to take ownership of identified problems with targeted reforms that are commensurate with the underlying risks.

These same elements should be the foundational elements of any reform agenda. They should apply not just to changes that I will call "responsive" changes—those designed to mitigate the risks exposed during the spring 2023 banking stress—but also to any other contemplated reforms of the bank regulatory framework. If we approach this task with humility and with full accountability of unintended consequences, I expect that we will find opportunities in a number of areas. These involve not only imposing new requirements and expectations on individual banks, but also opportunities to remediate deficiencies and overlapping requirements within the regulatory framework. Both approaches may be equally effective in enhancing the resilience of the banking system and promoting U.S. financial stability.

---

* At "Exploring Conventional Bank Funding Regimes in an Unconventional World" A Research Conference Co-Sponsored by the Federal Reserve Banks of Dallas and Atlanta, Dallas, Texas.

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

In my remarks this evening, I will reflect on these elements, as I share my views on the Fed's lender of last resort function, payments infrastructure, supervision, and regulation.

Lender of Last Resort and Payments Infrastructure

As part of the reform agenda, we must consider how to operationally enhance and optimize tools like the discount window to meet banking system liquidity needs more effectively. This must include ensuring the payments infrastructure that supports bank funding mechanisms is equipped to operate not just during business-as-usual conditions, but especially during stress events. Last year's banking stress clearly demonstrated the need for reforms and updates, but these issues existed long before the bank failures. Some banks encountered frictions in using the discount window that made it less effective, and these frictions potentially exacerbated the stress that some institutions experienced. Limits on the availability of payments services, including Fedwire, may also have interfered with the ability to effectively manage bank liquidity. These issues require a careful and impartial review to understand the facts, particularly if we base reform efforts on the recent events.

Addressing operational readiness

Maintenance of existing infrastructure is an often overlooked and sometimes thankless job. When the payments infrastructure works "well enough," as it seemed to do in the lead-up to the spring banking stress, it is easy to take for granted that it will work during times of stress. However, this is an area where we must become more vigilant and avoid complacency.

We know that SVB experienced difficulties in accessing discount window loans before its failure. Certainly, there are ways in which the Fed can enhance the technology, the operational readiness, and the services underpinning discount window loans and payment services to ensure that they are available when needed. On this front, I would note that the Federal Reserve recently published a proposal to expand the operating hours of the Fedwire Funds Service and the National Settlement Service (NSS), to operate 22 hours per day, 7 days per week, on a year-round basis. The proposal also requested feedback on whether the discount window should operate during these same expanded hours. The comment period remains open on this proposal, but this seems like it would be a critical improvement, and one that would be responsive to identified shortcomings.

Other changes are also needed to bring payment services and discount window lending into the 21st century, including modernizing the technology banks use to request loans electronically rather than relying upon a person to answer a telephone call, ensuring that collateral can move freely from the bank or FHLB to the Reserve Bank when needed, and identifying and reducing other areas of friction that banks experience in the use of the discount window. Operational improvements—including technology enhancements and investments—and improving operational readiness within the Federal Reserve System, should underpin any approach to improvements.

Bank liquidity sources

A critical component of the current reform agenda focuses on the ongoing evolution of bank funding and liquidity sources and mechanisms. Of course, any discussion about the discount window would be incomplete without considering these sources and mechanisms. The discount window is a critical tool, but it does not operate in isolation. It is also intended to be a source of liquidity as a last resort and at a penalty rate, not as a primary funding resource in the normal course of business at a market rate.

While discount window lending can support bank liquidity, it is best thought of as an additional resource in the federal safety net that allows eligible institutions to weather disruptions in liquidity markets and access other resources. Banks have a range of options to manage liquidity needs during business-as-usual operations and during times of stress, including repo markets and FHLB advances. Within this framework, the discount window operates as a backup liquidity authority, a "last resort" for funding needs. In evaluating the bank liquidity framework, it is imperative that we consider and understand the interrelationships among these resources, liquidity requirements and regulations, and bank liquidity planning.

These resources are complementary, so they must be thought about holistically when discussing and seriously considering changes to requirements. Yet, discussions about reforms are often approached in a piecemeal way.

Some policymakers have stated that a potential response to the 2023 banking stress would be to require banks to preposition collateral at the Fed's discount window. The notion is that by forcing banks to preposition collateral in this way, banks will have a ready pool of liquidity to draw from during times of stress. This compulsory requirement to preposition collateral, it is argued, could also mitigate some of the stigma associated with using the discount window, and thereby improve its effectiveness.

So, we must also ask if the perceived stigma of taking loans from the discount window will be mitigated by requirements to preposition collateral. If the stigma of receiving a discount window loan continues to impede the effectiveness of the Fed serving as a lender of last resort, we must consider other ways to address these stigma concerns. There is no reason for a bank to take a loan at a penalty rate or preposition collateral during periods of calm if the discount window operates effectively and communicates with banks on a regular basis. If the issue is that the window does not operate in an effective manner, requirements to use it will not succeed. Investments must be made to address its operational shortcomings.

Some reforms, like encouraging bank readiness to borrow from the discount window if that is part of their contingency funding plans, could be explored more thoroughly. If a bank includes the discount window in these plans and intends to use it during stress, the bank should be prepared to do so. But if we are honest, we recognize that our prior efforts to reduce discount window stigma, as during the COVID period, have not been durable or successful.

There are a number of reasons a bank could choose to borrow from the discount window, including market disruptions in liquidity access or a scarcity in the total amount of reserves in the banking system and a specific borrower's growing financial stress. To access primary discount window credit, a borrower must meet financial standards for borrowing. In some ways, these financial requirements to access primary credit suggest that an important "market signal" of discount window borrowing is related to a market liquidity disruption and may be less of a signal about any individual institution's financial condition. But discount window lending is an additional data point for the market and may be read as a sign of financial distress. This possible interpretation alone may be enough to deter usage of the discount window.

As we consider the future of the discount window, we should explore ways to validate the use of discount window lending in our regulatory framework. For example, are there ways to better recognize discount window borrowing capacity in our assessment of a firm's liquidity resources, for example in calculating a firm's compliance with the Liquidity Coverage Ratio?

As the resources available for bank funding continue to evolve, including the Federal Housing Finance Administration's (FHFA) active consideration of reforms to FHLB lending standards, we see direct impacts on access to liquidity. Even though the comment period for these changes just concluded on July 15, these significant shifts are already affecting how FHLB members will need to plan to use FHLB advances for liquidity funding.

Making regulatory changes to liquidity requirements while the FHFA is shifting FHLB funding prioritization for its members leads to several questions that would need to be answered before engaging in prudent policy-making. How would required collateral prepositioning at the discount window affect the availability or amount of FHLB advances that a bank can rely on for funding purposes? More broadly speaking, how will any requirement to preposition collateral at the discount window affect the availability and use of other funding resources or the day-to-day liquidity management practices of banks? A better approach would be to recognize and understand how the FHLBs support bank liquidity and work together with each FHLB through the Reserve Banks in advance of a bank stress to ensure that mechanisms are in place to facilitate the transfer of collateral to the discount window, and that the Reserve Banks have the appropriate seniority over such collateral. A practical and pragmatic approach will work to preserve the stability of the banking system much more effectively than disrupting the bank liquidity operations of the FHLB system that have been in place since the 1930s.

When it comes to the next steps in liquidity reform, I think it is imperative that we tackle known and identified issues that were exposed during the banking stress in the spring of 2023. This must include updating discount window operations and technology and making sure that payment services are available when needed. But for other reforms, a number of important questions remain unanswered, including understanding both where there are frictions and weaknesses in the current bank funding landscape, and what the potential impact (including intended and unintended consequences) of these reforms on the banking industry could be.

Reform of Supervision

Banking regulators play a vital role in promoting the safe and sound operation of individual banks and the stability of the U.S. financial system. These statutory responsibilities require banking regulators to ensure that banks are held to high standards: bank regulators enforce regulation to promote safety and soundness, engage in periodic examinations of banks and their holding companies, and require periodic reporting by regulated institutions. When a bank fails to meet these high standards, supervisory action can be taken to force remediation or, in some cases, impose an enforcement action that includes a civil money penalty.

Last year's banking stress highlighted the need for improvements in bank supervision, with several notable failures to identify and appropriately escalate issues during the examination process. Supervision that is not focused on core risks erodes the resiliency in the banking system. Bank failures and losses to the deposit insurance fund certainly demand attention, review, and accountability, but the underlying issues suggest we need to ensure that supervision works appropriately over time.

Many of the reforms targeted in this conference address broader structural concerns—like imposing sweeping new regulatory reforms, or broad changes to laws like those governing deposit insurance. I applaud the engagement on these issues, but often the most effective regulatory tool is supervision. Effective supervision requires transparency in expectations and an approach that incorporates remediating deficiencies as a part of meeting those expectations.

Many of the risks identified during last year's banking stress did not involve novel or unique risks. Addressing concentration risk, interest rate risk, and liquidity risk are all key risks that have long been elements deemed critical for effective supervision in bank examinations. These risks are known to create significant vulnerabilities and can be fatal to individual institutions if not managed appropriately over time.

It is clear in the case of SVB that these risks were not managed appropriately. Bank regulators and supervisors also failed to sufficiently identify and prioritize the appropriate risks. Instead, the focus was on broader, qualitative, and process- and policy-oriented risks. Ultimately, both the bank's management and examiners failed to appropriately emphasize these key issues.

An important step in the reform agenda—and one of the most effective reforms to build resilience against future banking stress—is to improve the prioritization of safety and soundness in the examination process, ensuring a careful focus on core financial risks. In my mind, successful prioritization involves increased transparency of expectations and a renewed focus on core financial risks. This includes avoiding issues that are only tangential to statutory mandates and critical areas of responsibility. Where necessary, it also includes adopting a more proactive approach for bank management and bank supervisors to deal with identified risks. Our goal must be to avoid straying from these core issues to focus on less foundational and less pressing areas.

There have been some notable examples of regulatory mission creep, including the climate guidance introduced last year by the banking agencies. I have no doubt that this guidance is well-intended, and that climate change is an important public policy issue. But the question should be whether banks should be required to divert limited risk management resources away from critical, near-term risk management, with a parallel shift in focus by bank examiners. Looking at this guidance through the lens of prioritization, one could reasonably conclude that climate change is not currently a financial risk to the banking system and does not justify a shift in prioritization.

While some may view this position as provocative, my goal is to demonstrate a more foundational point—mis-prioritizing supervisory objectives will have consequences, making banks riskier and the U.S. financial system less resilient over time.

Regulatory Reform

When it comes to regulatory reform efforts, we should acknowledge, as a starting point, that the bank regulatory system has undergone significant transformation since the passage of the Dodd-Frank Act, in response to the 2008 financial crisis. This has resulted in significantly increased liquidity and bank capital, new stress testing and resolution planning requirements, and several other improvements designed to promote bank resiliency. Not only the quantum, but the quality, of bank capital has also improved. Common equity tier 1 capital is now codified as the highest quality form of regulatory capital and is included within a capital framework that already includes gold-plating over international capital standards.

Measured against this baseline of resiliency, we need to carefully assess the need for regulatory improvements, while maintaining those elements of the bank regulatory framework that have proven durable and successful over time. I have not previously argued nor am I arguing today that the regulatory framework is perfect and beyond reproach. Or that there is no room for improvement or evolution over time. Where we find opportunities for needed improvements—either to maintain the system's effectiveness or respond to identified weaknesses—we should make those changes. But these changes should be motivated by a clear-eyed assessment of the facts, if the goal is to achieve changes that are focused, efficient, and durable over the long run.

Before proposing regulatory reform measures to remediate or address issues identified during the spring 2023 banking stress, we should first reflect on the causes that contributed to the failures of SVB and Signature Bank. These bank failures were followed by government intervention in the form of a guarantee on uninsured deposits at these institutions, and the creation of a broad-based emergency lending facility—the Bank Term Funding Program—designed to reassure the market about the underlying strength of the U.S. banking system.

Other characteristics of these bank failures—the rapid pace of depositors withdrawing uninsured deposits—appeared to deviate from the patterns seen in prior bank failures (in degree, if not in kind). But many of the core problems of these banks stemmed from well-known, core banking risks—interest rate risk, liquidity risk, and poor risk management. Each of these can be addressed effectively and efficiently through targeted improvements to the supervisory process.

Supplementary leverage ratio

Our current narrow approach to rulemaking—focusing on a specific reform, without considering the broader framework or context within which these rules exist—has created a corresponding narrowness when we think about the consequences of regulatory reform. An efficient regulatory system can build resilience both for bank safety and soundness and financial stability. Take for example missed opportunities in capital reform. The current set of capital reform proposals does not address or propose changes to leverage requirements, including the 5 percent leverage ratio that applies to U.S. global systemically important banks, commonly referred to as the enhanced supplementary leverage ratio (or eSLR). Treasury market intermediation can be disrupted by constraints imposed by the eSLR, as occurred during the early days of market stress during the pandemic. It seems prudent to address this known leverage rule constraint before future stresses emerge that would likely disrupt market functioning.

This narrow focus ignores that many requirements are intended to operate in a complementary way, and that these requirements in the aggregate may overlap or conflict, generating unintended consequences. The Federal Reserve has expressly acknowledged the complementary nature of these requirements, for example in noting that some leverage ratio requirements operate as a backstop to risk-based capital requirements. And yet, the discussions of

costs and benefits of reform tend to disregard the aggregate impact across rules, even when related reforms are proposed at the same time and the aggregate impacts can be identified and assessed.8

When policymakers publicly discuss changes to liquidity and capital, industry participants will modify their behavior in part to meet anticipated regulatory requirements, despite the regulatory uncertainty that accompanies reform efforts. While this response by banks is unfortunate, it is also predictable.

Regulatory process

My remarks this evening have primarily focused on the substance of reforms and the importance of demonstrating a case to support the changes. But it is also necessary to pause and reflect on the importance of following established process and procedure. This is especially important as we think about the choice between making policy reforms through supervision or regulation. Passing regulations under the Administrative Procedure Act requires agencies to follow specific notice-and-comment rulemaking procedures. I think we should approach this process through the most stringent and conservative lens, particularly when it comes to some of the most consequential rulemakings of the last decade. Rulemaking entails publishing rationales for agency action and seeking public input. These procedural requirements serve an important purpose and ultimately promote better agency decisionmaking. One of the most effective tools we have for doing so is the use of public Board meetings to address matters of significant public interest. My hope is that material items on the reform agenda will continue to be handled through public meetings that give greater visibility and insight into the thinking and rationales of different policymakers.

Closing Thoughts

I will conclude today's remarks by thanking all of our participants for joining us in Dallas and contributing to these important discussions. The elements that facilitate accountability parallel those elements necessary for effective reform—a deep understanding of facts, a careful identification of how elements of the banking system perform over time and during stress, and a commitment to take ownership of identified problems with targeted reforms that are commensurate with the underlying risks. As we engage in a review of our regulatory framework for liquidity and more broadly, these elements should serve as a guide to understanding the past and help us chart a path forward.

October 2024
Vol.11, No.4

Working Paper

No Safe Haven, Only Diversification and Contagion

— Intraday Evidence around the COVID-19 Pandemic*

By ZEYUN BEI, JUAN LIN AND YINGGANG ZHOU*

Abstract

Using the 2020 financial turmoil during the COVID-19 pandemic as a laboratory, we exam- ine contagion, safe-haven, and diversification effects across stocks, gold, and oil. We de- velop a unified approach to quantify these effects using multivariate downside-to-upside and downside-to-downside CoVaR measures. Although gold lost its safe-haven glitter in the early pandemic, a diversification benefit still existed in the form of reduced downside risk and up- side potential. However, strong contagion among the three assets occurred after the worldwide pandemic was declared on March 11, 2020. Further analysis shows that pandemic-related fear diminished diversification benefits of gold investment and exacerbated contagion spillovers.

JEL Codes: C22, C53, G11, G12, G17

Keywords: contagion, safe haven, diversification, CoVaR, COVID-19.

* We thank Mark Spiegel (the editor), three anonymous referees, Ghon Ree, Tianyang Wang, Yanxi Hou, Xuan Leng, seminar participants at Xiamen University, Hunan University, and City University of Hong Kong, and con- ference participants at the 2022 Asian Meeting of the Econometric Society in China for insightful comments. Juan Lin acknowledges financial support from the National Natural Science Foundation of China (72173107, 72273112). Yinggang Zhou acknowledges financial support from the National Social Science Foundation of China (19ZDA060) and the National Natural Science Foundation of China (71988101). All remaining errors are our own.

* Zeyun Bei, Wang Yanan Institute for Studies in Economics, Xiamen University and Department of Economics and Finance, City University of Hong Kong; e-mail: zeyun.bei@my.cityu.edu.hk.

Juan Lin, Corresponding author. Department of Finance at School of Economics and Wang Yanan Institute for Studies in Economics, Xiamen University; e-mail: ecsniffer@xmu.edu.cn.

Yinggang Zhou, Center for Macroeconomic Research and Department of Finance at School of Economics, Wang Yanan Institute for Studies in Economics, Xiamen University; e-mail: ygzhou@xmu.edu.cn.

1.Introduction

The COVID-19 pandemic, a once-in-a-century event, posed an unprecedented threat to the stability of global financial markets (Czech et al., 2022). In March 2020, market-wide circuit breakers in the US were triggered four times in reaction to large drops in the S&P 500 index. The price of the 2020 May futures contract for West Texas Intermediate (WTI) crude plunged to the hitherto-unfathomable level of −$37 on April 20, 2020. With almost all assets in distress, an im- portant question for investors and institutions was where to look for a safe asset. In other words, how could they identify contagion, safe havens, and diversification, which may exist simultane- ously in financial markets?

Moreover, ongoing debates persist regarding factors contributing to tail-risk spillovers among financial markets. Two mechanisms have been proposed to examine the role of gold in these spillovers. The first, known as the fundamental channel, examines how gold acts as a hedge against various fundamental shocks, including inflation (Jaffe, 1989; Wang et al., 2011), currency depre- ciation (Sjaastad and Scacciavillani, 1996; Capie et al., 2005; Joy, 2011), recessions (Baur and Lucey, 2010), and black-swan shocks (Bekiros et al., 2017). Li and Lucey (2017) find that these fundamental factors contribute to the time-varying safe-haven properties of gold against stock and bond market movements. The second channel emphasizes the impact of investor behavior, such as risk aversion, panic, and herding (Forbes and Rigobon, 2002), on the diversification benefits of gold investment. However, few studies have analyzed the combined influence of fundamentals and investor behavior on tail-risk spillovers.

In this paper, we make several contributions by addressing the above questions. First, we examine contagion, safe havens, and diversification within a unified framework. Despite the ex- tensive research on these topics, most address them in isolation. For instance, financial contagion is typically defined as “a significant increase in cross-market linkages after a shock to one country (or group of countries)” (Forbes and Rigobon, 2002) or as a “correlation over and above what one would expect from economic fundamentals” (Bekaert et al., 2005). Pericoli and Sbracia (2003) synthesize five representative definitions of contagion.[6] In contrast, a safe haven is an asset whose value either is uncorrelated with or negatively correlated with another asset or portfolio that is ex- periencing market stress or turmoil (Baur and Lucey, 2010).[7] The third strand of literature focuses on measures of diversification. Baur and Lucey (2010) distinguish a safe haven asset from a hedge and a diversifier. Christoffersen et al. (2012) and Christoffersen et al. (2018) construct measures of dynamic diversification benefits based on the expected shortfall.[8]

To identify these phenomena within a unified framework, we extend the CoVaR concept pro- posed by Adrian and Brunnermeier (2016). The CoVaR methodology has been widely applied in the literature to assess vulnerability to tail-risk, such as Fong and Wong (2012), Girardi and Ergu ¨ n (2013), Mainik and Schaanning (2014), Borri (2018), and Borri (2019). Building on this body of work, we use downside-to-upside and downside-to-downside CoVaR measures to characterize the dynamic upper and lower quantiles of returns in one market, conditional on other markets ex- periencing distress. Specifically, an asset is identified as a safe haven if the downside-to-upside CoVaR of its return significantly exceeds its unconditional upside value-at-risk (VaR), as such an asset provides extra hedging benefits when other asset markets are in distress. In contrast, when the downside-to-downside CoVaR of an asset return falls more steeply than its unconditional down- side VaR, this asset incurs additional losses due to contagion effects arising from extreme declines in returns on other assets. Finally, diversification effects emerge when either the downside-to- downside CoVaR of an asset return significantly exceeds its unconditional downside VaR, or the downside-to-upside CoVaR of an asset return declines more sharply than its unconditional upside VaR. This suggests that the tail risks of the asset (either downside risk or upside risk) are reduced when other assets experience distress. By extending the traditional two-dimensional CoVaR ap- proach to a three-dimensional framework, we comprehensively examine these phenomena across three markets within a unified analytical framework.

Second, we use the 2020 financial turmoil as a laboratory and characterize contagion, safe havens, and diversification in detail in the simplest system — one with three assets: stocks, oil, and gold. While the majority of papers find evidence in favor of the safe-haven status of gold (Baur and McDermott, 2010; Reboredo, 2013), our findings suggest that the role of gold may have changed over time. Using five-minute futures returns from January 16, 2020, to April 30, 2020, we discover that gold was not able to serve as a safe haven against the extreme risks from both the stock and oil markets. Although gold lost its safe-haven glitter even before the worldwide pandemic

---

[6] Various methods have been employed to measure financial contagion, including correlation coefficients analysis (Forbes and Rigobon, 2002; Brie`re et al., 2012; Støve et al., 2014), extreme value theory (Longin and Solnik, 2001), a copula approach (Rodriguez, 2007; Aloui et al., 2011), a factor model (Bekaert et al., 2014), a state-dependent sensitivity value-at-risk model (Adams et al., 2014), a sequential testing procedure (Blatt et al., 2015), a multivariate GARCH model (Dungey et al., 2015), a probit model (Dungey and Gajurel, 2015), and a Granger-causality test (Candelon and Tokpavi, 2016).

[7] A variety of methods have been proposed to quantify a safe haven. These include time-series regression (Baur and Lucey, 2010), quantile regression (Baur and McDermott, 2010), a copula approach (Reboredo, 2013; Bekiros et al., 2017), and measures based on coskewness and cokurtosis (Chan et al., 2018; Cheng et al., 2021).

[8] According to the measures, diversification benefits exist if the expected shortfall of a portfolio is reduced.

was declared on March 11, 2020, a diversification benefit still existed in terms of reduced downside risk and upside potential. However, in the period that followed, strong contagion among the three assets occurred. The extreme declines in gold returns could not be mitigated, while their upside potential may be limited through diversification.

Finally, this paper contributes to the literature on the determinants of dynamic tail-risk spillovers. The observed significant changes in gold's role as a diversifier raise an intriguing question: What factors have influenced this shift in gold's status — investor psychology or the pandemic itself? To address this question, we use the Thomson Reuters MarketPsych Indices (TRMI), an advanced linguistic index referenced in (Michaelides et al., 2015, 2019), to construct two distinct measures of investor sentiment: pandemic-related fear and relative optimism about gold compared to stocks and oil. Our findings indicate that prior to March 12, 2020, the relative optimism in the gold market played a significant role in reducing extreme losses emanating from stock and oil market crashes, thereby enhancing the diversification benefits of gold investment. However, following the World Health Organization's (WHO) declaration of COVID-19 as a global pandemic, fear sen- timent surrounding the pandemic emerged as the dominant driving factor. Our analysis presents evidence that capital flight from financial markets to traditionally safe assets such as bank deposits, rather than pandemic-related trading restrictions, is the primary driver amplifying contagion losses and eroding the diversification benefits typically associated with gold investment. Additionally, escalating concerns about bankruptcies are also identified as contributing factors to this dynamic.

The rest of the paper is organized as follows. Sections 2 and 3 describe the data and method- ology, respectively. Section 4 presents the empirical results, followed by additional analyses in Section 5. Concluding remarks are provided in the last section.

2.Data Description

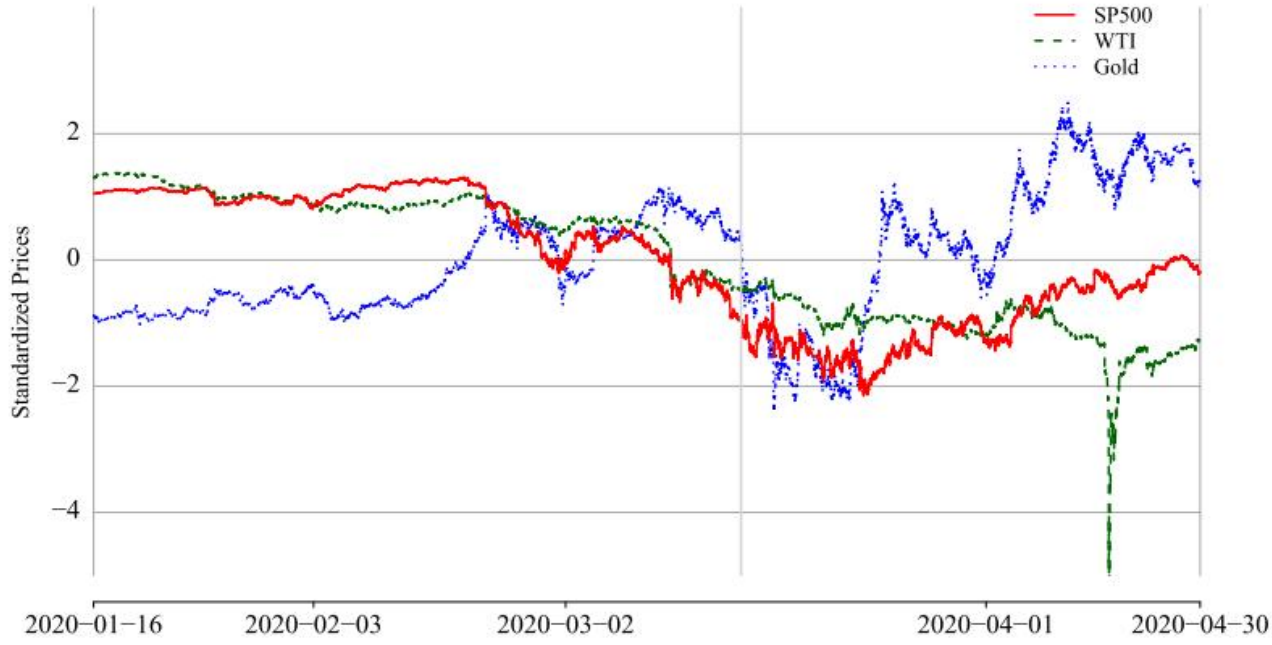
2.1.Futures-Contracts Sample

This study uses a data set consisting of nearby futures-contract prices for the S&P 500 index, WTI Crude Oil, and NYMEX Gold. Futures prices are used because they are widely regarded as benchmark prices for spot transactions, particularly in the case of commodity futures. The data were collected from the Thomson Reuters Eikon database, covering January 16, 2020, to April 30, 2020, at five-minute intervals. The start date of the sample period corresponds to the issuance of the first epidemiological alert on COVID-19 by the WHO Regional Office for the Americas. The end date was selected to cover the enormous price fluctuations in the oil market during this time. As negative values were observed in oil futures prices, simple returns were calculated using the formula $r_t^i = (P_t^i / P_{t-1}^i - 1) \times 100, i = S, O, G,$ where P_t^S, P_t^O, and P_t^G represent the prices of stock futures, oil futures, and gold futures, respectively, at time t.

Figure 1 displays the evolution of nearby futures contract prices for the S&P 500 index, WTI crude oil, and NYMEX gold for the entire sample period. The data have been standardized for the purpose of illustration.[9] The graph shows a clear change in the comovement of returns on the three futures during the whole sample period. To test for a dependence breakdown at an unknown date, we apply the sup test (Andrews, 1993; Patton, 2012).[10] The test results indicate that a structural break in the rank correlation coefficient occurred at 23:55 on the date of the WHO's pandemic announcement, March 11. Based on this finding, we split the sample into two periods: a pre-announcement period from January 16 to March 11 (7770 observations) and a post-announcement period from March 12 to April 30 (5485 observations). The vertical black line on the graph marks 23:55 on March 11. Prior to this time, the gold price moved in the opposite direction to the S&P 500 index and WTI price. However, since March 12, the gold price has moved in the same direction as the S&P 500 index and WTI price. The dashed line on the graph indicates a dramatic drop on April 20, when WTI crude oil futures prices turned negative.

[9] We standardize each series by subtracting its mean and dividing by its standard deviation.

[10] Please refer to Appendix C.1 for a detailed description of our detection of the structural break.



Note: The figure shows the time plot of five-minute (standardized) prices of S&P 500 futures, NYMEX Gold futures, and WTI Crude Oil futures from January 16, 2020, to April 30, 2020. The prices are standardized for illustration purposes. The vertical black line marks 23:55 on March 11. The green dashed line shows that the WTI Crude Oil futures prices plunged to negative values on April 20.

Fig. 1. Time plot of Futures Prices. (For interpretation of the colors in the figure(s), the reader is referred to the web version of this article.)

Table 1 reports summary statistics for the five-minute returns of S&P 500, WTI crude oil, and NYMEX gold futures in two subperiods. All the series are skewed and exhibit excess kurtosis. In particular, the skewness of the oil prices is large and negative in the second subperiod because prices were negative in late April. The corresponding standard deviation and kurtosis are also extremely large. The rank correlation coefficient between stock and oil returns is 0.346 in the pre-announcement period and 0.265 in the post-announcement period. However, the rank correlation coefficient between gold and stock returns changed its sign from −0.307 to 0.133 during the same periods. In addition, the rank correlation coefficient between gold and oil returns also changed from −0.191 to 0.087. This suggests that gold was a hedge for stock or oil risks up to March 11. However, after COVID-19 was declared a global pandemic, gold, traditionally considered a safe haven, declined along with stocks and oil, reflecting fears among investors of a liquidity crunch and dash for cash. Gold prices started to rise again on March 23.

Table 1
Summary Statistics for Stock, Gold, and Oil Futures Returns.

	Pre-announcement period			Post-announcement period		
	STOCK	GOLD	OIL	STOCK	GOLD	OIL
Mean	−0.001	0.000	−0.002	0.003	−0.001	−0.540
Std. Dev.	0.001	0.001	0.002	0.003	0.001	0.427
Skewness	0.732	−0.642	0.883	0.135	−0.025	−63.651
Kurtosis	43.495	16.933	54.532	7.323	8.305	4432.996
Rank Correlation						
STOCK	1.000	−0.307***	0.346***	1.000	0.133***	0.265***
GOLD		1.000	−0.191***		1.000	0.087***
OIL			1.000			1.000

Note: The table presents the mean, standard deviation (Std. Dev.), skewness, and kurtosis of the five-minute returns for S&P 500, NYMEX Gold, and WTI Crude Oil futures for the period from January 16, 2020, to April 30, 2020. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). *** indicates the rejection of the null hypothesis of zero correlation between the returns of two assets at a 1% significance level.

2.2.Sentiment and Other Variables

The sentiment data used in this study were obtained from the TRMI dataset. TRMI is an advanced linguistic index that uses natural language processing techniques to analyze news and social media in real time. It leverages a sophisticated grammar framework, tailored to various text sources, such as social media, earnings-conference-call transcripts, financial news, and regulatory filings, to generate manageable score series. This framework enables TRMI to offer customized lexicons, superior disambiguation, and optimized grammatical structures that enhance the accu- racy of its textual analytics. Compared to other data sets used in academic research, TRMI offers superior coverage (Audrino and Tetereva, 2019). It covers three content categories — news, so- cial media, and the combined content, and includes articles and posts in English dating back to 1998. TRMI covers tradable assets in five asset classes, including major commodities, global equi- ties, currencies, cryptocurrencies, and sovereign assets, as well as countries and their fundamental conditions.

We aim to determine whether investor psychology or the pandemic itself served as the primary determinant of risk spillovers during the pandemic. We focus on two types of investor psychology: asset-based investor sentiment and pandemic-related investor fear. The asset-based sentiment in- dices rely on hourly observations for the TRMI sentiment indices of gold, crude oil, and US stock markets, denoted by SENTgold, SENToil, and SENTstock, respectively. The values of SENTgold, SENToil, and SENTstock range from −1 to 1, with negative values representing pessimism and

positive values representing optimism. As the values increase toward 1 or decrease toward −1, the degree of optimism or pessimism intensifies, indicating heightened sentiment in either direc- tion. Additionally, we employ a fear-based sentiment measure derived from hourly observations of the humanInfectiousDisease index (SENTpandemic), a subindex of the US country-sentiment in- dex, to capture investor fear concerning the presence and outbreaks of the pandemic. The range of SENTpandemic spans from 0 to 1, with larger values signifying increased concerns about the pandemic. We supplement these sentiment measures with related coronavirus statistics, includ- ing daily counts of new confirmed COVID-19 cases (Cases) and new COVID-19 deaths (Deaths) worldwide, to serve as proxies for the pandemic effect. Previous studies by C, olak and O ¨ ztekin (2021) and John and Li (2021) propose that pandemic-induced fear had a substantial influence on investor risk-taking behavior.

To account for potential confounding factors in the US economy, we include several macroe- conomic and financial variables at a daily frequency, such as inflation, currency exchange rates, and the business cycle. As commonly used inflation indicators, such as the consumer price index and the producer price index, are only available on a monthly basis, we use the spreads of the US zero-coupon inflation-indexed swap with a one-year maturity (SWAP) as a proxy for inflation. The zero-coupon inflation-indexed swap is a financial derivative that facilitates the transfer of in- flation risk from one party to another through an exchange of cash flows. We also collect the US dollar index and calculate the logarithmic difference of the dollar index (rDXY). To account for the business cycle, we follow Yang and Zhou (2017) in using the term spread (TERM), default spread (DEF), and TED spread (TED). Specifically, TERM is defined as the difference between the 10-year and three-month Treasury yields.

A sharp decline in TERM might trigger a recession (Ferson and Harvey, 1991). DEF, which is defined as the difference between the Moody's BAA- rated corporate bond yield and the 10-year Treasury bond yield, serves as an indicator of credit risk and economic conditions. Last, TED is defined as the difference between the three-month London interbank offered rate (LIBOR) based on U.S. dollars and the three-month Treasury yield. It measures short-term financial market illiquidity.

In addition, Li and Lucey (2017) show that investors tend to seek gold as a safe haven dur- ing periods of heightened volatility in financial markets. Accordingly, we also include the daily realized volatilities of gold, oil, and stock returns, represented by RVgold, RVoil, and RVstock, re- spectively. These volatilities are calculated as the square root of the sum of squared five-minute returns within a trading day (see, Andersen et al., 2003). Lastly, we incorporate Amihud's (2002) measure of illiquidity in the gold market (ILLIQ). This measure is calculated as the ratio of the daily return of gold to its trading volume. All the economic and financial variables were obtained from Bloomberg and CEIC databases.

Table 2

Summary Statistics for Investor Sentiments and Relevant Variables.

	Pre-announcement Period			Post-announcement Period			Post-Pre
	Mean	Std.Dev	ADF-Stat	Mean	Std.Dev	ADF-Stat	Mean Difference
$SENT_{pandemic}$	0.256%	0.118%	−4.446***	0.441%	0.081%	−4.511***	0.185%***
$SENT_{oil}$	−13.850%	7.836%	−3.633**	−18.865%	3.690%	−4.439***	−5.015%***
$SENT_{gold}$	4.567%	4.818%	−3.629**	0.732%	5.943%	−5.183***	−3.834%***
$SENT_{stock}$	−5.761%	11.960%	−3.719**	−12.844%	7.597%	−4.840***	−7.083%***
$\log(Cases)$	7.050	1.749	−2.157	10.902	0.653	−2.966	3.852***
$\log(Deaths)$	3.694	1.581	−2.508	8.224	0.859	−2.112	4.530***
$SWAP$	1.183	0.407	0.011	−0.992	0.231	−2.951	−2.175***
$rDXY$	−0.019	0.446	−2.195	0.074	0.758	−2.747	0.093
$TERM$	0.067	0.156	0.168	0.620	0.175	−1.627	0.552***
DEF	2.199	0.276	1.456	3.621	0.363	−5.613***	1.422***
TED	0.232	0.092	−1.956	1.010	0.280	−2.800	0.778***
RV_{oil}	0.002	0.002	−0.491	0.094	0.545	−3.284*	0.092
RV_{gold}	0.001	0.000	−2.967	0.002	0.001	−3.634**	0.001***
RV_{stock}	0.001	0.001	−2.481	0.002	0.001	−3.069	0.001***
$ILLIQ$	0.011	0.012	−1.568	0.032	0.026	−0.049	0.021***

Note: The table presents summary statistics for investor sentiments and other relevant variables used in the regression analysis during the period from January 16, 2020, to April 30, 2020. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The term "ADF-Stat" denotes the Augmented Dickey-Fuller test statistic under the null hypothesis that a unit root is present in the series. The "Mean Difference" represents the average disparity in a given variable between the pre- and post-announcement subsamples. $SENT_{pandemic}$ corresponds to the hourly *humanInfectiousDisease* index, which quantifies sentiment regarding the presence and outbreak of contagious or epidemic diseases. $SENT_{oil}$, $SENT_{gold}$, and $SENT_{stock}$ represent the TRMI sentiment indices for crude oil, gold, and the US stock markets, respectively, measured at an hourly frequency. The variables *Cases* and *Deaths* refer to the daily global count of newly confirmed COVID-19 cases and deaths. The *SWAP* variable denotes spreads of the US zero-coupon inflation indexed swap with a one-year maturity. $rDXY$ represents the log difference of the US dollar index. The *TERM* variable indicates the term spread, which is calculated as the difference between the 10-year and three-month Treasury yields. *DEF* stands for the default spread, measured as the difference between Moody's BAA-rated corporate bond and 10-year Treasury bond yields. The *TED* variable denotes the TED spread, computed as the difference between the three-month LIBOR, based on the US dollar, and the three-month Treasury yield. RV_{oil}, RV_{gold}, and RV_{stock} correspond to the daily realized volatilities of oil, gold, and stock returns, respectively. The $ILLIQ$ variable represents the Amihud-type illiquidity indicator for the gold market. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 2 presents summary statistics for investor sentiment and other variables used in the em- pirical analysis. A notable shift in investor sentiment is evident across the two periods. The average SENTpandemic increases by 0.185 percentage points from 0.256% during the pre-announcement period to 0.441% during the post-announcement period, suggesting that investors became more concerned about the pandemic. Investor sentiment in the gold, stock, and oil markets declines significantly after March 11, indicating a loss of confidence in financial markets. We observe that

investors remained optimistic about gold on average, as the average sentiment index for the gold market is positive in both periods. However, the averaged sentiment index for the gold market decreases by 3.834 percentage points from 4.567% to 0.732%.

Prior to the announcement, the average sentiment indices for the stock and oil markets are −5.761% and −13.850%, respectively. They decrease to −12.844% and −18.865% after the announcement, respectively. The augmented Dickey-Fuller (ADF) test statistic indicates that all sentiment indices are stationary. Moreover, the average counts of newly confirmed cases and deaths rise rapidly following the announcement. Finally, the default spread, term spread, and TED spread increase significantly, suggesting a growth in credit risk and a reduction in liquidity. A decrease in the inflation swap spread indicates that the market expects a decline in inflation risk.

3.Methodology

3.1.VaR and CoVaR Measures

In this study, we assess the tail risks of three assets — stocks, oil, and gold — using VaR. Specifically, we focus on downside VaR, which quantifies the maximum potential loss that may arise from holding asset i at a confidence level of $1 - \alpha$, such that $\Pr(r_t^i \leq VaR_{\alpha,t}^i) = \alpha$. We also examine upside VaR, which measures the maximum potential gains that may result from holding asset i at a confidence level of $1 - \alpha$, such that $\Pr(r_t^i > VaR_{1-\alpha,t}^i) = \alpha$.

VaR alone is insufficient for capturing the risk spillover that may occur among various assets in a portfolio. To address this limitation, we adopt the CoVaR measure proposed by Adrian and Brunnermeier (2016) and modified by Girardi and Ergün (2013). In particular, we use the downside-to-downside CoVaR of asset j, denoted as $CoVaR_{DD,\beta,t}^{j|i}$, to measure the maximum potential loss of asset j when asset i is experiencing distress. This measure can evaluate the propagation of downside risks from asset i to asset j, formulated as follows:

$$\Pr(r_t^j \leq CoVaR_{DD,\beta,t}^{j|i} \,\big|\, r^i \leq VaR_{\alpha,t}^i) = \beta. \tag{1}$$

In this paper, we set $\alpha = \beta = 0.1$.

Furthermore, we define the downside-to-upside CoVaR of asset j, denoted as $CoVaR_{DU,\beta,t}^{j|i}$, which measures the maximum potential gains of asset j when asset i is in distress. This measure provides insights into the potential benefi ts of holding asset j when asset i is experiencing distress, formulated as follows:

$$\Pr(r_t^j > CoVaR_{DU,\beta,t}^{j|i} \,\big|\, r_t^i \leq VaR_{\alpha,t}^i) = \beta. \tag{2}$$

Expanding upon the two-market CoVaR, we introduce the three-market CoVaR. Specifically, the downside-to-downside CoVaR of gold, denoted as $CoVaR_{DD,\gamma,t}^{G|S,O}$, represents the potential max- imum loss of gold when both the stock and oil markets are in distress. This measure enables us to assess the propagation of downside risks from both the stock and oil markets to the gold market. It is formulated as follows:

$$\Pr(r_t^G \leq CoVaR_{DD,\gamma,t}^{G|S,O} \,\big|\, r_t^S \leq VaR_{\alpha,t}^S, r_t^O \leq VaR_{\beta,t}^O) = \gamma. \tag{3}$$

Similarly, we define the downside-to-upside CoVaR of gold, denoted as $CoVaR_{DU,\gamma,t}^{G|S,O}$, 7 which quantifies the potential maximum gains of gold when both the stock and oil markets are in distress. This measure captures the upside gains of gold related to a shift in demand from stocks and oil to gold. It is formulated as follows:

$$\Pr(r_t^G > CoVaR_{DU,\gamma,t}^{G|S,O} \,\big|\, r_t^S \leq VaR_{\alpha,t}^S, r_t^O \leq VaR_{\beta,t}^O) = \gamma. \tag{4}$$

In our analysis, we set $\gamma = 0.1$.[11]

3.2.Estimating CoVaR with the Dynamic Vine Copula

To estimate CoVaR measures, we opt for the vine copula approach over alternatives such as quantile regression or multivariate GARCH models. Quantile regression poses challenges in iden- tifying suitable state variables for price fluctuations in the stock, oil, and gold markets (Adrian and Brunnermeier, 2016). Meanwhile, multivariate GARCH models lack the flexibility to specify the joint distribution of different asset classes (Girardi and Ergu ¨ n, 2013). In contrast, our choice to rely on the copula-based CoVaR approach, as suggested by Reboredo and Ugolini (2015) and Re- boredo et al. (2016), is driven by its flexibility in specifying the marginal distributions of individual asset returns and their dependence structure separately. This methodological decision aligns well with our study's requirements, as it involves jointly modeling returns for three asset classes with distinct behaviors. Importantly, unlike Rodriguez

[11] We also experimented with an alternative set of probability levels $\alpha = \beta = \gamma = 0.05$ but this did not significantly impact our main results. The results of this supplementary analysis are available in the Internet Appendix A.2.

(2007) and Aloui et al. (2011), we utilize a vine copula approach to capture heterogeneous pairwise dependencies, including both asymmetric and tail dependencies inherent in the interplay among the three markets.

Let r_t^S, r_t^O, and r_t^G denote the returns for stocks, oil, and gold, respectively. According to Sklar's theorem, there exists a unique copula C that links the joint distribution function $F(r_t^S, r_t^O, r_t^G)$ of these three return series to their marginal distributions $FS(r_t^S)$, $FO(r_t^O)$, and $FG(r_t^G)$, respectively. The relationship is formulated as follows:

$$F\left(r_t^S, r_t^O, r_t^G\right) = C\left(F_S\left(r_t^S\right), F_O\left(r_t^O\right), F_G\left(r_t^G\right)\right).$$

To derive the joint distribution of the three return series, we first model the marginal dis- tributions of each series separately and then fit the copula model C(.) with the filtered returns $u_{jt} = F_j(r_t^j)$, j = S, O, G. To account for the time-varying dependence structure among the return series, we assume that the copula parameter δ t varies over time. Since δ t may be constrained to a certain range, we apply a monotonically increasing function g(•) to transform δ t to an uncon- strained parameter ht = g(δ t). To update ht, we use the driving mechanism of the Generalized Autoregressive Score (GAS) framework proposed in Creal et al. (2013). Specifically, the GAS specification for a bivariate copula density function can be expressed as:

$$h_{t+1} = \omega + \beta h_t + \alpha \Sigma_t^{-1/2} s_t$$
$$s_t = \frac{\partial}{\partial \delta_t} \log c\left(u_{1t}, u_{2t}; \delta_t\right)$$
$$\Sigma_t = E_{t-1}\left[s_t s_t'\right],$$

where β captures persistence in the copula parameter, s_tt is the score of the log copula density, Σ_t is the information matrix. The standardized score term $\Sigma^{-1/2}s_t$ improves the model's local fit with respect to the likelihood in the steepest ascent direction.

Given the marginal distributions and the time-varying copula model specified, we can use the procedure proposed by Reboredo and Ugolini (2015) to calculate $CoVaR^{j|i}_{DD,\beta,t}$ in Eq.(1) and $CoVaR^{j|i}_{DU,\beta,t}$ in Eq.(2). In the three-dimensional case, we use a vine copula, which decomposes a multivariate copula density function into a product of bivariate copula densities. For example, a three-dimensional vine copula can be represented as a product of three bivariate copulas, namely, $c_{S,O}$, $c_{O,G}$ and $c_{S,G|O}$,

$$c\left(F_S\left(r_t^S\right), F_O\left(r_t^O\right), F_G\left(r_t^G\right)\right) = c_{S,O}\left(F_S\left(r_t^S\right), F_O\left(r_t^O\right)\right) c_{O,G}\left(F_O\left(r_t^O\right), F_G\left(r_t^G\right)\right)$$
$$c_{S,G|O}\left(F_{S|O}\left(r_t^S \mid r_t^O\right), F_{G|O}\left(r_t^G \mid r_t^O\right)\right),$$

where $c_{S,O}$, $c_{O,G}$ and $c_{S,G|O}$ are called pair-copulas, and the conditional distribution F(y|x) for any two random variables x and y is given by:

$$F(y \mid x) = \frac{\partial C_{x,y}\left(F_x(x), F_y(y)\right)}{\partial F_x(x)}. \tag{5}$$

where $c_{S,O}$, $c_{O,G}$ and $c_{S,G|O}$ are called pair-copulas, and the conditional distribution F(y|x) for any two random variables x and y is given by:

The vine copula approach allows us to select different copula functions for $c_{S,O}$, $c_{O,G}$ and $c_{S,G|O}$, which facilitates the modeling of the heterogeneous dependence between each pair of vari- ables. Using the bivariate dynamic copula model as the pair copula in a vine copula, we can construct a three-dimensional time-varying vine copula model. To express $\mathrm{CoVaR}^{G|S,O}_{DD,\gamma,t}$ in terms of the vine copula representation, we rewrite Eq.(3) as follows:

$$C_{G,S|O}\left(F_{G|O}\left(CoVaR^{G|S,O}_{DD,\gamma,t}\middle|VaR^{O}_{\beta,t}\right), F_{S|O}\left(VaR^{S|O}_{\alpha,t}\middle|VaR^{O}_{\beta,t}\right)\right) = \alpha\gamma. \tag{6}$$

The vine copula representation allows us to calculate $\mathrm{CoVaR}^{G|S,O}_{DD,\gamma,t}$ through a three-step procedure:

Step 1 Solve Eq. (6) to obtain $F_{G|O}(CoVaR^{G|S,O}_{DD,\gamma,t}|VaR^{O}_{\beta,t})$;

Step 2 Use Eq. (5) to obtain $F_G(CoVaR^{G|S,O}_{DD,\gamma,t})$ from the value of $F_{G|O}(CoVaR^{G|S,O}_{DD,\gamma,t}|VaR^{O}_{\beta,t})$;

Step 3 Finally, compute $CoVaR^{G|S,O}_{DD,\gamma,t}$ by applying the inverse distribution function of F_G to a specified confidence level of $1-\gamma$.

Similarly, we can express Eq.(4) in an alternative form, as shown in Eq.(7):

$$C_{G,S|O}\left(F_{G|O}\left(CoVaR^{G|S,O}_{DU,\gamma,t}\middle|VaR^{O}_{\beta,t}\right),F_{S|O}\left(VaR^{S|O}_{\alpha,t}\middle|VaR^{O}_{\beta,t}\right)\right)=\alpha(1-\gamma). \tag{7}$$

We can calculate $\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DU},\gamma,\mathrm{t}}$ using a similar three-step procedure as described previously. This vine copula approach allows for the examination of financial contagion, safe haven, and di- versification effects within a single framework.

3.3.Hypothesis Tests for Contagion, Safe-Haven, and Diversification Effects

In this section, we test for contagion, safe-haven, and diversification effects within a uni- fied framework. Financial contagion refers to the phenomenon where one asset suffers downside spillover effects from market turbulence in other assets. A safe haven is an asset that appreciates significantly in value as a result of a shift in demand, when other assets face market turmoil. Di- versification, on the other hand, refers to the reduction of downside risk or moderation of upside potential in a portfolio during periods of extreme price fluctuations in other assets.

To examine these concepts, we conduct a one-sided (two-sample) Kolmogorov-Smirnov (KS) test, which has been used by Bernal et al. (2014), Reboredo et al. (2016), and Mensi et al. (2017). Specifically, our analysis aims to determine whether the CoVaR and VaR of a given asset return are drawn from the same population distribution.[12] We use a three-market setup here to describe the testing process, while tests in a two-market setup can be found in Appendix B.

We begin by testing whether contagion effects exist that are transmitted from the stock and oil markets to the gold market. To do so, we formulate a null hypothesis that assumes no contagion risks are transmitted from the stock and oil markets to the gold market:

$$H_0: CoVaR^{G|S,O}_{DD,\gamma,t}=VaR^{G}_{\gamma,t}. \tag{8}$$

The one-sided alternative hypothesis assumes that the downside risk of gold increases when both the stock and oil markets are experiencing distress, formulated as follows:

$$H_1: CoVaR^{G|S,O}_{DD,\gamma,t}<VaR^{G}_{\gamma,t}, \tag{9}$$

where $\mathrm{VaR}^{\mathrm{G}}_{\gamma,\mathrm{t}}$ is the downside VaR for gold returns at a confidence level of $1-\gamma$.

To test the hypotheses, we employ the one-sided KS test to compare the cumulative distribu- tion functions of downside-to-downside CoVaR and downside VaR. The KS test statistic measures the distance between the two cumulative distribution functions and determines whether they are statistically different. The test statistic, denoted as KSmn, is formulated as follows:

$$KS_{mn}=\left(\frac{mn}{m+n}\right)^{1/2}\sup_{x}\left(F_m(x)-G_n(x)\right). \tag{10}$$

Here, Fm and Gn are the empirical distribution functions of $\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DD},\gamma,\mathrm{t}}$ and $\mathrm{VaR}^{\mathrm{G}}_{\gamma,\mathrm{t}}$, respectively, and m and n are the sizes of the two samples. If the null hypothesis is rejected in favor of the alternative hypothesis (9), we can conclude that there exist contagion effects from the stock and oil markets to the gold market. To account for the estimation errors that arise from estimating the distribution functions for CoVaR and VaR, we rely on the bootstrap KS test proposed by Abadie (2002).

Next, we investigate whether gold serves as a safe-haven asset during periods of turmoil in both the stock and oil markets. Specifically, we test the null hypothesis that gold does not function as a safe haven, given by

$$H_0: CoVaR^{G|S,O}_{DU,\gamma,t}=VaR^{G}_{1-\gamma,t}, \tag{11}$$

against the alternative hypothesis that the upside potential of gold increases when both the stock and oil markets are in distress, as expressed by

$$H_1: CoVaR^{G|S,O}_{DU,\gamma,t}>VaR^{G}_{1-\gamma,t}, \tag{12}$$

where $\mathrm{VaR}^{\mathrm{G}}_{\gamma,\mathrm{t}}$ is the upside VaR for gold returns.

To test the null hypothesis in (11), we again use the KS test statistic in (10) to compare the cumulative distribution functions of $\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DU},\gamma,\mathrm{t}}$ and $\mathrm{VaR}^{\mathrm{G}}_{\gamma,\mathrm{t}}$. If the null hypothesis is rejected in favor of the alternative hypothesis (12), we can conclude that gold serves as a safe haven against extreme losses from both the stock and oil markets.

[12] Aastveit et al. (2021) employ a similar one-sided KS test for the null hypothesis that the actual and counterfactual impulse response functions are generated from the same population distribution. The rejection of the null hypothesis indicates that the observed impulse response functions are statistically larger than the counterfactual impulse response functions.

Finally, we consider the diversification effects of incorporating gold into a portfolio of stocks and oil. We test the null hypothesis (Eq. (8)) against the alternative hypothesis, which states that the extreme losses in gold are mitigated when both the stock and oil markets are in distress,

$$H_1 : CoVaR^{G|S,O}_{DD,\gamma,t} > VaR^{G}_{\gamma,t}. \tag{13}$$

And we test the null hypothesis (Eq. (11)) against the alternative hypothesis that the upside potential of gold is reduced when both the stock and oil markets are in distress,

$$H_1 : CoVaR^{G|S,O}_{DU,\gamma,t} < VaR^{G}_{1-\gamma,t}. \tag{14}$$

Note that the alternative hypotheses in Equations (13) and (14) are the opposite of those in Equations (9) and (12), respectively. Rejection of the null hypothesis as stated in Eq. (8) in favor of the alternative hypothesis in Eq. (13), or rejection of the null hypothesis in Eq. (11) in favor of the alternative hypothesis in Eq. (14), would indicate the presence of a diversification effect. Rejection of either null hypothesis in favor of the corresponding alternative would suggest that gold's downside risk is reduced or its upside potential is moderated during periods of distress in both the stock and oil markets. This implication would suggest that gold may offer a distinct risk-return profile compared to stocks and oil. As a result, including gold in a portfolio of stocks and oil could improve the portfolio's risk-return tradeoff and enhance diversification benefits.

3.4. Tail-risk spillover measures and their driving factors

The KS test statistic, as expressed in Eq. (10), is a valuable tool for differentiating among contagion, safe-haven status, and diversification in financial markets. Nevertheless, to gain a more comprehensive understanding of tail-risk spillovers from the stock and oil markets to the gold market, it requires additional measures that quantify the magnitude of these spillovers. One such measure is the downside-to-downside ΔCoVaR, proposed by Adrian and Brunnermeier (2016). The measure is calculated as the difference between the downside VaR of gold returns, given the distress of the stock and oil markets, and the downside VaR of gold returns, given the median state of the stock and oil markets. The formulation is as follows:

$$\Delta CoVaR^{G|S,O}_{DD,\gamma,t} = CoVaR^{G|r^S_t \le VaR^S_{0.1,t}, r^O_t \le VaR^O_{0.1,t}}_{DD,\gamma,t} - CoVaR^{G|r^S_t \le VaR^S_{0.5,t}, r^O_t \le VaR^O_{0.5,t}}_{DD,\gamma,t}. \tag{15}$$

We refer to $\Delta\,\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DD},\gamma,t}$ as a measure of contagion intensity in the gold market when discussing tail-risk spillovers from the stock and oil markets. This measure captures the change in extreme losses of gold that occurs when the stock and oil markets shift from normal to extreme market conditions. A decrease in $\Delta\,\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DD},\gamma,t}$ indicates a higher level of contagion intensity, as it implies a greater potential for extreme losses in gold returns when both the stock and oil markets are in distress relative to their benchmark conditions.

Building upon the downside-to-downside ΔCoVaR measure, we introduce a new measure called the downside-to-upside ΔCoVaR. This measure quantifies the incremental changes in potential upside profits for gold when the stock and oil markets are in distress relative to their median state. Specifically, we calculate the downside-to-upside ΔCoVaR as the difference between the upside VaR of gold returns, conditional on the distress of the stock and oil markets, and the upside VaR of gold returns under the median state of the stock and oil markets. The downside-to-upside ΔCoVaR is formulated as follows:

$$\Delta CoVaR^{G|S,O}_{DU,\gamma,t} = CoVaR^{G|r^S_t \le VaR^S_{0.1,t}, r^O_t \le VaR^O_{0.1,t}}_{DU,\gamma,t} - CoVaR^{G|r^S_t \le VaR^S_{0.5,t}, r^O_t \le VaR^O_{0.5,t}}_{DU,\gamma,t}. \tag{16}$$

We refer to $\Delta\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DU},\gamma,t}$ as a measure of diversification intensity in the gold market. An increase in this measure indicates that gold performs better when both the stock and oil markets face distress compared to their median market conditions. This highlights gold's potential to act as a valuable hedge against investment losses, providing enhanced diversification benefits to investors. Therefore, a higher $\Delta\mathrm{CoVaR}^{\mathrm{G|S,O}}_{\mathrm{DU},\gamma,t}$ value indicates a more pronounced level of diversification intensity.

Having defined the risk-spillover measures, we now investigate the key drivers behind these spillovers. Specifically, we examine whether investor psychology or the pandemic itself is the main factor driving spillovers. To evaluate investor psychology, we constructan asset-based sentiment measure reflecting investors' relative optimism about gold compared to stocks and oil. This measure, denoted as $OPTIM_{gold,t}$, is calculated as the difference between the sentiment index of gold and a weighted average of the sentimentindices of stocks and oil. The weights in the average are determined based on the number of references to each asset at time ??.

Formally, we define $OPTIM_{gold,t}$ as follows:

$$OPTIM_{gold,t} = \log(SENT_{gold,t} + 1) - \log\left(\frac{SENT_{oil,t} \times \#Reference_{oil,t} + SENT_{stock,t} \times \#Reference_{stock,t}}{\#Reference_{oil,t} + \#Reference_{stock,t}} + 1\right). \quad (17)$$

Here, $\#Reference_i$ represents the number of references related to asset i at time t. To facilitate a direct comparison between our fear-based sentiment measure and asset-based sentiment measure, we normalize the humanInfectiousDisease index using a natural logarithm. The resultant index, labeled $FEAR_{pandemic} = log(SENT_{pandemic})$, quantifies the level of fear and concern associated specifically with the pandemic. Recognizing the potential correlation between these two measures of investor psychology, we refine the asset-based investor sentiment measure by regressing it on pandemic-related investor fear and extracting the residuals. The modified measure is labeled as $OPTIM_{gold,t}$. This procedure filters out emotional noise associated with the pandemic, providing a cleaner measure of investor sentiment toward assets.

Given our sentiment measures are constructed at an hourly frequency,[13] we estimate the following predictive regression using hourly observations:

$$\Delta CoVaR_{t+1}^{G|S,O} = \alpha + \beta_1 FEAR_{pandemic,t} + \beta_2 OPTIM_{gold,t}^{\perp} + \beta_3 \log(Cases)_t + \beta_4 \log(Deaths)_t + Control_t + e_t. \quad (18)$$

Here, $\Delta \mathrm{CoVaR}_{t+1}^{G|S,O}$ represents $\Delta \mathrm{CoVaR}_{DD,t+1}^{G|S,O}$ as defined in Eq. (15) or $\Delta \mathrm{CoVaR}_{DU,t+1}^{G|S,O}$ as defined in Eq. (16). Meanwhile, log(Cases)t and log(Deaths)t represent the natural logarithm of the number of new confirmed COVID-19 cases and deaths, respectively;[14] and Controlt is a vector of control variables that includes inflation swap spreads (SWAP), log changes of the dollar index (rDXY), the term spread (TERM), the default spread (DEF), the TED spread (TED), gold-return volatility (RVgold), oil-return volatility (RVoil), stock-return volatility (RVstock), Amihud's (2002) measure of illiquidity in the gold market (ILLIQ), hourly gold returns, and the median state of the gold market (measured by the 50th percentile of hourly gold returns).

To obtain hourly data for empirical analysis, we convert five-minute data, such as the $\Delta \mathrm{CoVaR}_{DD,t}^{G|S,O}$ and $\Delta \mathrm{CoVaR}_{DU,t}^{G|S,O}$ measures, into hourly data by averaging the five-minute values within an hour. Daily data, including Cases, Deaths, and certain economic and financial indicators, are trans- formed into hourly data by assigning the daily value to every trading hour within a day, following the methodology used by Fama and French (1992, 1993). To ensure the comparability among different estimation coefficients, we standardize our main explanatory variables (FEARpandemic, $\mathrm{OPTIM}_{gold,t}$, log(Cases), and log(Death)) by subtracting their means and scaling them by their standard deviations. If investor sentiments prove to be statistically significant in Granger-causing the $\Delta \mathrm{CoVaR}_{DD,\gamma,t}^{G|S,O}$ or $\Delta \mathrm{CoVaR}_{DU,\gamma,t}^{G|S,O}$ measures, it would suggest that these sentiments are pivotal in driving the risk spillovers from the stock and oil markets to the gold market. We also assess the magnitudes of the primary coefficients and compare the explanatory powers of regression models to identify the predominant factor accounting for significant changes in tail-risk spillovers among the markets.

4.Empirical Results

In this section, we start by constructing models for the conditional joint distributions of the three return series. We then examine the contagion, safe-haven, and diversification effects between pairs of the three markets, as well as the simultaneous effects involving all three markets. Additionally, we investigate the factors driving risk spillovers to the gold market. The estimation results for the conditional joint distributions can be found in Appendix sections C.2 and C.3.

4.1.Safe-Haven and Contagion Effects in a Two-Market Setup

After specifying the conditional joint distribution for stock, oil, and gold returns, we obtain the VaR and CoVaR values following the procedures outlined in Section 3.2. We first report the test results for safe-haven and contagion effects in a two-market setup.

Table 3 presents the results of the KS bootstrapping test for contagion effects between the stock and oil markets. The null hypotheses of no difference between the downside-to-downside CoVaR and downside VaR values for stock and oil returns are overwhelmingly rejected for the entire sample period. This provides evidence of extreme downside-risk spillover effects between the stock and oil markets, transmitted in both directions.

[13] TRMIs are constructed using text contents sourced from news and social media that appear and are collected within a specific time interval. Because of the limited number of references for each observation of minute-frequency sentiment, hourly observations are used for our analysis.

[14] To circumvent numerical issues, we add one to the number of new confirmed cases and deaths before computing their natural logarithm. While using the original data instead of log-transformed values yields similar results, we opt for the latter to standardize the scales of the variables.

Table 3
Test Results for Contagion Effects between the Stock and Oil Markets.

Hypotheses	Pre-announcement period	Post-announcement period	Implication for contagion effects if H_0 is rejected
$H_0: CoVaR^{O\|S}_{DD.\beta,t} = VaR^{O}_{\beta,t}$	0.365***	0.394***	Contagion risks transmitted from stock market distress to the oil market
$H_1: CoVaR^{O\|S}_{DD.\beta,t} < VaR^{O}_{\beta,t}$	(0.000)	(0.000)	
$H_0: CoVaR^{S\|O}_{DD.\beta,t} = VaR^{S}_{\beta,t}$	0.202***	0.203***	Contagion risks transmitted from oil market distress to the stock market
$H_1: CoVaR^{S\|O}_{DD.\beta,t} < VaR^{S}_{\beta,t}$	(0.000)	(0.000)	

Note: The table presents the one-sided KS test statistics, with bootstrap p-values in parentheses, for contagion effects between the stock and oil markets. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The one-sided (two sample) KS test statistic is given by,

$$KS_{mn} = \left(\frac{mn}{m+n}\right)^{1/2} \sup_x \left(F_m(x) - G_n(x)\right)$$

where F_m and G_n are the empirical distribution functions of $CoVaR^{j|i}_{DD,\beta,t}$ and $VaR^{j}_{\beta,t}$, and m and n are the sizes of the two samples. The last column of the table indicates the implication for contagion effects if the null hypothesis (H_0 in the first column) is rejected in favor of the alternative hypothesis (H_1 in the first column). "***" indicates statistical significance at the 1% level.

Table 4 presents the results of the KS bootstrapping test for the role of gold when either the stock or oil market is in distress, in two subperiods. The first two rows report the results of gold being a safe haven against stock or oil market distress. The null hypothesis of no safe-haven effect is strongly rejected in the pre-announcement period, while it is supported in the post-announcement period.

Table 4
Test Results for Safe Haven and Contagion Effects between the Gold and Stock (or Oil) Markets.

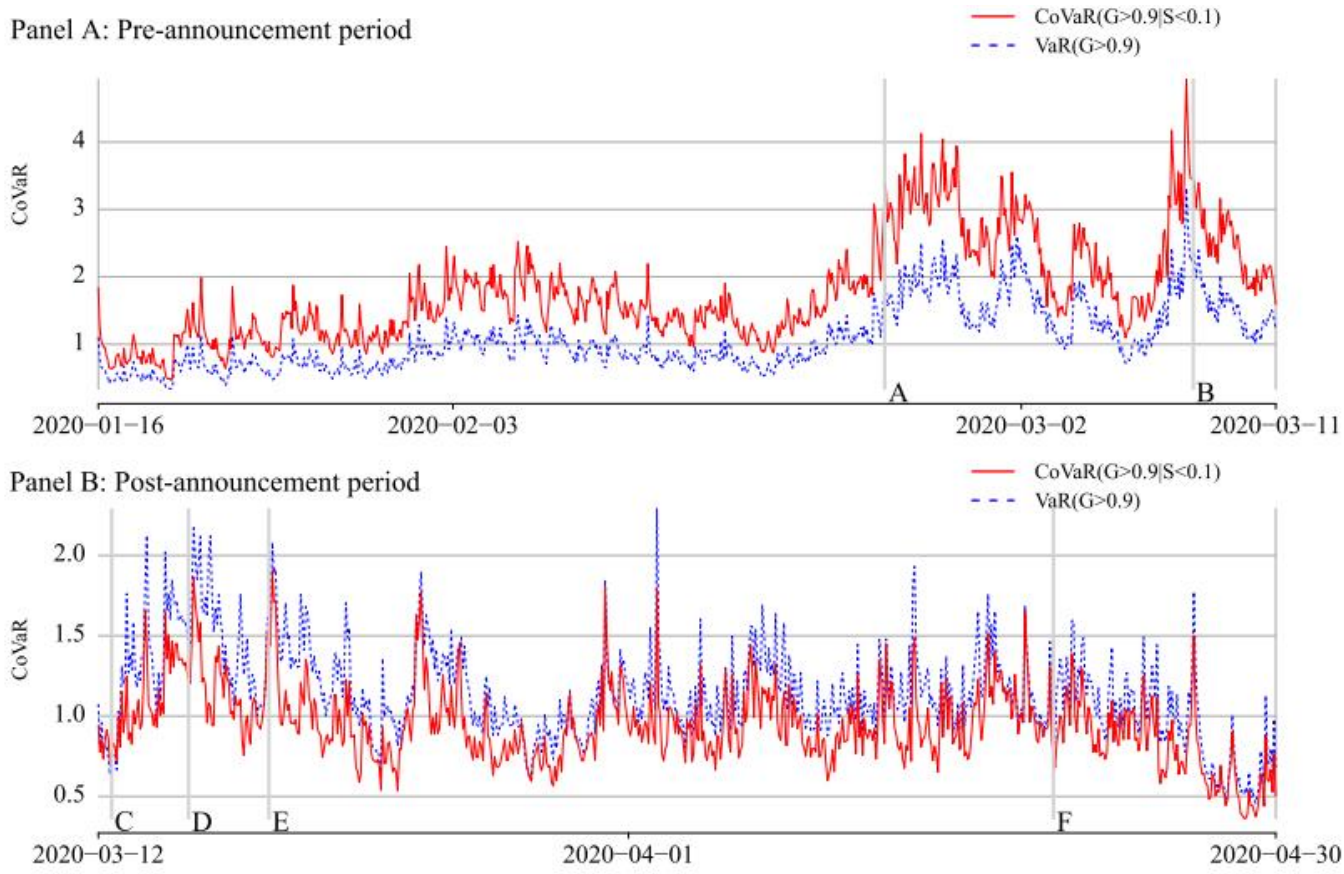
Hypotheses	Pre-announcement period	Post-announcement period	Implication for safe haven or contagion effects if H_0 is rejected
$H_0: CoVaR^{G\|S}_{DU.\beta,t} = VaR^{G}_{1-\beta,t}$	0.405***	0.000	Gold is a safe haven against stock market distress
$H_1: CoVaR^{G\|S}_{DU.\beta,t} > VaR^{G}_{1-\beta,t}$	(0.000)	(1.000)	
$H_0: CoVaR^{G\|O}_{DU.\beta,t} = VaR^{G}_{1-\beta,t}$	0.273***	0.001	Gold is a safe haven against oil market distress
$H_1: CoVaR^{G\|O}_{DU.\beta,t} > VaR^{G}_{1-\beta,t}$	(0.000)	(0.992)	
$H_0: CoVaR^{G\|S}_{DD.\beta,t} = VaR^{G}_{\beta,t}$	0.000	0.283***	Contagion risks transmitted from stock market distress to the gold market
$H_1: CoVaR^{G\|S}_{DD.\beta,t} < VaR^{G}_{\beta,t}$	(1.000)	(0.000)	
$H_0: CoVaR^{G\|O}_{DD.\beta,t} = VaR^{G}_{\beta,t}$	0.000	0.211***	Contagion risks transmitted from oil market distress to the gold market
$H_1: CoVaR^{G\|O}_{DD.\beta,t} < VaR^{G}_{\beta,t}$	(0.998)	(0.000)	

Note: The table presents the one-sided KS test statistics, with bootstrap p-values in parentheses, for safe haven and contagion effects between the gold and stock (or oil) markets. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The one-sided (two-sample) KS test statistic is given by,

$$KS_{mn} = \left(\frac{mn}{m+n}\right)^{1/2} \sup_x \left(F_m(x) - G_n(x)\right)$$

where F_m and G_n are the empirical distribution functions of $CoVaR^{j|i}_{DU.\beta,t}$ ($CoVaR^{j|i}_{DD,\beta,t}$) and $VaR^{j}_{1-\beta,t}$ ($VaR^{j}_{\beta,t}$) if we test for the safe haven (contagion) effect, and m and n are the sizes of the two samples. The last column of the table indicates the implication for safe haven/contagion effects if the null hypothesis (H_0 in the first column) is rejected in favor of the alternative hypothesis (H_1 in the first column). "***" indicates statistical significance at the 1% level.

To illustrate the test results, Figures 2, 3 and 4 depict the VaR and CoVaR dynamics for gold returns in two subperiods. Figure 2 shows that during the pre-announcement period, conditional on the stock market being in distress, the downside-to-upside CoVaR values for gold returns are con- sistently greater than the upside VaR values. However, in the post-announcement period, these val- ues appear to be systematically lower than the upside VaR values. Similarly, Figure 3 demonstrates that, conditional on the oil market being in distress, the downside-to-upside CoVaR values for gold returns are systematically greater than the upside VaR values in the pre-announcement period, while they tend to be systematically lower than the upside VaR values in the post-announcement period.

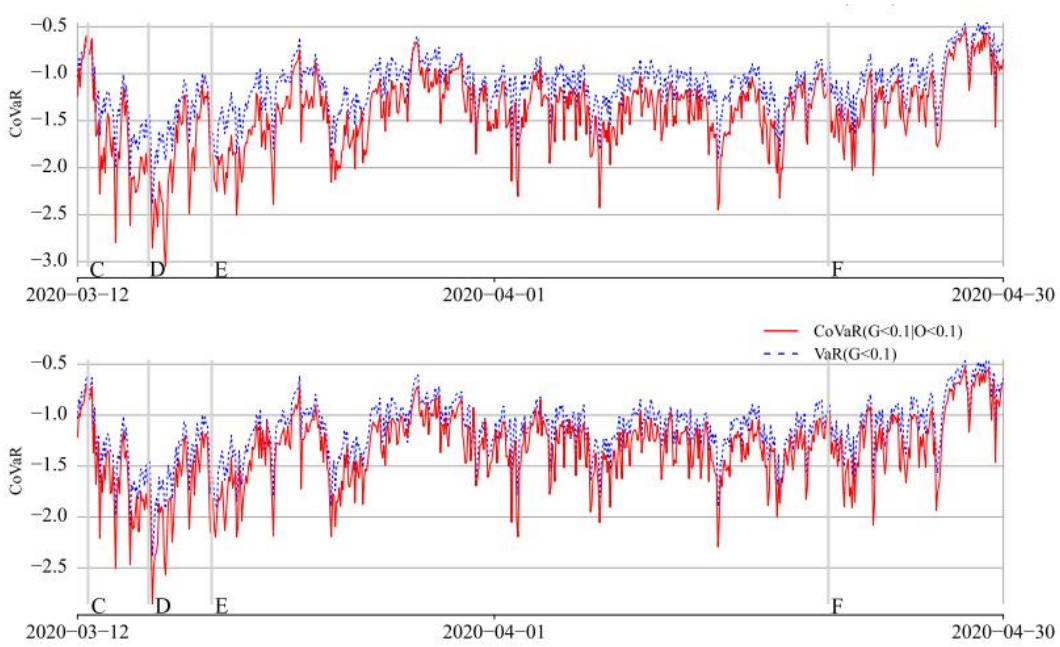


Note: This figure depicts the estimates of upside VaR and downside-to-upside CoVaR for gold returns, conditional on the stock market being in distress, for two subperiods. VaR(G>0.9) denotes the upside VaR for gold returns, while CoVaR(G>0.9|S<0.1) represents the downside-to-upside CoVaR for gold returns, conditional on the stock market being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

Fig. 2. Time Plot of Upside VaR and Downside-to-Upside CoVaR for Gold Returns Conditional on Stock Market Distress.

Our test results and graphical evidence suggest that the role of gold as a safe haven has changed significantly since COVID-19 was declared a pandemic. Prior to the pandemic announce- ment, gold served as a safe haven against extreme losses in the stock or oil market. However, after the announcement of the pandemic, gold lost its safe-haven status because of the market panic and the heightened demand for liquidity. Our findings align with those of Beckmann et al. (2019), who observe that gold protected investors against losses from other financial markets before the collapse of Lehman Brothers in 2008. However, after 2008, gold was unable to maintain its role as a safe haven asset against stocks, bonds, and exchange rate risk.

We report the results of gold suffering from contagion effects in the last two rows of Table 4. During the pre-announcement period, the null hypothesis of no contagion effect cannot be rejected, while in the post-announcement period, the alternative hypothesis favoring a contagion effect is strongly supported. To further illustrate our test results, Figure 4 shows that in the post- announcement period, the downside-to-downside CoVaR values for gold returns are systematically lower than the downside VaR values, conditional on either the stock market or the oil market being in distress. These results suggest that the extreme downside movements of the stock market or oil market had tail-risk spillover effects on the gold market after the pandemic announcement.



Note: This figure depicts the estimates of downside VaR and downside-to-downside CoVaR for gold returns, conditional on either the stock market or the oil market experiencing distress in the post-announcement period. VaR(G<0.1) denotes the downside VaR for gold returns, while CoVaR(G<0.1|S<0.1) (CoVaR(G<0.1|O<0.1)) represents the downside-to-downside CoVaR for gold returns, conditional on the stock (oil) market being in turmoil. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

Fig. 4. Time Plot of Downside VaR and Downside-to-Downside CoVaR for Gold Returns Conditional on Stock or Oil Market Distress in the Post-Announcement Period.

4.2.Safe-Haven, Contagion, and Diversification Effects in a Three-Market Setup

Table 5 presents the results of the KS bootstrapping test conducted for two subperiods under the condition of distress in both the stock and oil markets. First, we examine whether gold can be considered as a safe-haven asset during such times, using Eq.(11) as the null hypothesis that gold does not serve as a safe-haven asset and Eq.(12) as the alternative hypothesis that it does. The test results for both subperiods are reported in the first row of Table 5, and in both cases, they support the null hypothesis. Therefore, we conclude that gold was not able to serve as a safe haven during periods of turmoil in both the stock and oil markets throughout the entire sample period.

Table 5
Test Results for Safe Haven, Contagion, and Diversification Effects across the Stock, Gold, and Oil Markets.

Hypotheses	Pre-announcement period	Post-announcement period	Implication for safe haven/contagion/diversification effects if H_0 is rejected
H_0: $CoVaR^{G|S,O}_{DU,\gamma,t} = VaR^{G}_{1-\gamma,t}$	0.000	0.000	Gold is a safe haven against both stock and oil market distress
H_1: $CoVaR^{G|S,O}_{DU,\gamma,t} > VaR^{G}_{1-\gamma,t}$	(1.000)	(1.000)	
H_0: $CoVaR^{G|S,O}_{DD,\gamma,t} = VaR^{G}_{\gamma,t}$	0.003	0.514***	Gold suffers the contagion risk from both stock and oil market distress
H_1: $CoVaR^{G|S,O}_{DD,\gamma,t} < VaR^{G}_{\gamma,t}$	(0.946)	(0.000)	
H_0: $CoVaR^{G|S,O}_{DU,\gamma,t} = VaR^{G}_{1-\gamma,t}$	0.655***	0.989***	Diversification effect exists since the upside potential of gold returns is reduced.
H_1: $CoVaR^{G|S,O}_{DU,\gamma,t} < VaR^{G}_{1-\gamma,t}$	(0.000)	(0.000)	
H_0: $CoVaR^{G|S,O}_{DD,\gamma,t} = VaR^{G}_{\gamma,t}$	0.346***	0.000	Diversification effect exists since the extreme losses of gold returns are mitigated.
H_1: $CoVaR^{G|S,O}_{DD,\gamma,t} > VaR^{G}_{\gamma,t}$	(0.000)	(1.000)	

Note: The table presents the one-sided KS test statistics, with bootstrap p-values in parentheses, for safe haven, contagion, and diversification effects across the stock, oil and gold markets. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The one-sided (two sample) KS test statistic is given by,

$$KS_{mn} = \left(\frac{mn}{m+n}\right)^{1/2} \sup_{x} \left(F_m(x) - G_n(x)\right)$$

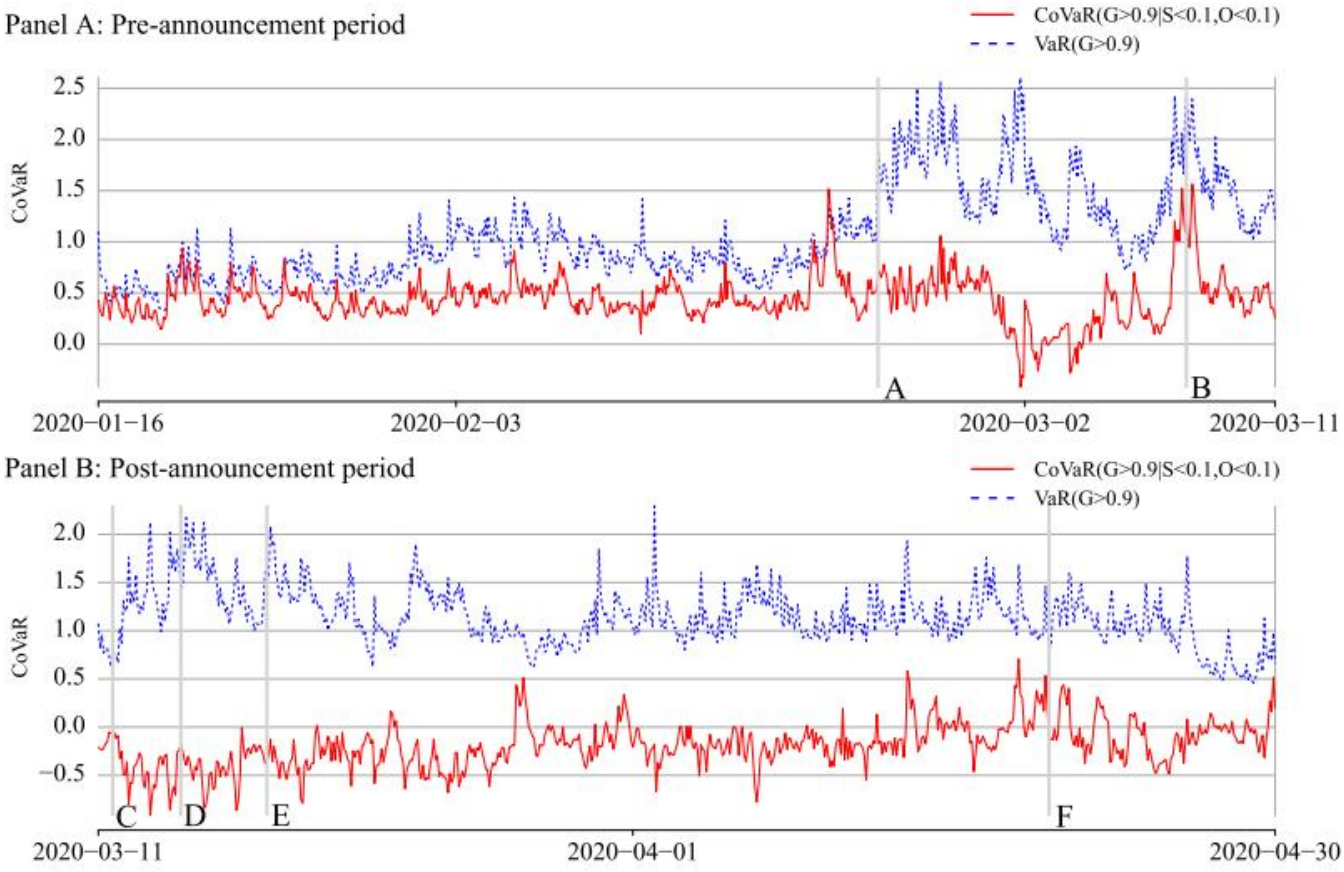
where F_m and G_n are the empirical distribution functions of $CoVaR^{G|S,O}_{DU,\gamma,t}$ ($CoVaR^{G|S,O}_{DD,\gamma,t}$) and $VaR^{G}_{1-\gamma,t}$ ($VaR^{G}_{\gamma,t}$), and m and n are the sizes of the two samples. The last column in the table indicates the implication for safe haven/contagion/diversification effects, if the null hypothesis (H_0 in the first column) is rejected in favor of the alternative hypothesis (H_1 in the first column). "***" indicates statistical significance at the 1% level.

Combining the results from Tables 3 and 5, we find a more complete story of the safe-haven role of gold during times of market turmoil. Our findings suggest that contagion occurred between the stock and oil markets and that gold was not a safe-haven asset when both the stock and oil markets were in distress, even before the announcement of the pandemic. The results in Table 4, which indicated that gold was a safe haven against either stock or oil market distress before the pandemic announcement, do not provide a comprehensive picture. Arguably, a safe-haven effect against one market’s distress disappears if two or more markets are in distress simultaneously.

Next, we examine the potential contagion effects from both the stock and oil markets to the gold market, using the KS bootstrapping test. We test the null hypothesis in Eq.(8) that there are no contagion effects against the alternative hypothesis in Eq.(9) that such effects do exist. The results of the test are presented in the second row of Table 5. Our findings show that in the pre- announcement period, we fail to reject the null hypothesis of no contagion effects. However, in the post-announcement period, we strongly support the alternative hypothesis, pointing to the presence of contagion effects. These findings suggest that the downside risks from both the stock and oil markets had tail-risk spillover effects on gold returns after the announcement.

Furthermore, we conduct two additional tests to explore the existence of diversification ef- fects. The first test aims to examine the null hypothesis stated in Eq.(11), which assumes no diversification effects, against the alternative hypothesis stated in Eq.(14), which assumes the pres- ence of diversification effects in the form of reduced upside potential. Our results, reported in the third row of Table 5, indicate that in both subperiods, we strongly reject the null hypothesis in favor of the alternative, suggesting that the upside potential of gold is limited when both the stock and oil markets are under distress. The second test aims to investigate the null hypothesis stated in Eq.(8), which assumes no diversification effects, against the alternative hypothesis stated in Eq.(13), which assumes the presence of diversification effects in the form of reduced downside risk. Our results, presented in the last row of Table 5, reveal that in the pre-announcement period, we overwhelmingly reject the null hypothesis in favor of the alternative. However, we could not reject the null hypothesis in the post-announcement period. This suggests that before the announce- ment, the extreme losses of gold were mitigated by diversification, but after the announcement, the diversification benefits disappeared.

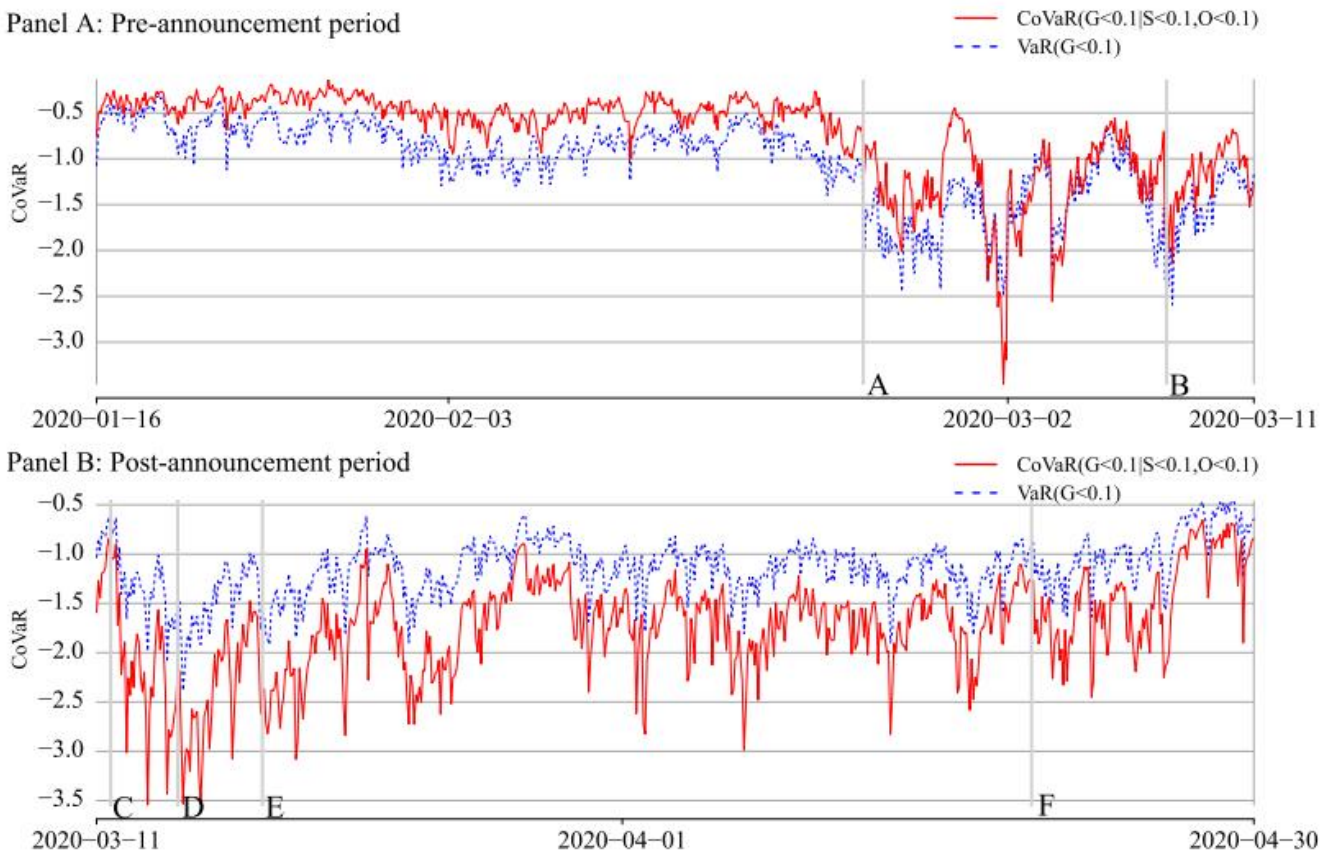
To provide additional insights into our findings, Figure 5 depicts the upside VaR and downside- to-upside CoVaR values for gold returns during two subperiods, conditional on the turmoil in both the stock and oil markets. As illustrated in Figure 5, the downside-to-upside CoVaR values for gold returns consistently remain lower than the upside VaR values, suggesting that gold was unable to protect investors from the extreme losses in the stock and oil markets throughout the entire sample period.



Note: This figure depicts the estimates of upside VaR and downside-to-upside CoVaR for gold returns, conditional on both the stock and oil markets being in distress across two subperiods. VaR(G>0.9) denotes the upside VaR for gold returns, while CoVaR(G>0.9|S<0.1, O<0.1) represents the downside-to-upside CoVaR for gold returns, conditional on both the stock and oil markets being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

Fig. 5. Time Plot of Upside VaR and Downside-to-Upside CoVaR for Gold Returns Conditional on both Stock and Oil Market Distress.

Figure 6 depicts the downside VaR and downside-to-downside CoVaR values for gold returns during two subperiods, given simultaneous crashes in the stock and oil markets. The top chart in Figure 6 shows that during the pre-announcement period, the downside-to-downside CoVaR values for gold returns are frequently larger than the downside VaR values, implying the existence of diversification benefits that helped mitigate the extreme losses of gold investment. However, the downside-to-downside CoVaR fluctuated below the downside VaR in early March, reflecting an increase in dependence among the three markets that may have eliminated diversification benefits. In the post-announcement period, the lower plot of Figure 6 demonstrates that the downside-to- downside CoVaR values for gold returns are systematically lower than the downside VaR values. This suggests the presence of contagion effects from the stock and oil markets to the gold market.



Note: This figure depicts the estimates of downside VaR and downside-to-downside CoVaR for gold returns, conditional on both the stock and oil markets being in distress across two subperiods. VaR(G<0.1) denotes the downside VaR for gold returns, while CoVaR(G<0.1|S<0.1, O<0.1) represents the downside-to-downside CoVaR for gold returns, conditional on both the stock and oil markets being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

Fig. 6. Time Plot of Downside VaR and Downside-to-Downside CoVaR for Gold Returns conditional on both Stock and Oil Market Distress.

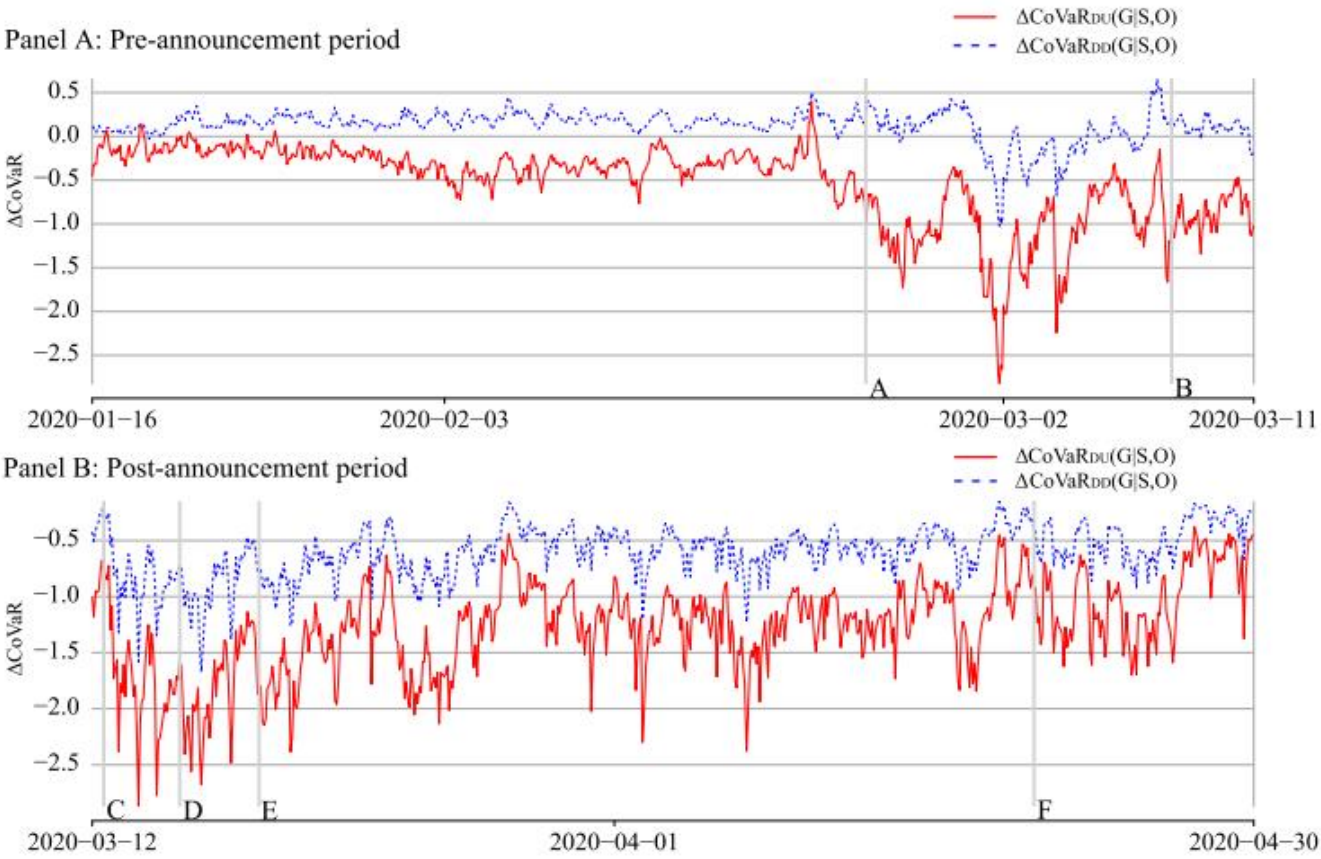
To summarize, gold did not act as a safe haven against extreme losses from stock and oil investments prior to the COVID-19 pandemic announcement. Nevertheless, it still provided di- versification benefits by reducing both the downside risk and upside potential during simultaneous stock and oil market crashes. Following the announcement, concerns over the pandemic intensi- fied, leading to the transmission of extreme downside risks from the stock and oil markets to the gold market. During this period, gold was unable to offset the losses and had limited potential for upside gains. Consequently, the diversification benefits of gold were substantially diminished.

4.3.Tail-Spillover Intensity Measures and Their Determinants

Figure 7 illustrates the estimates of two measures — contagion intensity and diversifica- tion intensity, represented by the downside-to-downside ΔCoVaR ($\Delta\mathrm{CoVaR}^{G|S,O}_{DD,t}$ in Eq.(15)) and downside-to-upside ΔCoVaR ($\Delta\mathrm{CoVaR}^{G|S,O}_{DU,t}$ in Eq.(16)), respectively — on an hourly basis. The plot reveals significant changes in these measures over two subperiods. Considering the contagion- intensity measure, the upper plot of Figure 7 shows that $\Delta\mathrm{CoVaR}^{G|S,O}_{DD,t}$ is predominantly positive before the announcement, with an average of 0.126. This indicates that when the stock and oil markets experience distress relative to their median state, extreme losses of gold are mitigated. However, the lower plot of Figure 7 exhibits a marked increase in contagion risk following the WHO's declaration of COVID-19 as a global pandemic on March 11. $\Delta\mathrm{CoVaR}^{G|S,O}_{DD,t}$ consistently remains below zero, with an average of −0.599, suggesting that the coronavirus-induced panic eliminated the diversification benefits from gold investment, thereby amplifying contagion risk.

In contrast, the diversification-intensity measure, $\Delta\mathrm{CoVaR}^{G|S,O}_{DU,t}$, is generally negative prior to the announcement, with an average of −0.530, and declines to approximately −2.8 in early March because of the

pandemic. After the announcement, the average value of $\Delta\,\mathrm{CoVaR}_{\mathrm{DU,t}}^{\mathrm{G|S,O}}$ is − 1.276, which is twice the pre-announcement level, signifying a substantial decrease in gold ' s diversification benefits. Overall, the results align with our findings in Section 4.2, suggesting that gold served as a diversification instrument prior to the announcement, while contagion effects pervaded all three markets after the announcement.



Note: This figure depicts two measures $\Delta CoVaR_{DD}^{G|S,O}$ and $\Delta CoVaR_{DU}^{G|S,O}$, which are used to quantify contagion intensity and diversification intensity for the gold market. These measures are defined in Eq. (15) and (16), respectively. $\Delta\mathrm{CoVaR}_{DD}(\mathrm{G|S,\ O})$ ($\Delta\mathrm{CoVaR}_{DU}(\mathrm{G|S,\ O})$) calculates the difference between the downside (upside) VaR of gold returns conditional on the distress of the stock and oil markets and the downside (upside) VaR of gold returns conditional on the median state of the stock and oil markets. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

Fig. 7. Time Plot of Downside-to-downside and Downside-to-upside ΔCoVaR for Gold Returns.

With the well-defined risk-spillover measures, we further examine the drivers of tail-risk spillovers from the stock and oil markets to the gold market across two subperiods using Eq.(18). The ADF test confirms the stationarity of both downside-to-downside and downside-to-upside ΔCoVaR measures.

Panel A of Table 6 summarizes the results for the determinants of contagion intensity. Dur- ing the pre-announcement period, the coefficients on $FEAR_{pandemic}$ are consistently negative and significant under at the 5% level or better, as shown in columns (1), (3), and (5), indicating that intensified fear and concern about the pandemic increased the contagion risk from the stock and oil markets to the gold market. The coefficients on $OPTIM_{gold}$ are consistently positive and statistically significant at the 1% level, as shown in columns (2), (4), and (5), suggesting that a more optimistic outlook for gold, relative to stocks and oil, mitigated contagious losses from the stock and oil markets. Furthermore, the significantly negative coefficients of log(Cases) suggest that the heightened severity of the pandemic contributed to greater contagion losses from the stock and oil markets to the gold market.

Furthermore, the examination of the coefficient magnitudes and statistical significance for $\mathrm{OPTIM}_{\mathrm{gold}}$, FEARpandemic and log(Cases) (in absolute values) reveals that $\mathrm{OPTIM}_{\mathrm{gold}}$ is a more important factor in explaining gold′s role as a diversifier in the pre-announcement period. Specif- ically, as shown in column (5), after incorporating all control variables, the coefficient magnitude for OPTIM⊥ stands at 0.046 with a t-statistic of 7.406, surpassing those for FEARpandemic (-0.014 with a t-statistic of -2.306) and log(Cases) (-0.029 with a t-statistic of -3.194). In terms of economic significance, a one-standard-deviation surge in OPTIM⊥ is associated with a 4.6 percentage point reduction in contagion losses, whereas a similar increase in FEARpandemic is linked to a 1.4 percentage point escalation in such losses. Interestingly, the opposing signs of the coefficients for FEARpandemic and OPTIM⊥ suggest that investors reacted differently to fear stemming from the pandemic and optimism related to gold. Specifically, investors appeared to retreat from the gold market in response to pandemic fears, thereby increasing contagion losses. Conversely, optimism regarding gold encouraged investors to allocate funds to it as a diversifica- tion strategy, which in turn reduced the contagion losses from gold investment during periods of distress in riskier asset classes.

Following the announcement, as shown in columns (6)-(10), FEARpandemic emerges as the dominant factor in explaining contagion intensity. The magnitude of the coefficient on FEARpandemic ranges from -0.073 to -0.081, which, in absolute terms, is approximately two to four times larger than those observed in the pre-announcement period, where they range from -0.014 to -0.045. In contrast, the coefficient on OPTIM⊥ proves to be statistically insignificant post-announcement, fluctuating between -0.001 and -0.014 — systematically smaller in absolute terms compared to the pre-announcement range of 0.046 to 0.059. Moreover, when other explanatory and control variables are included in the model (as shown in column (10)), the pandemic metrics and asset-based optimism are overshadowed by FEARpandemic, as shown by their coefficients losing statistical sig- nificance. The goodness of fit of our model, gauged by the adjusted R-squared, stands at 20.3% in column (10), signifying that the explanatory variables collectively account for 20.3% of the variation in tail-risk spillovers to the gold market. Meanwhile, the adjusted R-squared of 13.4% in column (6) for the single variable FEARpandemic suggests that this variable alone explains a signifi- cant portion of the variation in tail-risk spillovers to the gold market. Overall, our findings indicate that FEARpandemic serves as the dominant factor in determining contagion intensity.

Table 6
Determinants of Contagion and Diversification Intensities.

	Pre-announcement period					Post-announcement period				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Regression Results on Contagion Intensity										
$FEAR_{pandemic}$	−0.045***		−0.022***		−0.014**	−0.073***		−0.081***		−0.079***
	(0.006)		(0.006)		(0.006)	(0.007)		(0.017)		(0.018)
$OPTIM^{\perp}_{gold}$		0.059***		0.048***	0.046***		−0.001		−0.014	−0.011
		(0.006)		(0.006)	(0.006)		(0.009)		(0.011)	(0.011)
log(*Cases*)					−0.029***					0.014
					(0.009)					(0.121)
log(*Deaths*)					0.004					−0.084
					(0.008)					(0.077)
Adjusted R^2	0.064	0.109	0.292	0.331	0.345	0.134	−0.001	0.201	0.177	0.203
Panel B: Regression Results on Diversification Intensity										
$FEAR_{pandemic}$	−0.081***		−0.022**		−0.009	−0.134***		−0.164***		−0.170***
	(0.010)		(0.011)		(0.010)	(0.012)		(0.029)		(0.030)
$OPTIM^{\perp}_{gold}$		0.065***		0.084***	0.081***		0.011		0.002	0.018
		(0.010)		(0.010)	(0.010)		(0.015)		(0.018)	(0.018)
log(*Cases*)					−0.052***					0.042
					(0.015)					(0.202)
log(*Deaths*)					0.016					−0.065
					(0.013)					(0.129)
Adjusted R^2	0.074	0.046	0.282	0.333	0.342	0.155	−0.001	0.231	0.194	0.230
Control	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Observations	887	887	844	844	844	717	717	681	681	681

Note: This table reports regression results for the determinants of contagion and diversification intensities based on the baseline regression (18). The dependent variable in Panel A is contagion intensity, while in Panel B, it is diversification intensity. $FEAR_{pandemic}$ is the logarithm of the fear-based sentiment concerning infectious diseases. $OPTIM^{\perp}_{gold}$ measures the relative optimism on gold which is orthogonal to the panic-related investor fear measure. $\log(Cases)_t$ and $\log(Deaths)_t$ are the logarithm of the number (+1) of new confirmed cases and deaths during the COVID-19 pandemic. The primary explanatory variables ($FEAR_{pandemic}$, $OPTIM^{\perp}_{gold}$, $\log(Cases)$, and $\log(Death)$) are standardized by subtracting their means and scaling by their standard deviations. *Control* is a vector of control variables from regression (18). Robust standard errors are reported in parentheses. "*", "**", and "***" indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel B of Table 6 presents the results of our analysis on the determinants of diversification intensity, using CoVaRG|S,O as the dependent variable. Our findings are qualitatively similar to those of contagion intensity in Panel A. During the pre-announcement period, the coefficients for OPTIM⊥ are significantly positive at the 1% level, indicating that increased optimism about gold relative to stocks and oil enhanced the diversification benefits against distressed stock and oil markets. In contrast, the coefficients of FEARpandemic are negative, suggesting that increased fear and concerns related to the pandemic led to a reduction in the diversification benefits of gold investment. Upon accounting for all explanatory variables in column (5), our analysis shows that OPTIM⊥ is the dominant driving factor of dynamic diversification intensity during the preannouncement period. However, following the announcement, we observe a significant expansion in the negative effect of FEARpandemic, as evidenced by the estimated coefficient decreasing from −0.009 (column (5)) to −0.170 (column(10)). In addition, our model that includes all explanatory variables (column (10)) yields an adjusted R-squared of 23.0%, accounting for 23.0% of the variation in diversification intensity. Notably, FEARpandemic (column (6)) provides an adjusted R-squared of 15.5%, suggesting that this single variable explains over 50% of the total explana- tory power provided by all independent variables in our model. The pandemic metrics, log(Cases) and log(Deaths), are both insignificant during the post-announcement period. Consequently, our findings indicate that fear of the pandemic became the dominant driving force in explaining diver- sification intensity after the announcement.

In summary, our findings suggest that a positive outlook on the gold market, relative to the stock and oil markets, played a crucial role in providing diversification benefits by mitigating extreme losses for stock and oil investments before the pandemic announcement. However, af- ter the pandemic was announced, fear related to the health crisis became the dominant driving factor. Supporting this notion, a survey of US households conducted by Hanspal et al. (2021) demonstrates that households faced significant liquidity needs

during the pandemic. These needs stemmed from increased expected health expenditures and reduced income attributable to shut- down policies and unemployment. Consequently, households displayed a pronounced inclination to curtail investment activities and increase their anticipated debt levels. Moreover, fear amplified investors' risk-aversion behavior, as noted by Guiso et al. (2018). As panic over the pandemic grew, the gold market crashed along with the stock and oil markets, exacerbating contagion losses and diminishing the diversification benefits of investing in gold. Lastly, our findings suggest that the psychological impact of the pandemic may have had a more significant effect on asset tail- risk spillovers than the pandemic itself, particularly during the post-announcement period. These results are consistent with the findings of Kaplanski and Levy (2010), who argue that economic losses resulting from severe disasters, especially those that pose risks to human life and cause significant losses, may primarily stem from mood and anxiety rather than the disaster itself.

5.Additional Analyses

In this section, we examine the impacts of trading activities and bankruptcy sentiment, aiming to provide further economic insights and elucidate interdependencies among assets from a broader perspective.

5.1.The Impact of Trading Activities

We have demonstrated the significant influence of investor psychology on tail risk spillovers be- tween assets during the pandemic. However, the underlying mechanisms behind this phenomenon remain unclear. To address this gap, we delve into the interactive role of liquidity and trading activities in gold′s transition from a diversifier to a contagion asset.

There are two competing hypotheses regarding the impact of liquidity on spillovers between asset classes. The first hypothesis suggests that trading restrictions, potentially stemming from pandemic-related constraints, may limit investors′ ability to hedge investments, thereby reducing gold′s effectiveness as a diversifier during market distress. Existing literature suggests that such restrictions can also impair the price efficiency of futures markets (Han and Liang, 2017; Hu et al., 2020). On the other hand, the second hypothesis posits that fire sales or capital outflows can trigger contagion across asset classes (Kiyotaki and Moore, 2002; Wang et al., 2011). Heightened con- cerns related to the pandemic, potential job losses, and income insecurity, might prompt investors to reduce investments and cut spending, seeking safer assets like cash or bank deposits (Hanspal et al., 2021; Levine et al., 2021). This shift in behavior could result in capital outflows from finan- cial markets, potentially eroding the diversification benefits associated with gold investment.

To test these hypotheses, we expand our analysis to incorporate the trading volume of gold. Our goal is to compare the impact of pandemic-related investor fear and asset-based investor sen- timent on contagion and diversification intensities during periods of low and high trading volumes of gold. We utilize data from the Thomson Reuters Eikon database, collected at an hourly fre- quency, to construct two indicator variables based on the median trading volume, denoted as q0.5: 1{VolGold ≥q0.5} for above-median volume and 1{VolGold <q0.5} for below-median volume. We then reevaluate spillover intensities using the following augmented regression model:

$$\begin{aligned}\Delta CoVaR^{gold|stock,oil}_{s\in\{DU,DD\},t+1} = \alpha &+ \beta_1 FEAR_{pandemic,t} \times 1_{\{Vol_{Gold}\geq q_{0.5}\}} \\ &+ \beta_2 FEAR_{pandemic,t} \times 1_{\{Vol_{Gold}<q_{0.5}\}} \\ &+ \beta_3 OPTIM^{\perp}_{gold,t} \times 1_{\{Vol_{Gold}\geq q_{0.5}\}} \\ &+ \beta_4 OPTIM^{\perp}_{gold,t} \times 1_{\{Vol_{Gold}<q_{0.5}\}} + Control_t + \varepsilon_t,\end{aligned} \tag{19}$$

where ΔCoVaR represents the hourly downside-to-upside (s = DU) or downside-to-downside (s = DD) tail dependence intensity of the gold market. FEARpandemic,t quantifies the level of fear and concern associated specifically with the pandemic. OPTIM⊥ denotes the relative optimism on gold, orthogonal to the pandemic-related fear. The control variable Controlt includes pandemic-related variables, along with other controls from the baseline regression. The coefficients β 1 and β 3 quantify the effects of pandemic-related fear and asset-based sentiment on contagion losses and diversification benefits during periods of high trading volume, while β 2 and β 4 represent the corresponding impacts during periods of low trading volume. We hypothesize that if the absence of gold' s safe haven properties is attributed to reduced trading activity due to various restrictions, interaction terms involving 1{VolGold <q0.5} (indicating below-median trading volume) would exhibit more substantial coefficients compared to those with 1{VolGold ≥ q0.5} (indi- cating above-median trading volume).

Table 7
The Impact of Gold Trading Volume on Contagion and Diversification Intensities.

	Pre-announcement period				Post-announcement period			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Regression Results on Contagion Intensity								
$FEAR_{pandemic} \times 1\{Vol_{Gold} \geq q_{0.5}\}$	−0.049***	−0.024***			−0.088***	−0.090***		
	(0.007)	(0.007)			(0.010)	(0.018)		
$FEAR_{pandemic} \times 1\{Vol_{Gold} < q_{0.5}\}$	−0.029**	−0.005			−0.049***	−0.046**		
	(0.012)	(0.011)			(0.012)	(0.020)		
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} \geq q_{0.5}\}$			0.076***	0.065***			−0.038***	−0.019
			(0.007)	(0.008)			(0.012)	(0.014)
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} < q_{0.5}\}$			0.020**	0.029***			0.048***	0.002
			(0.010)	(0.010)			(0.013)	(0.014)
$\Delta Slope$	[−0.020]	[−0.019]	[0.056***]	[0.036***]	[−0.039**]	[−0.044**]	[−0.086***]	[−0.021]
Adjusted R^2	0.066	0.313	0.132	0.319	0.137	0.202	0.029	0.197
Panel B: Regression Results on Diversification Intensity								
$FEAR_{pandemic} \times 1\{Vol_{Gold} \geq q_{0.5}\}$	−0.099***	−0.055***			−0.151***	−0.161***		
	(0.011)	(0.013)			(0.017)	(0.028)		
$FEAR_{pandemic} \times 1\{Vol_{Gold} < q_{0.5}\}$	−0.025	0.003			−0.110***	−0.116***		
	(0.020)	(0.020)			(0.020)	(0.033)		
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} \geq q_{0.5}\}$			0.095***	0.129***			−0.068***	−0.012
			(0.012)	(0.013)			(0.020)	(0.024)
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} < q_{0.5}\}$			0.001	0.053***			0.115***	0.046*
			(0.018)	(0.017)			(0.023)	(0.024)
$\Delta Slope$	[−0.074***]	[−0.032]	[0.094***]	[0.076***]	[−0.042]	[−0.063**]	[−0.184***]	[−0.058*]
Adjusted R^2	0.088	0.194	0.070	0.284	0.155	0.229	0.047	0.230
Control	No	Yes	No	Yes	No	Yes	No	Yes
Observations	860	818	860	818	700	686	700	686

Note: This table presents regression results for the impact of gold trading volume on contagion and diversification intensities based on the regression (19). The dependent variable in Panel A is contagion intensity, while in panel B, it is diversification intensity. $FEAR_{pandemic}$ is the logarithm of the fear-based sentiment concerning infectious diseases. $OPTIM^{\perp}_{gold}$ measures the relative optimism on gold which is orthogonal to the panic-related investor fear measure. The indicators $1_{\{Vol_{Gold} \geq q_{0.5}\}}$ and $1_{\{Vol_{Gold} < q_{0.5}\}}$ are assigned a value of one if the gold market's trading volume is at or above, and below the median of the sample, respectively. *Control* includes new confirmed cases and deaths during the pandemic, along with other variables from the baseline regression. Reported are regression slopes, robust standard errors (in parentheses), and adjusted R^2 values. The difference in coefficients on the interaction effects between the primary variables ($FEAR_{pandemic}$ or $OPTIM^{\perp}_{gold}$) and the above-median and below-median dummies is denoted by square brackets ($\Delta Slope$). Definitions for all other variables are presented in Table A.1 of Appendix A. "*","**", and "***" indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7 presents regression results illustrating how trading volume affects contagion and di- versification intensities, delineated in Panel A and Panel B, respectively. The results for the pre- announcement period are provided in Columns (1)-(4), while Columns (5)-(8) cover the post- announcement period. The coefficient associated with FEARpandemic is found to be more negative across two distinct subperiods during periods of high trading volume, which implies that the ad- verse effects of pandemic-induced investor fear on both contagion and diversification intensities were exacerbated when gold trading volume was elevated.

On the other hand, OPTIM⊥ exhibits a contrasting role across the two sub-periods. During the pre-announcement period, OPTIM⊥ positively influences both contagion and diversification intensities across all levels of gold trading volume. Notably, the positive impact of OPTIM⊥ is amplified during periods of high trading volume, indicated by a larger coefficient compared to periods of low trading volume. This suggests that optimism in the gold market enhanced its stabilizing effect on contagion and diversification during the early stages of the pandemic, with this effect being more pronounced when market activity is elevated. In contrast, during the post-announcement period, the coefficient of OPTIM⊥remains positive during low-volume intervals but turns negative during high-volume periods. This indicates that optimism in the gold market did not aid in achieving diversification benefits or in mitigating contagion losses through gold investment during times of high trading volume. In contrast, such benefits might be attainable during periods of reduced liquidity. This shift in behavior could be attributed to seller-driven capital outflows, which rapidly eroded gold′s appeal for diversification in times of high trading volume.

We also expand our analysis to include the trading volumes of all three asset markets and compare the influence of pandemic-related investor fear and asset-based investor optimism on contagion and diversification intensities between periods of low and high trading activities within these markets. The results,

presented in Table IA.6 in the Internet Appendix, align qualitatively with those of Table 7.

The transition of gold from a diversifying asset to a conduit for contagion during periods of elevated trading volume, particularly after the WHO′s announcement, can be attributed to capital outflows from the market, which seem to have been driven by seller actions. This outflow quickly eroded the diversification potential of gold in times of high trading volume. To elucidate this effect, Table IA.7 investigates the effects of pandemic-related fear and asset-based optimism on contagion and diversification intensities under conditions of high and low outflow volumes. The findings are consistent with those presented in Table 7, particularly during the post-announcement period. In this phase, pandemic-related fear exerted a more pronounced negative influence on both contagion and diversification intensities amidst high trading volume. Simultaneously, the beneficial effect of market optimism diminished and potentially turned negative during periods of high outflow volume.

Furthermore, additional evidence supporting the market outflow hypothesis relates to bank deposit growth. During the COVID-19 pandemic, U.S. banks experienced significant deposit in- flows, especially after the WHO′s declaration on March 11, 2020, as illustrated in Figure IA.3. The influx of bank deposit inflows may lead to outflows from financial markets, as observed by Lin (2020), who notes a crowding-out effect between stock investment and bank deposit funding. Based on this, we extend our analysis to investigate the impact of bank deposit growth on the shifts in gold′s diversification properties during periods of high and low deposit growth. The results, presented in Table IA.8, indicate that high deposit growth exacerbated gold′s transition from a diversifier to a contagion asset during the post-announcement period. Our results further support the notion that capital outflows from financial markets to bank deposits contributed to reshaping gold′s role in diversification.

5.2.The Impact of Bankruptcy Sentiment

We have demonstrated that investor fear related to the pandemic significantly intensified conta- gion among the three asset markets during the post-announcement period. The threat of corporate bankruptcies and potential job losses due to the pandemic may influence investor behavior. We further investigate how investors respond to concerns over bankruptcies and assess the impact of bankruptcy sentiment on shaping the tail-risk spillover effects.

To gauge bankruptcy sentiment, we utilize the bondDefault index from the TRMI dataset (de- noted as SENTbankruptcy), a sub-index of the U.S. country sentiment index. This index, available at an hourly frequency, reflects investor sentiment about debt defaults, late payments, and bankruptcies. It ranges from −1 to 1, with negative values representing pessimism and positive values in- dicating optimism. We define indicator variables $1\{SENTBankruptcy \geq q0.5\}$ for periods when bankruptcy sentiment is at or above the median, denoting optimistic sentiment, and $1\{SENTBankruptcy < q0.5\}$ for periods below the median, indicative of pessimistic sentiment. We then regress both contagion and diversification intensities on the interaction terms between sentiment-based variables and these indicators. Specifically, the regression model is formulated as follows:

$$\begin{aligned}\Delta CoVaR^{gold|stock,oil}_{s\in\{DU,DD\},t+1} = \alpha &+ \beta_1 FEAR_{pandemic,t} \times 1_{\{SENT_{Bankruptcy} \geq q_{0.5}\}} \\ &+ \beta_2 FEAR_{pandemic,t} \times 1_{\{SENT_{Bankruptcy} < q_{0.5}\}} \\ &+ \beta_3 OPTIM^{\perp}_{gold,t} \times 1_{\{SENT_{Bankruptcy} \geq q_{0.5}\}} \\ &+ \beta_4 OPTIM^{\perp}_{gold,t} \times 1_{\{SENT_{Bankruptcy} < q_{0.5}\}} + Control_t + \epsilon_t,\end{aligned} \tag{20}$$

where ΔCoVaR represents the hourly downside-to-upside (s = DU) or downside-to-

downside (s = DD) tail dependence intensity of the gold market. FEARpandemic,t quantifies the level of fear and concern associated with the pandemic. $OPTIM^{\perp}$ denotes the relative optimism on gold, orthogonal to the pandemic-related fears. The control variable Controlt includes pandemic-related variables, along with other controls from the baseline regression. The coef- ficients β 1 and β 3 quantify the impact of pandemic-induced fear and asset-based optimism on contagion and diversification, respectively, under conditions of heightened optimism regarding bankruptcy. Conversely, β 2 and β 4 measure these effects during periods of increased bankruptcy pessimism.

Table 8 presents the results. Panel A reports on contagion intensity, while Panel B ad- dresses diversification intensity. Columns (1)-(4) show results for the pre-announcement period, and Columns (5)-(8) display those for the post-announcement period. Our findings indicate that pandemic-related fear, coupled with a pessimistic bankruptcy sentiment, significantly exacerbated contagion losses and diminished diversification benefits. This effect was especially pronounced in the post-announcement period, as evidenced by the larger negative coefficient of Fearpandemic × 1{SENTBankruptcy<q0.5}.

In contrast, during the pre-announcement period, investor optimism regarding the gold market encouraged

portfolio diversification into gold as a hedge against pessimistic bankruptcy sen- timent. This is illustrated by the significantly higher positive coefficient for the interaction term ⊥ gold,t ×1{SENTBankruptcy <q0.5} in the pre-announcement period. However, in the post-announcementperiod, investors appeared less inclined to diversify their portfolios through gold as a hedge against bankruptcy pessimism, possibly favoring more secure alternatives such as bank deposits. This is indicated by the significant negative coefficient for the term OPTIM⊥ × 1{SENTBankruptcy <q0.5} in the post-announcement period. It suggests that optimism toward the gold market translated into diversification benefits primarily in the absence of bankruptcy concerns.

Our results are consistent with the findings of Levine, Lin, Tai and Xie (2021) and Hanspal, Weber and Wohlfart (2021), indicating that increased concerns related to the pandemic, potential job losses, and income insecurity may prompt investors to reduce their investment and expenses and seek safer options such as cash or bank deposits.

Table 8
The Impact of Bankruptcy Sentiment on Contagion and Diversification Intensities.

	Pre-announcement period				Post-announcement period			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Regression Results on Contagion Intensity								
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$	−0.078***	−0.030			−0.043***	−0.028		
	(0.022)	(0.023)			(0.011)	(0.022)		
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$	−0.043***	−0.019***			−0.107***	−0.104***		
	(0.006)	(0.006)			(0.012)	(0.019)		
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$			−0.013	0.028**			0.028**	0.002
			(0.012)	(0.012)			(0.011)	(0.013)
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$			0.079***	0.063***			−0.041***	−0.034**
			(0.006)	(0.007)			(0.013)	(0.016)
$\Delta Slope$	[−0.035]	[−0.011]	[−0.092***]	[−0.034**]	[0.065***]	[0.077***]	[0.069***]	[0.036*]
Adjusted R^2	0.066	0.313	0.151	0.317	0.148	0.208	0.018	0.200
Panel B: Regression Results on Diversification Intensity								
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$	−0.140***	−0.076*			−0.100***	−0.089**		
	(0.037)	(0.041)			(0.018)	(0.036)		
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$	−0.077***	−0.034***			−0.173***	−0.186***		
	(0.010)	(0.011)			(0.020)	(0.029)		
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$			−0.005	0.079***			0.067***	0.045**
			(0.021)	(0.020)			(0.019)	(0.021)
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$			0.083***	0.110***			−0.065***	−0.035
			(0.011)	(0.012)			(0.023)	(0.027)
$\Delta Slope$	[−0.063]	[−0.069*]	[−0.088***]	[−0.031]	[0.073**]	[0.110***]	[0.132***]	[0.081**]
Adjusted R^2	0.076	0.281	0.059	0.280	0.161	0.233	0.024	0.231
Control	No	Yes	No	Yes	No	Yes	No	Yes
Observations	887	844	887	844	717	703	717	703

Note: The table presents regression results for the impact of bankruptcy sentiment on contagion and diversification intensities based on the regression (20). The dependent variable in Panel A is contagion intensity, while in Panel B, it is diversification intensity. $FEAR_{pandemic}$ is the logarithm of the fear-based sentiment concerning infectious diseases. $OPTIM^{\perp}_{gold}$ measures the relative optimism on gold which is orthogonal to the panic-related investor fear measure. The indicator $1_{\{SENT_{Bankruptcy} \geq q_{0.5}\}}$ is set to one if bankruptcy sentiment is at or above its sample median, reflecting an optimistic bankruptcy sentiment period, while $1_{\{SENT_{Bankruptcy} < q_{0.5}\}}$ is set to one when sentiment is below the median, indicating a pessimistic bankruptcy sentiment period. *Control* includes new confirmed cases and deaths during the pandemic, along with other variables from the baseline regression. Reported are regression slopes, robust standard errors (in parentheses), and adjusted R^2 values. The difference in coefficients on the interaction effects between the primary variables ($FEAR_{pandemic}$ or $OPTIM^{\perp}_{gold}$) and the above-median and below-median dummies is denoted by square brackets ($\Delta Slope$). Definitions for all other variables are presented in Table A.1 of Appendix A. "*","**", and "***" indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

6.Conclusion

This paper examined the comovement among stock futures, gold futures, and oil futures using five-minute data from January 16, 2020, to April 30, 2020. A significant structural break was detected at 23:55 on March 11, leading to the division of the sample into two subperiods. To evaluate contagion, safe-haven status, and diversification within a unified framework, we used CoVaR measures based on the GAS-driven dynamic vine copula.

Our primary finding is that there was no safe haven but only contagion and diversification. Throughout the entire sample period, gold failed to serve as a safe-haven asset amidst extreme downside contagion risks in the stock and oil markets. Instead, gold provided diversification ben- efits prior to the pandemic

announcement but became exposed to contagion risks originating from both the stock and oil markets following the WHO′s declaration of COVID-19 as a global pan- demic. Using downside-to-downside and downside-to-upside ΔCoVaR measures, we identified the optimistic outlook on gold compared to stocks and oil as the primary driver of gold′s diversification benefits before the pandemic announcement. In contrast, after the pandemic announcement, the escalating anxiety over global health had a more substantial effect on asset tail-risk spillovers than the pandemic itself. Our evidence suggests that capital flows to safe assets, rather than the trading restrictions imposed due to the pandemic, and concerns over bankruptcies amplify the contagion losses and diminish diversification benefits of gold. In summary, our findings emphasize that the psychological impact of the pandemic had a more substantial effect on asset tail-risk spillovers than the pandemic itself, particularly during the post-announcement period.

We conclude by suggesting two directions for future research. First, our study used only three assets as a laboratory to demonstrate the usefulness of our unified framework. Expanding the port- folio to include additional asset classes, such as bonds, commodities, and cryptocurrencies, would be an interesting extension. For a larger portfolio, considering a single index model specification for CoVaR measures, as proposed by Fan et al. (2018), could be beneficial. Second, our research identified sentiment factors as the primary determinants of gold′s changing role without resorting to a structural model. However, as Reinhart and Rogoff (2009) noted, "this time is different." To account for distinct economic characteristics during various periods, a dynamic structural model may be necessary.

References

Aastveit, K.A., Bjørnland, H.C., Cross, J.L., 2021. Inflation expectations and the pass-through of oil prices. Review of Economics and Statistics , 1–26.

Abadie, A., 2002. Bootstrap tests for distributional treatment effects in instrumental variable mod- els. Journal of the American Statistical Association 97, 284–292.

Adams, Z., Fu¨ss, R., Gropp, R., 2014. Spillover effects among financial institutions: A state- dependent sensitivity value-at-risk approach. Journal of Financial and Quantitative Analysis 49, 575–598.

Adrian, T., Brunnermeier, M.K., 2016. CoVaR. The American Economic Review 106, 1705–1741.

Almeida, C., Czado, C., Manner, H., 2016. Modeling high-dimensional time-varying dependence using dynamic d-vine models. Applied Stochastic Models in Business and Industry 32, 621–638.

Aloui, R., A¨ıssa, M.S.B., Nguyen, D.K., 2011. Global financial crisis, extreme interdependences, and contagion effects: The role of economic structure? Journal of Banking & Finance 35, 130–141.

Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. Journal of Financial Markets 5, 31–56.

Andersen, T.G., Bollerslev, T., Diebold, F.X., Labys, P., 2003. Modeling and forecasting realized volatility. Econometrica 71, 579–625.

Andrews, D.W., 1993. Tests for parameter instability and structural change with unknown change point. Econometrica: Journal of the Econometric Society , 821–856.

Audrino, F., Tetereva, A., 2019. Sentiment spillover effects for us and european companies. Jour- nal of Banking & Finance 106, 542–567.

Baur, D.G., Lucey, B.M., 2010. Is gold a hedge or a safe haven? an analysis of stocks, bonds and gold. Financial Review 45, 217–229.

Baur, D.G., McDermott, T.K., 2010. Is gold a safe haven? international evidence. Journal of Banking & Finance 34, 1886–1898.

Beckmann, J., Berger, T., Czudaj, R., 2019. Gold price dynamics and the role of uncertainty.

Quantitative Finance 19, 663–681.

Bekaert, G., Ehrmann, M., Fratzscher, M., Mehl, A., 2014. The global crisis and equity market contagion. Journal of Finance 69, 2597–2649.

Bekaert, G., Harvey, C.R., Ng, A., 2005. Market integration and contagion. Journal of Business 78, 39–70.

Bekiros, S., Boubaker, S., Nguyen, D.K., Uddin, G.S., 2017. Black swan events and safe havens: The role of gold in globally integrated emerging markets. Journal of International Money and Finance 73, 317–334.

Bernal, O., Gnabo, J.Y., Guilmin, G., 2014. Assessing the contribution of banks, insurance and other financial services to systemic risk. Journal of Banking & Finance 47, 270–287.

Blatt, D., Candelon, B., Manner, H., 2015. Detecting contagion in a multivariate time series system: An application to sovereign bond markets in europe. Journal of Banking & Finance 59, 1–13.

Borri, N., 2018. Local currency systemic risk. Emerging Markets Review 34, 111–123.

Borri, N., 2019. Conditional tail-risk in cryptocurrency markets. Journal of Empirical Finance 50, 1–19.

Brie`re, M., Chapelle, A., Szafarz, A., 2012. No contagion, only globalization and flight to quality.

Journal of International Money and Finance 31, 1729–1744.

Candelon, B., Tokpavi, S., 2016. A nonparametric test for granger causality in distribution with application to financial contagion. Journal of Business & Economic Statistics 34, 240–253.

Capie, F., Mills, T.C., Wood, G., 2005. Gold as a hedge against the dollar. Journal of International Financial Markets, Institutions and Money 15, 343–352.

C¸ olak, G., O¨ ztekin, O¨ ., 2021. The impact of COVID-19 pandemic on bank lending around the world. Journal of Banking & Finance 133, 106207.

Chan, K., Yang, J., Zhou, Y., 2018. Conditional co-skewness and safe-haven currencies: A regime switching approach. Journal of Empirical Finance 48, 58–80.

Cheng, X., Chen, H., Zhou, Y., 2021. Is the renminbi a safe-haven currency? evidence from con- ditional coskewness and cokurtosis. Journal of International Money and Finance 113, 102359.

Christoffersen, P., Errunza, V., Jacobs, K., Langlois, H., 2012. Is the potential for international diversification disappearing? a dynamic copula approach. Review of Financial Studies 25, 3711– 3751.

Christoffersen, P., Jacobs, K., Jin, X., Langlois, H., 2018. Dynamic dependence and diversification in corporate credit. Review of Finance 22, 521–560.

Creal, D., Koopman, S.J., Lucas, A., 2013. Generalized autoregressive score models with applica- tions. Journal of Applied Econometrics 28, 777–795.

Czado, C., Schepsmeier, U., Min, A., 2012. Maximum likelihood estimation of mixed c-vines with application to exchange rates. Statistical Modelling 12, 229–255.

Czech, R., Huang, S., Lou, D., Wang, T., 2022. Unintended consequences of holding dollar assets.
Working Paper, Available at SSRN: https://ssrn.com/abstract=4012879 .
Dungey, M., Gajurel, D., 2015. Contagion and banking crisis−international evidence for 2007− 2009. Journal of Banking & Finance 60, 271−283.
Dungey, M., Milunovich, G., Thorp, S., Yang, M., 2015. Endogenous crisis dating and contagion using smooth transition structural garch. Journal of Banking & Finance 58, 71−79.
Engle, R.F., Lee, G.G., 1999. A permanent and transitory component model of stock return volatil- ity, in: Cointegration, Causality, and Forecasting: A Festschrift in Honor of Clive W.J. Granger. Oxford University Press, Oxford, pp. 475−497.
Fama, E.F., French, K.R., 1992. The cross-section of expected stock returns. Journal of Finance 47, 427−465.
Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3−56.
Fan, Y., Ha¨rdle, W.K., Wang, W., Zhu, L., 2018. Single-index-based covar with very high- dimensional covariates. Journal of Business & Economic Statistics 36, 212−226.
Ferson, W.E., Harvey, C.R., 1991. The variation of economic risk premiums. Journal of Political Economy 99, 385−415.
Fong, T.P.W., Wong, A.Y., 2012. Gauging potential sovereign risk contagion in europe. Economics Letters 115, 496−499.
Forbes, K.J., Rigobon, R., 2002. No contagion, only interdependence: measuring stock market comovements. Journal of Finance 57, 2223−2261.
Girardi, G., Ergu¨n, A.T., 2013. Systemic risk measurement: Multivariate garch estimation of covar.
Journal of Banking & Finance 37, 3169−3180.
Guidotti, E., 2022. A worldwide epidemiological database for covid-19 at fine-grained spatial resolution. Scientific Data 9, 112.
Guiso, L., Sapienza, P., Zingales, L., 2018. Time varying risk aversion. Journal of Financial Economics 128, 403−421.
Hafner, C.M., Manner, H., 2012. Dynamic stochastic copula models: Estimation, inference and applications. Journal of Applied Econometrics 27, 269−295.
Han, Q., Liang, J., 2017. Index futures trading restrictions and spot market quality: Evidence from the recent chinese stock market crash. Journal of Futures Markets 37, 411−428.
Hanspal, T., Weber, A., Wohlfart, J., 2021. Exposure to the covid-19 stock market crash and its effect on household expectations. Review of Economics and Statistics 103, 994−1010.
Hu, J., Wang, T., Hu, W., Tong, J., 2020. The impact of trading restrictions and margin require- ments on stock index futures. Journal of Futures Markets 40, 1176−1191.
Jaffe, J.F., 1989. Gold and gold stocks as investments for institutional portfolios. Financial Ana- lysts Journal 45, 53−59.
John, K., Li, J., 2021. COVID-19, volatility dynamics, and sentiment trading. Journal of Banking & Finance 133, 106162.
Joy, M., 2011. Gold and the us dollar: Hedge or haven? Finance Research Letters 8, 120−131.
Kaplanski, G., Levy, H., 2010. Sentiment and stock prices: The case of aviation disasters. Journal of Financial Economics 95, 174−201.
Kiyotaki, N., Moore, J., 2002. Balance-sheet contagion. American Economic Review 92, 46−50.
Levine, R., Lin, C., Tai, M., Xie, W., 2021. How did depositors respond to covid-19? Review of Financial Studies 34, 5438−5473.
Li, S., Lucey, B.M., 2017. Reassessing the role of precious metals as safe havens−what colour is your haven and why? Journal of Commodity Markets 7, 1−14.
Lin, L., 2020. Bank deposits and the stock market. Review of Financial Studies 33, 2622−2658.
Longin, F., Solnik, B., 2001. Extreme correlation of international equity markets. Journal of Finance 56, 649−676.
Mainik, G., Schaanning, E., 2014. On dependence consistency of covarand some other systemic risk measures. Statistics & Risk Modeling 31, 49−77.
Mensi, W., Hammoudeh, S., Shahzad, S.J.H., Shahbaz, M., 2017. Modeling systemic risk and dependence structure between oil and stock markets using a variational mode decomposition- based copula method. Journal of Banking & Finance 75, 258−279.
Michaelides, A., Milidonis, A., Nishiotis, G.P., 2019. Private information in currency markets.
Journal of Financial Economics 131, 643−665.
Michaelides, A., Milidonis, A., Nishiotis, G.P., Papakyriakou, P., 2015. The adverse effects of systematic leakage ahead of official sovereign debt rating announcements. Journal of Financial Economics 116,

526–547.

Patton, A.J., 2012. A review of copula models for economic time series. Journal of Multivariate Analysis 110, 4–18.

Pericoli, M., Sbracia, M., 2003. A primer on financial contagion. Journal of Economic Surveys 17, 571–608.

Reboredo, J.C., 2013. Is gold a safe haven or a hedge for the us dollar? implications for risk management. Journal of Banking & Finance 37, 2665–2676.

Reboredo, J.C., Rivera-Castro, M.A., Ugolini, A., 2016. Downside and upside risk spillovers between exchange rates and stock prices. Journal of Banking & Finance 62, 76–96.

Reboredo, J.C., Ugolini, A., 2015. Systemic risk in european sovereign debt markets: A covar- copula approach. Journal of International Money and Finance 51, 214–244.

Reinhart, C.M., Rogoff, K.S., 2009. This Time Is Different. Princeton University Press, Princeton. doi:10.1515/9781400831722.

Rodriguez, J.C., 2007. Measuring financial contagion: A copula approach. Journal of Empirical Finance 14, 401–423.

Sjaastad, L.A., Scacciavillani, F., 1996. The price of gold and the exchange rate. Journal of International Money and Finance 15, 879–897.

Støve, B., Tjøstheim, D., Hufthammer, K.O., 2014. Using local gaussian correlation in a nonlinear re-examination of financial contagion. Journal of Empirical Finance 25, 62–82.

Wang, K.M., Lee, Y.M., Thi, T.B.N., 2011. Time and place where gold acts as an inflation hedge: An application of long-run and short-run threshold model. Economic Modelling 28, 806–819.

Weiß, G.N., Supper, H., 2013. Forecasting liquidity-adjusted intraday value-at-risk with vine copulas. Journal of Banking & Finance 37, 3334–3350.

Yang, Z., Zhou, Y., 2017. Quantitative easing and volatility spillovers across countries and asset classes. Management Science 63, 333–354.

Table 1: Summary Statistics for Stock, Gold, and Oil Futures Returns

Note: The table presents the mean, standard deviation (Std. Dev.), skewness, and kurtosis of the five-minute returns for S&P 500, NYMEX Gold, and WTI Crude Oil futures for the period from January 16, 2020, to April 30, 2020. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post- announcement period (March 12 to April 30). *** indicates the rejection of the null hypothesis of zero correlation between the returns of two assets at a 1% significance level.

	STOCK	GOLD	OIL	STOCK	GOLD	OIL
Mean	−0.001	0.000	−0.002	0.003	−0.001	−0.540
Std. Dev.	0.001	0.001	0.002	0.003	0.001	0.427
Skewness	0.732	−0.642	0.883	0.135	−0.025	−63.651
Kurtosis	43.495	16.933	54.532	7.323	8.305	4432.996
Rank Correlation						
STOCK	1.000	-0.307^{***}	0.346^{***}	1.000	0.133^{***}	0.265^{***}
GOLD		1.000	-0.191^{***}		1.000	0.087^{***}
OIL			1.000			1.000

Table 2: Summary Statistics for Investor Sentiments and Relevant Variables

Note: The table presents summary statistics for investor sentiments and other relevant variables used in the regression analysis during the period from January 16, 2020, to April 30, 2020. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The term "ADF-Stat" denotes the Augmented Dickey-Fuller test statistic under the null hypothesis that a unit root is present in the series. The "Mean Difference" represents the average disparity in a given variable between the pre- and post-announcement subsamples. SENTpandemic corresponds to the hourly humanInfectiousDisease index, which quantifies sentiment regarding the presence and outbreak of contagious or epidemic diseases. SENToil, SENTgold, and SENTstock represent the TRMI sentiment indices for crude oil, gold, and the US stock markets, respectively, measured at an hourly frequency. The variables Cases and Deaths refer to the daily global count of newly confirmed COVID-19 cases and deaths. The SWAP variable denotes spreads of the US zero-coupon inflation indexed swap with a one-year maturity. rDXY represents the log difference of the US dollar index. The TERM variable indicates the term spread, which is calculated as the difference between the 10-year and three-month Treasury yields. DEF stands for the default spread, measured as the difference between Moody's BAA-rated corporate bond and 10-year Treasury bond yields. The TED variable denotes the TED spread, computed as the difference between the three-month LIBOR, based on the US dollar, and the three-month Treasury yield. RVoil, RVgold, and RVstock correspond to the daily realized volatilities of oil, gold, and stock returns, respectively. The ILLIQ variable represents the Amihud-type illiquidity indicator for the gold market. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Mean	Std.Dev	ADF-Stat	Mean	Std.Dev	ADF-Stat	Mean Difference
$SENT_{pandemic}$	0.256%	0.118%	-4.446^{***}	0.441%	0.081%	-4.511^{***}	$0.185\%^{***}$
$SENT_{oil}$	−13.850%	7.836%	-3.633^{**}	−18.865%	3.690%	-4.439^{***}	$-5.015\%^{***}$
$SENT_{gold}$	4.567%	4.818%	-3.629^{**}	0.732%	5.943%	-5.183^{***}	$-3.834\%^{***}$
$SENT_{stock}$	−5.761%	11.960%	-3.719^{**}	−12.844%	7.597%	-4.840^{***}	$-7.083\%^{***}$
log(*Cases*)	7.050	1.749	-2.157	10.902	0.653	-2.966	3.852^{***}
log(*Deaths*)	3.694	1.581	-2.508	99 8.224	0.859	-2.112	4.530^{***}
SWAP	1.183	0.407	0.011	−0.992	0.231	−2.951	-2.175^{***}
rDXY	−0.019	0.446	−2.195	0.074	0.758	−2.747	0.093

TERM	0.067	0.156	0.168	0.620	0.175	−1.627	0.552***
DEF	2.199	0.276	1.456	3.621	0.363	−5.613***	1.422***
TED	0.232	0.092	−1.956	1.010	0.280	−2.800	0.778***
RV_{oil}	0.002	0.002	−0.491	0.094	0.545	−3.284*	0.092
RV_{gold}	0.001	0.000	−2.967	0.002	0.001	−3.634**	0.001***
RV_{stock}	0.001	0.001	−2.481	0.002	0.001	−3.069	0.001***
ILLIQ	0.011	0.012	−1.568	0.032	0.026	−0.049	0.021***

Table 3: Test Results for Contagion Effects between the Stock and Oil Markets

Note: The table presents the one-sided KS test statistics, with bootstrap p-values in parentheses, for contagion effects between the stock and oil markets. The sample period is split into two subperiods: the pre-announcement period (Jan- uary 16 to March 11) and the post-announcement period (March 12 to April 30). The one-sided (two sample) KS test statistic is given by,

$$KS_{mn} = \left(\frac{mn}{m+n}\right)^{1/2} \sup_x (F_m(x) - G_n(x))$$

where F_m and G_n are the empirical distribution functions of $CoVaR^{j|i}_{DD,\delta,t}$ and $VaR^{j}_{\delta,t}$, and m and n are the sizes of the two samples. The last column of the table indicates the implication for contagion effects if the null hypothesis (H_0 in the first column) is rejected in favor of the alternative hypothesis (H_1 in the first column). "***" indicates statistical significance at the 1% level.

Hypotheses		Pre-announcement	Post-announcement period	Implication for contagion effects if H_0 is rejected
H_0: $CoVaR^{O\|S}$	$= VaR^{O}$	(0.000)	0.394*** (0.000)	Contagion risks transmitted from stock market distress to the oil market
H : $CoVaR^{O\|S}$	$< VaR^{O}$			
H_0: $CoVaR^{S\|O}$	$= VaR^{S}$	(0.000)	0.203*** (0.000)	Contagion risks transmitted from oil market distress to the stock market
H : $CoVaR^{S\|O}$	$< VaR^{S}$			

Table 4: Test Results for Safe Haven and Contagion Effects between the Gold and Stock (or Oil) Markets

Note: The table presents the one-sided KS test statistics, with bootstrap p-values in parentheses, for safe haven and contagion effects between the gold and stock (or oil) markets. The sample period is split into two subperiods: the pre- announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The one- sided (two-sample) KS test statistic is given by,

$$KS_{mn} = \left(\frac{mn}{m+n}\right)^{1/2} \sup_x (F_m(x) - G_n(x))$$

where F_m and G_n are the empirical distribution functions of $CoVaR^{j|i}_{DU,\delta,t}$ ($CoVaR^{j|i}_{DD,\delta,t}$) and $VaR^{j}_{1-\delta,t}$ ($VaR^{j}_{\delta,t}$) if we test for the safe haven (contagion) effect, and m and n are the sizes of the two samples. The last column of the table indicates the implication for safe haven/contagion effects if the null hypothesis (H_0 in the first column) is rejected in favor of the alternative hypothesis (H_1 in the first column). "***" indicates statistical significance at the 1% level.

Hypotheses		Pre-announcement	Post-announcement period	Implication for safe haven or contagion effects if H_0 is rejected
H_0: $CoVaR^{G\|S}$	$= VaR^{G}$		0.000	Gold is a safe haven against

H_1: $CoVaR^{G\|S}$ $> VaR^G$	(0.000)	(1.000)	stock market distress
H_0: $CoVaR^{G\|O} = VaR^G$ H_1: $CoVaR^{G\|O} > VaR^G$	(0.000)	0.001 (0.992)	Gold is a safe haven against oil market distress
H_0: $CoVaR^{G\|S} = VaR^G$ H_1: $CoVaR^{G\|S} < VaR^G$	(1.000)	0.283*** (0.000)	Contagion risks transmitted from stock market distress to the gold market
H_0: $CoVaR^{G\|O} = VaR^G$ H_1: $CoVaR^{G\|O} < VaR^G$	(0.998)	0.211*** (0.000)	Contagion risks transmitted from oil market distress to the gold market

Table 5: Test Results for Safe Haven, Contagion, and Diversification Effects across the Stock, Gold, and Oil Markets

Note: The table presents the one-sided KS test statistics, with bootstrap p-values in parentheses, for safe haven, conta- gion, and diversification effects across the stock, oil and gold markets. The sample period is split into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). The one-sided (two sample) KS test statistic is given by,

$$KS_{mn} = \left(\frac{mn}{m+n}\right)^{1/2} \sup_x (F_m(x) - G_n(x))$$

where F_m and G_n are the empirical distribution functions of $CoVaR^{G|S,O}_{DU,\gamma,t}$ ($CoVaR^{G|S,O}_{DD,\gamma,t}$) and $VaR^G_{1-\gamma,t}$ ($VaR^G_{\gamma,t}$), and m and n are the sizes of the two samples. The last column in the table indicates the implication for safe haven/contagion/diversification effects, if the null hypothesis (H_0 in the first column) is rejected in favor of the alternative hypothesis (H_1 in the first column). "***" indicates statistical significance at the 1% level.

Hypotheses	Pre-announcement period	Post-announcement period	Implication for safe haven/contagion/ diversification effects if H_0 is rejected
H_0: $CoVaR^{G\|S,O}_{DU,\gamma,t} = VaR^G_{1-\gamma,t}$ H_1: $CoVaR^{G\|S,O}_{DU,\gamma,t} > VaR^G_{1-\gamma,t}$	0.000	0.000 (1.000)	Gold is a safe haven against both stock and oil market distress
H_0: $CoVaR^{G\|S,O}_{DD,\gamma,t} = VaR^G_{\gamma,t}$ H_1: $CoVaR^{G\|S,O}_{DD,\gamma,t} < VaR^G_{\gamma,t}$	0.003 (0.946)	0.514*** (0.000)	Gold suffers the contagion risk from both stock and oil market distress
H_0: $CoVaR^{G\|S,O}_{DU,\gamma,t} = VaR^G_{1-\gamma,t}$ H_1: $CoVaR^{G\|S,O}_{DU,\gamma,t} < VaR^G_{1-\gamma,t}$	0.655*** (0.000)	0.989*** (0.000)	Diversification effect exists since the upside potential of gold returns is reduced.
H_0: $CoVaR^{G\|S,O}_{DD,\gamma,t} = VaR^G_{\gamma,t}$ H_1: $CoVaR^{G\|S,O}_{DD,\gamma,t} > VaR^G_{\gamma,t}$	0.346*** (0.000)	0.000 (1.000)	Diversification effect exists since the extreme losses of gold returns are mitigated.

Table 6: Determinants of Contagion and Diversification Intensities

Note: This table reports regression results for the determinants of contagion and diversification intensities based on the baseline regression (18). The dependent variable in Panel A is contagion intensity, while in Panel B, it is diversification intensity. FEARpandemic is the logarithm of the fear-based sentiment concerning infectious diseases. OPTIM$\perp$ measures the relative optimism on gold which is orthogonal to the panic-related investor fear measure. log(Cases)t and log(Deaths)t are the logarithm of the number (+1) of new confirmed cases and deaths during the COVID-19 pandemic. The primary

explanatory variables (FEARpandemic, OPTIM⊥, log(Cases), and log(Death)) are standardized by subtracting their means and scaling by their standard deviations. Control is a vector of control variables from regression (18). Robust standard errors are reported in parentheses. "*","**", and "***" indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Pre-announcement period					Post-announcement period				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Regression Results on Contagion Intensity										
$FEAR_{pandemic}$	-0.045^{***}		-0.022^{***}		-0.014^{**}	-0.073^{***}		-0.081^{***}		-0.079^{***}
	(0.006)		(0.006)		(0.006)	(0.007)		(0.017)		(0.018)
$OPTIM^{\perp}_{gold}$		0.059^{***}		0.048^{***}	0.046^{***}		-0.001		-0.014	-0.011
		(0.006)		(0.006)	(0.006)		(0.009)		(0.011)	(0.011)
log(*Cases*)					-0.029^{***}					0.014
					(0.009)					(0.121)
log(*Deaths*)					0.004					-0.084
					(0.008)					(0.077)
Adjusted R^2	0.064	0.109	0.292	0.331	0.345	0.134	-0.001	0.201	0.177	0.203
Panel B: Regression Results on Diversification Intensity										
$FEAR_{pandemic}$	-0.081^{***}		-0.022^{**}		-0.009	-0.134^{***}		-0.164^{***}		-0.170^{***}
	(0.010)		(0.011)		(0.010)	(0.012)		(0.029)		(0.030)
$OPTIM^{\perp}_{gold}$ |		0.065^{***}		0.084^{***}	0.081^{***}		0.011		0.002	0.018
		(0.010)		(0.010)	(0.010)		(0.015)		(0.018)	(0.018)
log(*Cases*)					-0.052^{***}					0.042
					(0.015)					(0.202)
log(*Deaths*)					0.016					-0.065
					(0.013)					(0.129)
Adjusted R^2	0.074	0.046	0.282	0.333	0.342	0.155	-0.001	0.231	0.194	0.230
Control	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Observations	887	887	844	844	844	717	717	681	681	681

Table 7: The Impact of Gold Trading Volume on Contagion and Diversification Intensities

Note: This table presents regression results for the impact of gold trading volume on contagion and diversification intensities based on the regression (19). The dependent variable in Panel A is contagion intensity, while in panel B, it is diversification intensity. FEARpandemic is the logarithm of the fear-based sentiment concerning infectious diseases. OPTIM⊥ measures the relative optimism on gold which is orthogonal to the panic-related investor fear measure. The indicators 1{VolGold ≥q0.5} and 1{VolGold <q0.5} are assigned a value of one if the gold market's trading volume is at or above, and below the median of the sample, respectively.

Control includes new confirmed cases and deaths during the pandemic, along with other variables from the baseline regression. Reported are regression slopes, robust standard errors (in parentheses), and adjusted R2 values. The difference in coefficients on the interaction effects between the primary variables (FEARpandemic or OPTIM⊥) and the above-median and below-median dummies is denoted by square brackets (ΔSlope). Definitions for all other variables are presented in Appendix A. "*","**", and "***" indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Pre-announcement period				Post-announcement period			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Regression Results on Contagion Intensity								
$FEAR_{pandemic} \times 1\{Vol_{Gold} \geq q_{0.5}\}$	-0.049^{***} (0.007)	-0.024^{***} (0.007)			-0.088^{***} (0.010)	-0.090^{***} (0.018)		
$FEAR_{pandemic} \times 1\{Vol_{Gold} < q_{0.5}\}$	-0.029^{**} (0.012)	-0.005 (0.011)			-0.049^{***} (0.012)	-0.046^{**} (0.020)		
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} \geq q_{0.5}\}$			0.076^{***} (0.007)	0.065^{***} (0.008)			-0.038^{***} (0.012)	-0.019 (0.014)
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} < q_{0.5}\}$			0.020^{**} (0.010)	0.029^{***} (0.010)			0.048^{***} (0.013)	0.002 (0.014)
$\Delta Slope$	$[-0.020]$	$[-0.019]$	$[0.056^{***}]$	$[0.036^{***}]$	$[-0.039^{**}]$	$[-0.044^{**}]$	$[-0.086^{***}]$	$[-0.021]$
Adjusted R^2	0.066	0.313	0.132	0.319	0.137	0.202	0.029	0.197
Panel B: Regression Results on Diversification Intensity								
$FEAR_{pandemic} \times 1\{Vol_{Gold} \geq q_{0.5}\}$	-0.099^{***} (0.011)	-0.055^{***} (0.013)			-0.151^{***} (0.017)	-0.161^{***} (0.028)		
$FEAR_{pandemic} \times 1\{Vol_{Gold} < q_{0.5}\}$	-0.025 (0.020)	0.003 (0.020)			-0.110^{***} (0.020)	-0.116^{***} (0.033)		
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} \geq q_{0.5}\}$			0.095^{***} (0.012)	0.129^{***} (0.013)			-0.068^{***} (0.020)	-0.012 (0.024)
$OPTIM^{\perp}_{gold} \times 1\{Vol_{Gold} < q_{0.5}\}$			0.001 (0.018)	0.053^{***} (0.017)			0.115^{***} (0.023)	0.046^{*} (0.024)
$\Delta Slope$	$[-0.074^{***}]$	$[-0.032]$	$[0.094^{***}]$	$[0.076^{***}]$	$[-0.042]$	$[-0.063^{**}]$	$[-0.184^{***}]$	$[-0.058^{*}]$
Adjusted R^2	0.088	0.194	0.070	0.284	0.155	0.229	0.047	0.230
Control	No	Yes	No	Yes	No	Yes	No	Yes
Observations	860	818	860	818	700	686	700	686

Table 8: The Impact of Bankruptcy Sentiment on Contagion and Diversification Intensities

Note: The table presents regression results for the impact of bankruptcy sentiment on contagion and diversification intensities based on the regression (20). The dependent variable in Panel A is contagion intensity, while in Panel B, it is diversification intensity. $FEAR_{pandemic}$ is the logarithm of the fear-based sentiment concerning infectious diseases. $OPTIM^{\perp}_{gold}$ measures the relative optimism on gold which is orthogonal to the panic-related investor fear measure. The indicator $1_{\{SENT_{Bankruptcy} \geq q_{0.5}\}}$ is set to one if bankruptcy sentiment is at or above its sample median, reflecting an optimistic bankruptcy sentiment period, while $1_{\{SENT_{Bankruptcy} < q_{0.5}\}}$ is set to one when sentiment is below the median, indicating a pessimistic bankruptcy sentiment period. *Control* includes new confirmed cases and deaths during the pandemic, along with other variables from the baseline regression. Reported are regression slopes, robust standard errors (in parentheses), and adjusted R^2 values. The difference in coefficients on the interaction effects between the primary variables ($FEAR_{pandemic}$ or $OPTIM^{\perp}_{gold}$) and the above-median and below-median dummies is denoted by square brackets ($\Delta Slope$). Definitions for all other variables are presented in Appendix A. "*","**", and "***" indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Pre-announcement period				Post-announcement period			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Regression Results on Contagion Intensity								
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$	-0.078^{***} (0.022)	-0.030 (0.023)			-0.043^{***} (0.011)	-0.028 (0.022)		
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$	-0.043^{***} (0.006)	-0.019^{***} (0.006)			-0.107^{***} (0.012)	-0.104^{***} (0.019)		
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$			-0.013 (0.012)	0.028^{**} (0.012)			0.028^{**} (0.011)	0.002 (0.013)
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$			0.079^{***} (0.006)	0.063^{***} (0.007)			-0.041^{***} (0.013)	-0.034^{**} (0.016)
$\Delta Slope$	$[-0.035]$	$[-0.011]$	$[-0.092^{***}]$	$[-0.034^{**}]$	$[0.065^{***}]$	$[0.077^{***}]$	$[0.069^{***}]$	$[0.036^{*}]$
Adjusted R^2	0.066	0.313	0.151	0.317	0.148	0.208	0.018	0.200
Panel B: Regression Results on Diversification Intensity								
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$	-0.140^{***} (0.037)	-0.076^{*} (0.041)			-0.100^{***} (0.018)	-0.089^{**} (0.036)		
$FEAR_{pandemic} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$	-0.077^{***} (0.010)	-0.034^{***} (0.011)			-0.173^{***} (0.020)	-0.186^{***} (0.029)		
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} \geq q_{0.5}\}$			-0.005 (0.021)	0.079^{***} (0.020)			0.067^{***} (0.019)	0.045^{**} (0.021)
$OPTIM^{\perp}_{gold} \times 1\{SENT_{Bankruptcy} < q_{0.5}\}$			0.083^{***} (0.011)	0.110^{***} (0.012)			-0.065^{***} (0.023)	-0.035 (0.027)
$\Delta Slope$	$[-0.063]$	$[-0.069^{*}]$	$[-0.088^{***}]$	$[-0.031]$	$[0.073^{**}]$	$[0.110^{***}]$	$[0.132^{***}]$	$[0.081^{**}]$
Adjusted R^2	0.076	0.281	0.059	0.280	0.161	0.233	0.024	0.231
Control	No	Yes	No	Yes	No	Yes	No	Yes
Observations	887	844	887	844	717	703	717	703

Figure 1: Time plot of Futures Prices

Note: The figure shows the time plot of five-minute (standardized) prices of S&P 500 futures, NYMEX Gold futures, and WTI Crude Oil futures from January 16, 2020, to April 30, 2020. The prices are standardized for illustration purposes. The vertical black line marks 23:55 on March 11. The green dashed line shows that the WTI Crude Oil futures prices plunged to negative values on April 20.

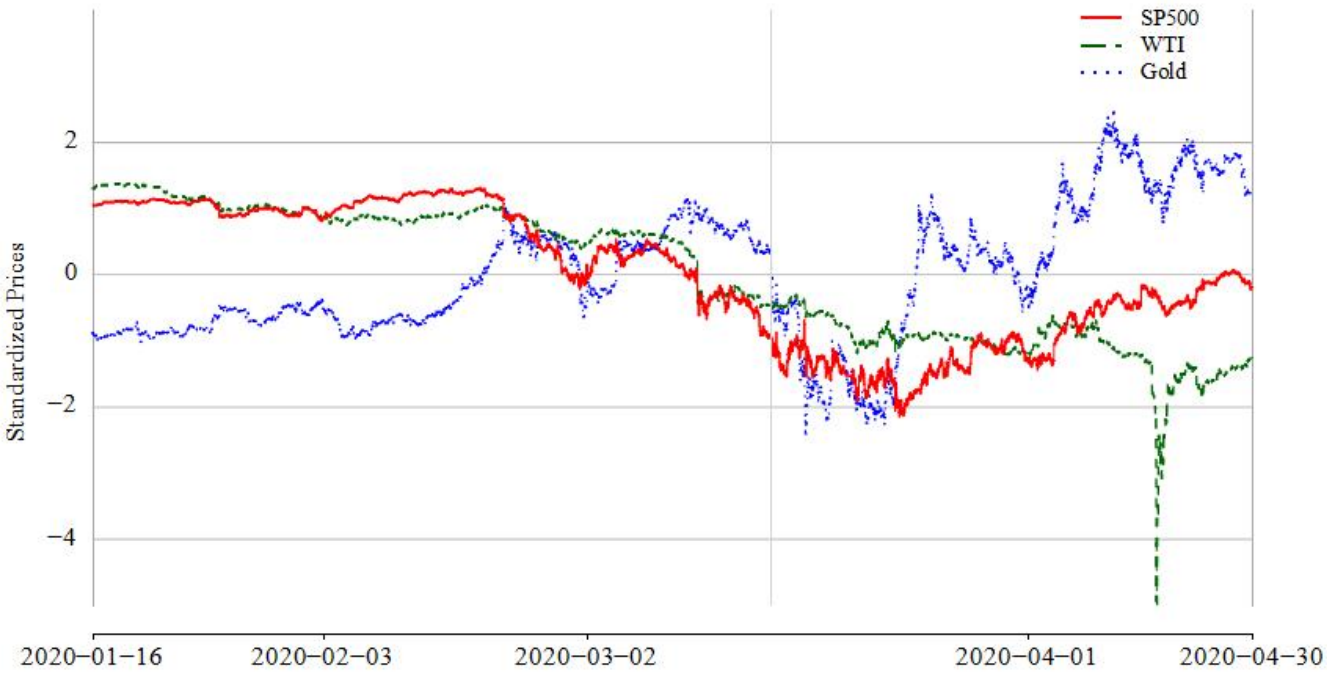


Figure 2: Time Plot of Upside VaR and Downside-to-Upside CoVaR for Gold Returns Conditional on Stock Market Distress

Note: This figure depicts the estimates of upside VaR and downside-to-upside CoVaR for gold returns, conditional on the stock market being in distress, for two subperiods. VaR(G>0.9) denotes the upside VaR for gold returns, while CoVaR(G>0.9|S<0.1) represents the downside-to-upside CoVaR for gold returns, conditional on the stock market being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

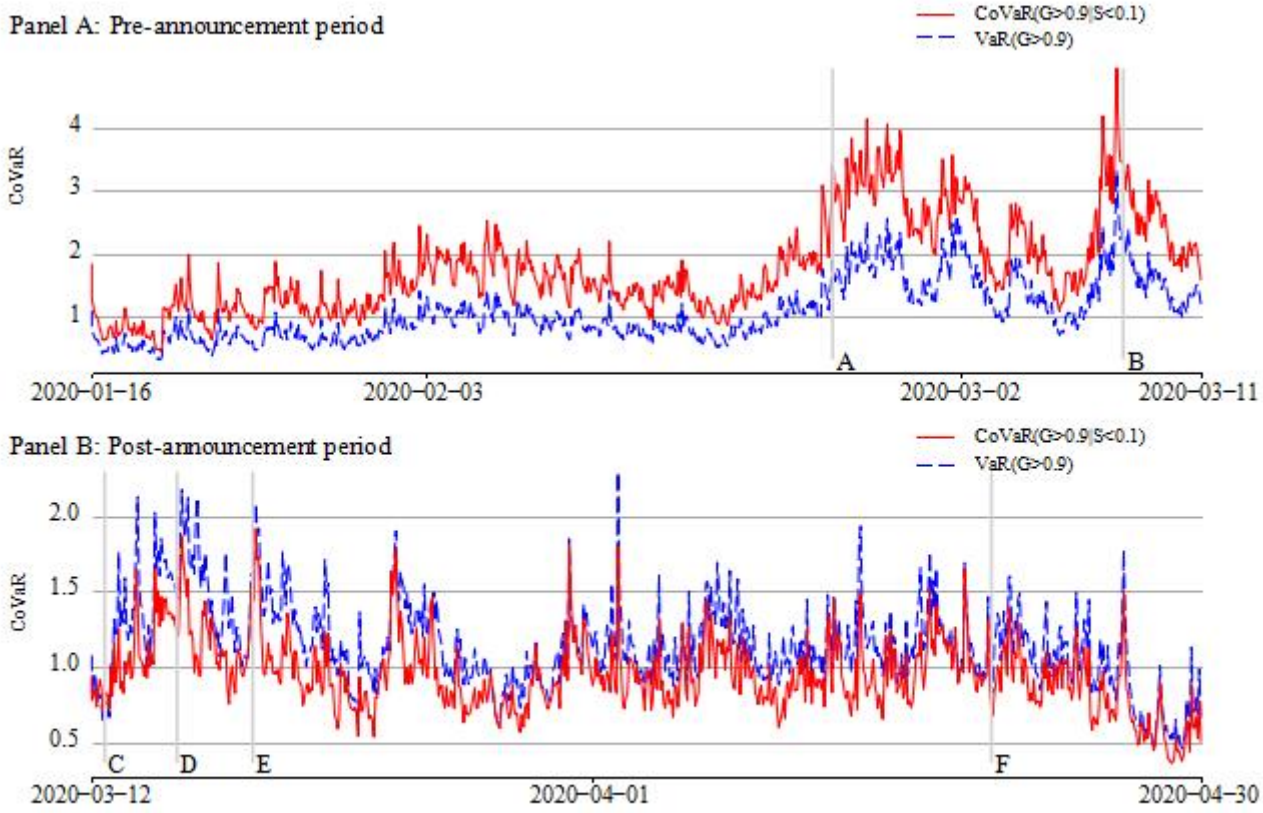


Figure 3: Time Plot of Upside VaR and Downside-to-Upside CoVaR for Gold Returns Conditional on Oil Market Distress

Note: This figure depicts the estimates of upside VaR and downside-to-upside CoVaR for gold returns, conditional on the oil market being in distress, for two subperiods. VaR(G>0.9) denotes the upside VaR for gold returns, while CoVaR(G>0.9|O<0.1) represents the downside-to-upside CoVaR for gold returns, conditional on the oil market being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

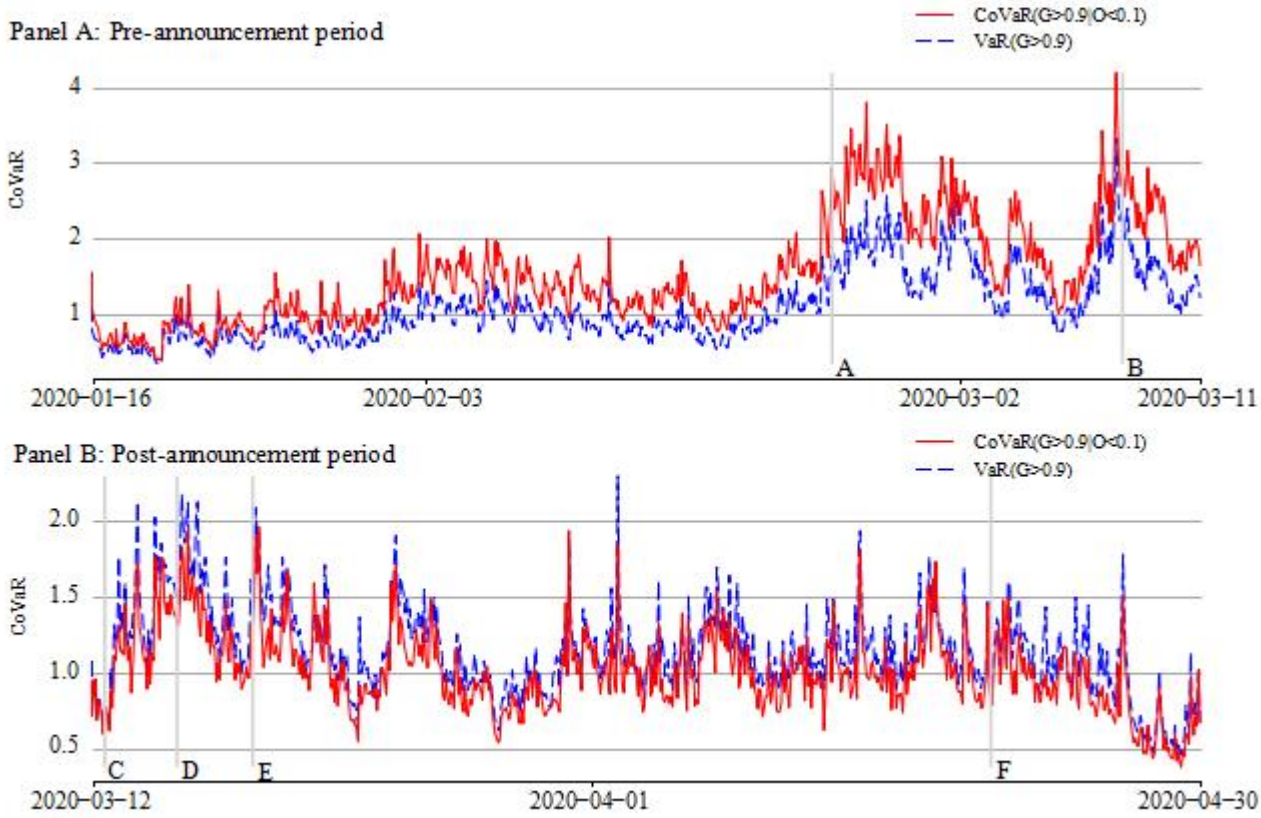


Figure 4: Time Plot of Downside VaR and Downside-to-Downside CoVaR for Gold Returns Conditional on Stock or Oil Market Distress in the Post-Announcement Period

Note: This figure depicts the estimates of downside VaR and downside-to-downside CoVaR for gold returns, conditional on either the stock market or the oil market experiencing distress in the post-announcement period. VaR(G<0.1) denotes the downside VaR for gold returns, while CoVaR(G<0.1|S<0.1) (CoVaR(G<0.1|O<0.1)) represents the downside-to-downside CoVaR for gold returns, conditional on the stock (oil) market being in turmoil. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

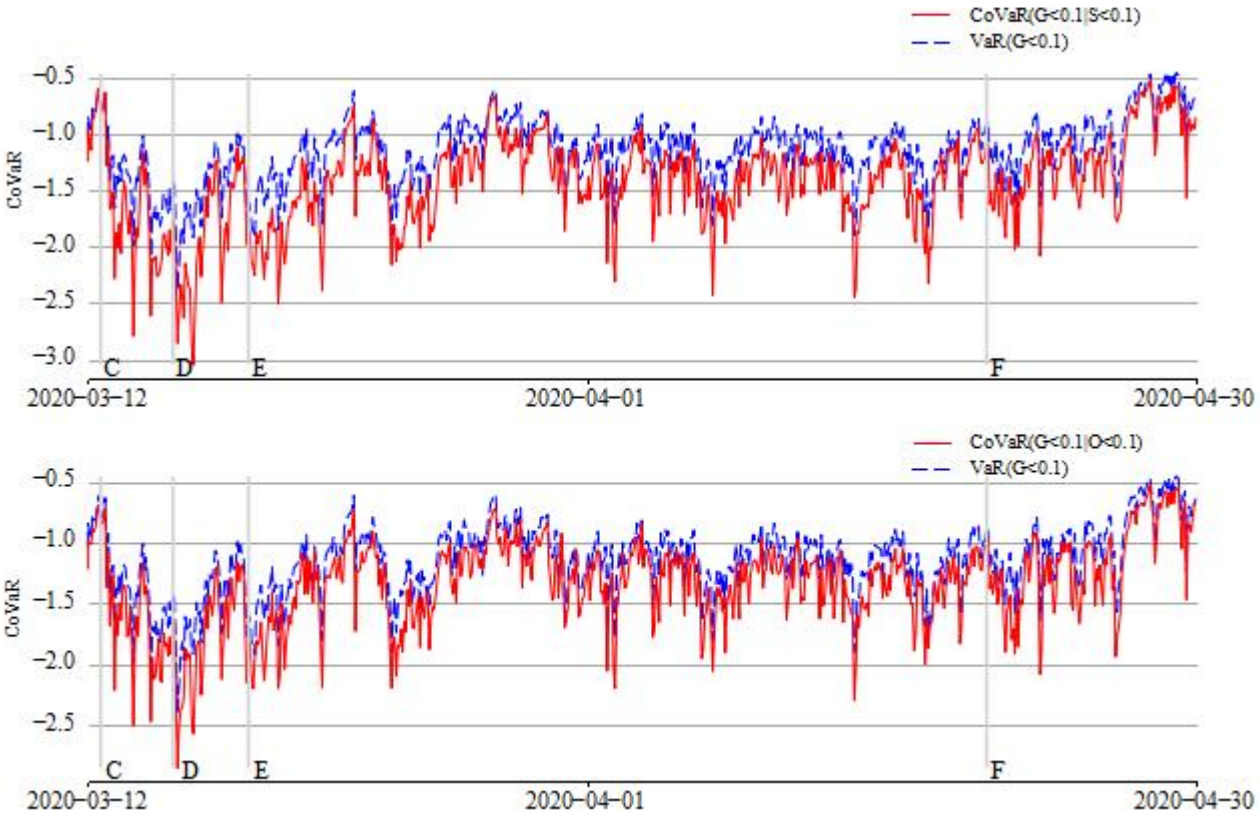


Figure 5: Time Plot of Upside VaR and Downside-to-Upside CoVaR for Gold Returns Conditional on both Stock and Oil Market Distress

Note: This figure depicts the estimates of upside VaR and downside-to-upside CoVaR for gold returns, conditional on both the stock and oil markets being in distress across two subperiods. VaR(G>0.9) denotes the upside VaR for gold returns, while CoVaR(G>0.9|S<0.1, O<0.1) represents the downside-to-upside CoVaR for gold returns, conditional on both the stock and oil markets being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

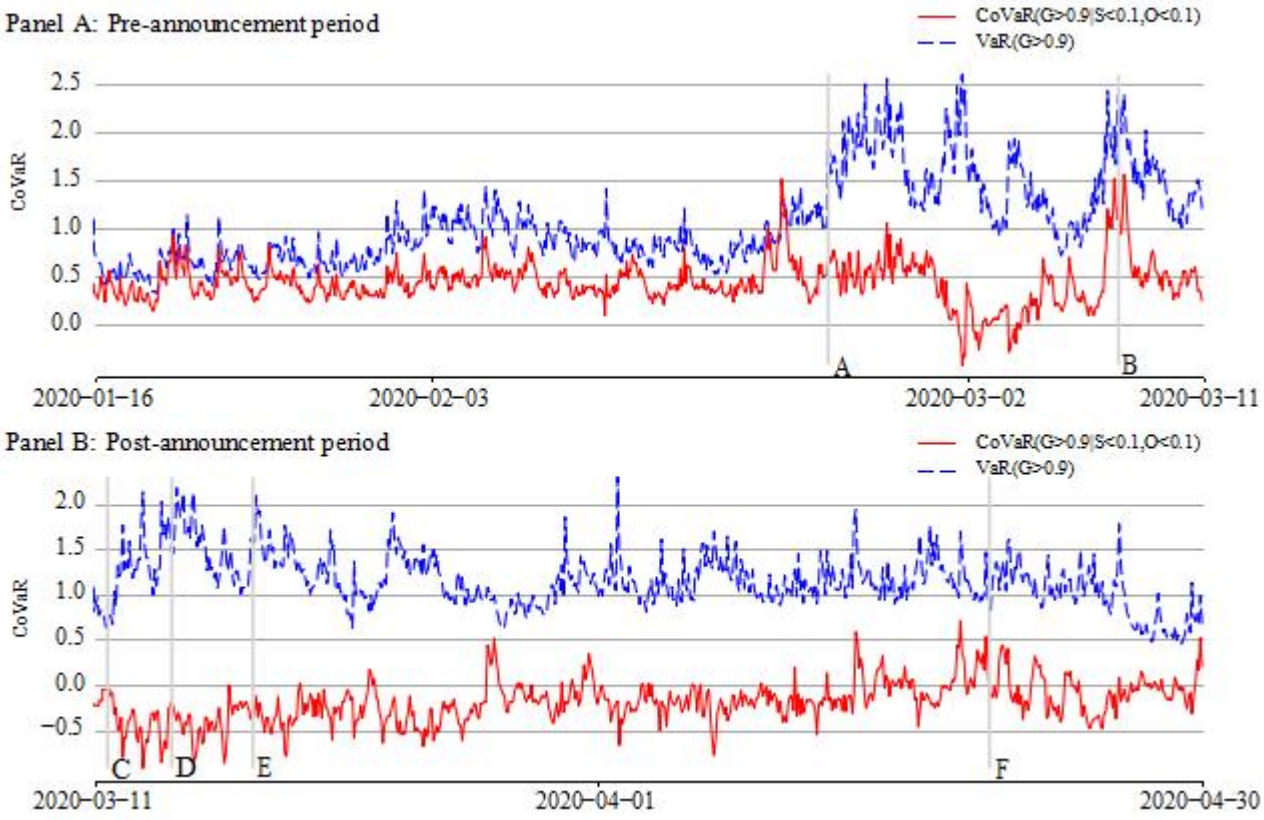


Figure 6: Time Plot of Downside VaR and Downside-to-Downside CoVaR for Gold Returns conditional on both Stock and Oil Market Distress

Note: This figure depicts the estimates of downside VaR and downside-to-downside CoVaR for gold returns, conditional on both the stock and oil markets being in distress across two subperiods. VaR(G<0.1) denotes the downside VaR for gold returns, while CoVaR(G<0.1|S<0.1, O<0.1) represents the downside-to-downside CoVaR for gold returns, conditional on both the stock and oil markets being in turmoil. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.

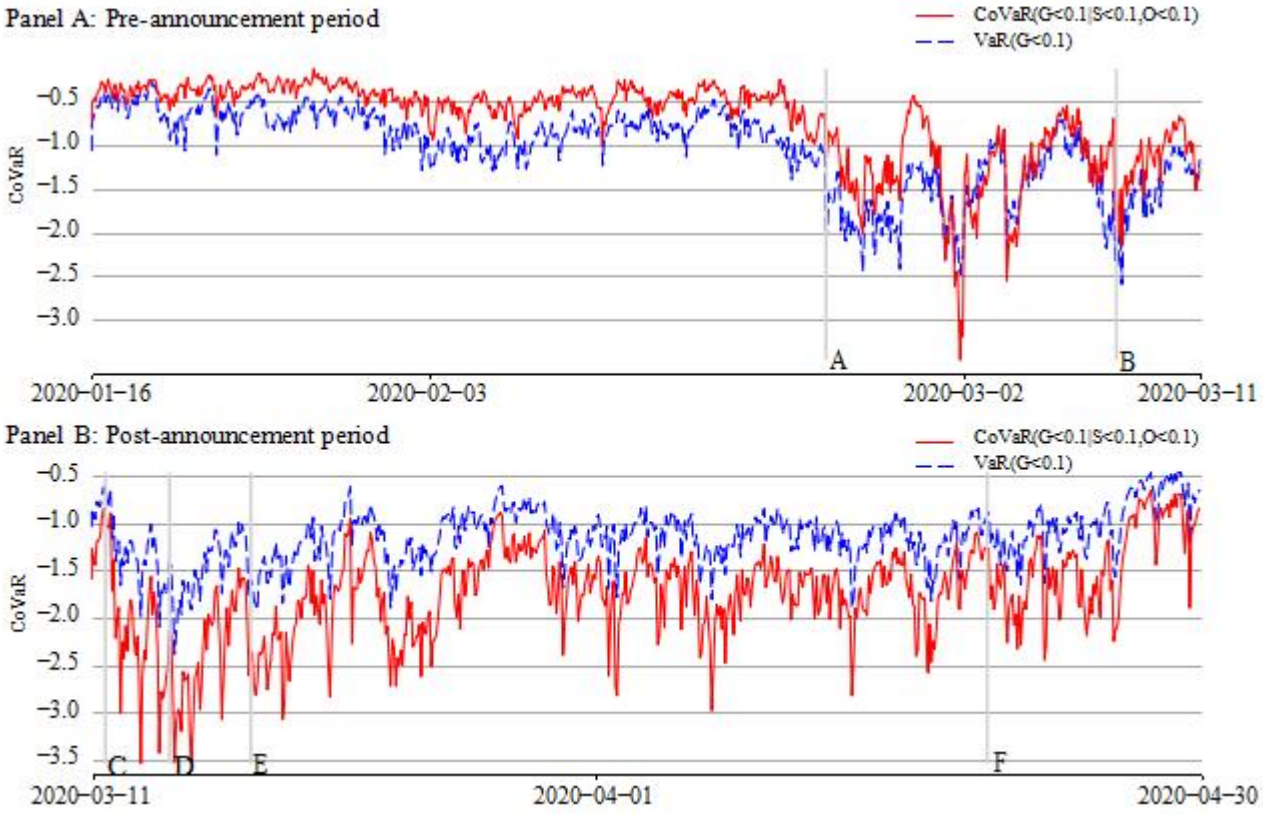
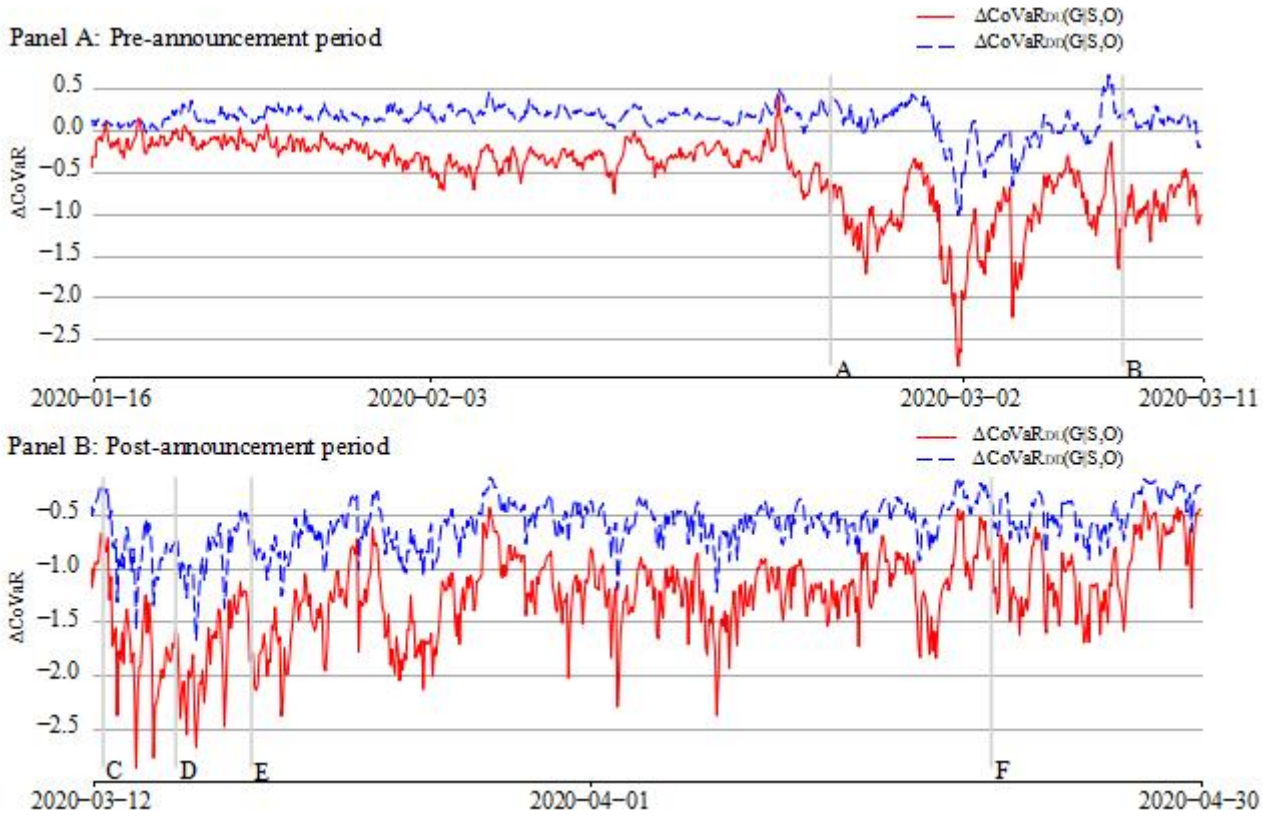


Figure 7: Time Plot of Downside-to-downside and Downside-to-upside ΔCoVaR for Gold Returns

Note: This figure depicts two measures $\Delta CoVaR^{G|S,O}_{DD}$ and $\Delta CoVaR^{G|S,O}_{DU}$, which are used to quantify contagion intensity and diversification intensity for the gold market. These measures are defined in Eq.(15) and (16), respectively. $\Delta CoVaR_{DD}(G|S, O)$ ($\Delta CoVaR_{DU}(G|S, O)$) calculates the difference between the downside (upside) VaR of gold returns conditional on the distress of the stock and oil markets and the downside (upside) VaR of gold returns conditional on the median state of the stock and oil markets. Label A represents the date on which global financial markets plunged on February 24, 2020 due to the COVID-19 panic. Label B represents the date on which the market-wide circuit breaker was triggered for the first time on March 9, 2020. Label C represents the date on which the market-wide circuit breaker was triggered for the second time on March 12, 2020. Label D represents the date on which the market-wide circuit breaker was triggered for the third time on March 16, 2020. Label E represents the date on which the market-wide circuit breaker was triggered for the fourth time on March 18, 2020. Label F represents the date on which WTI crude oil prices turned negative on April 20, 2020.



Appendix A. Variable Definitions

Table A.1: Variable Definitions and Data Sources

Variable	Definition	Original source
$\Delta CoVaR^{G|S,O}_{t+1}$	Contagion intensity in the gold market ($\Delta CoVaR^{G|S,O}_{DD,t+1}$) or diversification intensity in the gold market ($\Delta CoVaR^{G|S,O}_{DU,t+1}$)	Authors' computations
$FEAR_{pandemic}$	Logarithm of the *humanInfectiousDisease* index	TRMI data set
$OPTIM^{\perp}_{gold}$	The relative optimism on gold, orthogonal to panic-related investor fear, is defined as the residuals from regressing the relative gold optimism (the difference between the gold sentiment index and a weighted average of the stock and oil sentiment indices) on pandemic-related investor fear	TRMI data set
log(*Cases*)	Logarithm of the number (+1) of new confirmed COVID-19 cases	Guidotti (2022)
log(*Deaths*)	Logarithm of the number (+1) of new confirmed COVID-19 deaths	Guidotti (2022)
SWAP	Inflation swap spreads	Bloomberg
rDXY	Log changes of the dollar index	Bloomberg
TERM	Term spread, defined as the difference between the 10-year and three-month Treasury yields	Bloomberg
DEF	Default spread, defined as the difference between the Moody's BAA-rated corporate bond yield and the 10-year Treasury bond yield	Bloomberg
TED	TED spread, defined as the difference between the three-month London interbank offered rate (LIBOR) based on U.S. dollars and the three-month Treasury yield	Bloomberg
RV_{gold}	Realized volatility of the gold market	Authors' computations
RV_{oil}	Realized volatility of the oil market	Authors' computations
RV_{stock}	Realized volatility of the stock market	Authors' computations
ILLIQ	Illiquidity of the gold market	Authors' computations
Median state of the gold market	50*th* percentile of hourly gold returns	Authors' computations

Notes: This table reports the variable definitions and data sources used in the baseline regression (18).

Appendix B. Tests for Contagion, Safe-Haven, and Diversification Effects in a Two-Market Setup

To examine whether there exist contagion risks transmitted from asset i to asset j, we consider the null hypothesis of no contagion effects by equalizing the CDFs of downside-to-downside CoVaR and downside VaR as follows:

$$H_0 : CoVaR^{j|i}_{DD,\beta,t} = VaR^{j}_{\beta,t} \tag{B.1}$$

against the alternative hypothesis that the downside risk of asset j increases when market i is in distress,

$$H_1 : CoVaR^{j|i}_{DD,\beta,t} < VaR^{j}_{\beta,t} \tag{B.2}$$

where $VaR^{j}_{\beta,t}$ is the downside VaR for asset j for a confidence level $1-\beta$.

To test the null hypothesis in (B.1), we compare the empirical distribution functions of downside to-downside CoVaR and downside VaR using (10). If the null hypothesis is rejected in favor of the alternative hypothesis (B.2), we can conclude that contagion effects exist from asset i to asset j.

Second, to investigate whether asset j serves as a safe haven when asset i is in market turmoil, we test the null hypothesis of no safe haven effect by equalizing the CDFs of downside-to-upside CoVaR and upside VaR as follows:

$$H_0 : CoVaR^{j|i}_{DU,\beta,t} = VaR^{j}_{1-\beta,t} \tag{B.3}$$

against the alternative hypothesis that the upside potential of asset j increases when market i is in distress,

$$H_1 : CoVaR^{j|i}_{DU,\beta,t} > VaR^{j}_{1-\beta,t} \tag{B.4}$$

where $VaR^{j}_{1-\beta,t}$ is the upside VaR for asset j.

To test the null hypothesis in (B.3), we again use the KS bootstrapping test statistic defined in (10), by comparing the empirical distribution functions of $CoVaR^{j|i}_{DU,\beta,t}$ and $VaR^{j}_{1-\beta,t}$. If the null hypothesis is rejected in favor of the alternative hypothesis (B.4), we can conclude that asset j serves as a safe haven against extreme losses from asset i.

For diversification, we test the null hypothesis (B.1) against the alternative that the downside risk of asset j is reduced when markets i is in distress,

$$H_1 : CoVaR^{j|i}_{DD,\beta,t} > VaR^{j}_{\beta,t} \tag{B.5}$$

and the null hypothesis (B.3) against the alternative that the upside potential of asset j is reduced when market i is in distress,

$$H_1 : CoVaR^{j|i}_{DU,\beta,t} < VaR^{j}_{1-\beta,t} \tag{B.6}$$

When the null hypothesis (B.1) is rejected in favor of the alternative (B.5) or the null hypothesis (B.3) is rejected in favor of the alternative (B.6), we can conclude that a diversification effect exists.

Appendix C. Estimation Results of Conditional Joint Distribution Models

Due to the flexibility of dynamic copula modeling, we separately report the estimation results of marginal distributions of the three return series and their dependence structure.

C.1 Detection of the Structural Break

In this section, we clarify our rationale for selecting the pandemic announcement date as a breakpoint for our analysis. Asset correlations can experience structural changes during critical periods such as a global health crisis. Such shifts are pivotal as they can significantly affect the estimation of the copula function (Patton, 2012) which, in turn affects the precision of the CoVaR measures.

To initiate our analysis, we employ an ARMA(r, s)-component GARCH(p, q) model with a skew t distribution to fit the returns for the S&P 500 index, oil, and gold. The standardized residuals from this model are then transformed into uniformly distributed variables through their empirical cumulative distribution functions, resulting in the series $\hat{U}_{jt}$ for each of the three asset returns.

To identify potential breakpoints, we employ the sup test outlined by Patton (2012). This

test searches for the maximum discrepancy in rank correlation coefficients $\hat{\rho}$ within the interval $[\tau^*_{min}, \tau^*_{max}]$. Here, we set $\tau^*_{min} = \lceil 0.15T \rceil$, indicating the smallest integer greater than or equal to $0.15T$, and $\tau^*_{max} = \lfloor 0.85T \rfloor$, representing the largest integer smaller than or equal to $0.85T$, where T denotes the sample size. These parameters are set to ensure that the breakpoints are not positioned too close to the beginning or end of the sample period, thereby mitigating potential biases.

For a pair of asset returns, the sup test statistic ($\hat{Q}_{sup}$) is defined as:

$$\hat{Q}_{sup} = \max_{\tau \in [\tau^*_{min}, \tau^*_{max}]} |\hat{\rho}_{1,\tau} - \hat{\rho}_{2,\tau}|,$$

where $\hat{\rho}_{1,\tau}$ and $\hat{\rho}_{2,\tau}$ represent the estimated rank correlations before and after the potential breakpoint τ:

$$\hat{\rho}_{1,\tau} \equiv \frac{12}{\tau} \sum_{t=1}^{\tau} \hat{U}_{1t}\hat{U}_{2t} - 3$$

$$\hat{\rho}_{2,\tau} \equiv \frac{12}{T-\tau} \sum_{t=\tau+1} \hat{U}_{1t}\hat{U}_{2t} - 3,$$

The critical value for $\hat{Q}_{sup}$ is determined through an *i.i.d.* bootstrap procedure with 1000 replications.

Our results strongly reject the null hypothesis of no structure break for both gold-stock and gold-oil returns, with a *p*-value of 0.000. Notably, the breakpoint is identified on March 11, 2020, at 23:55, where the rank correlation coefficients exhibit the maximum discrepancy before and after this point among all candidate breakpoints. In contrast, when examining the stock-oil returns, we cannot reject the null hypothesis of no breakpoint (*p*-value: 0.1217).

C.2 Models for the Marginal Distributions

The intraday patterns in the high-frequency returns might severely distort the estimation of traditional volatility models. Following Andersen et al. (2003) and Weiß and Supper (2013), we first deseasonalize the raw high-frequency data. We assume the deseasonalized returns are character-

ized by a flexible ARMA(r, s)-component GARCH(p, q)-skew t structure, where $1 \leq r, s \leq 5$, $1 \leq p, q \leq 2$. The component GARCH models proposed by Engle and Lee (1999) incorporate the long-memory features into a short-memory model and are suitable to fit the high-frequency data.

For simplicity, we present only the optimal ARMA and GARCH orders selected by the AIC criterion in Table C.1. The estimation results for the marginal distributions of individual return series are available upon request. Several goodness-of-fit tests are applied to evaluate whether the marginal distributions are correctly specified. The Ljung-Box Q test fails to reject the null hypothesis of no serial correlation in the standardized residuals. The ARCH LM test fails to reject the null hypothesis of no ARCH effects in the standardized residuals. In addition, both the Anderson-Darling (AD) and the Cramer-von Mises (CvM) tests fail to reject the null hypothesis of uniformity of the probability integral transformation of the standardized residuals, supporting the adequacy of the skew t distributions.

Table C.1: Estimation Results for Marginal Distribution Models

Note: This table presents estimation results for marginal distribution models. The sample period is divided into two subperiods: the pre-announcement period (January 16 to March 11) and the post-announcement period (March 12 to April 30). We report the optimal ARMA and GARCH orders for the marginal distributions selected by the AIC. Ljung-Box denotes the Ljung-Box test statistic with corresponding p values (in square brackets) to test for serial correlation in the standardized residuals of GARCH-skew t models, computed using 20 lags. ARCH-LM denotes Engle's LM test statistic with p values (in square brackets) to test for the presence of ARCH effects in the standardized residuals of GARCH-skew t models, computed using 20 lags. A-D and CvM denote the Anderson-Darling and Cramér-von Mises tests to test for the null hypothesis of uniformity of the probability integral transform series, respectively. P values (in square brackets) less than 0.05 indicate the rejection of the null hypotheses.

	Pre-announcement period			Post-announcement period		
	Stock	Gold	Oil	Stock	Gold	Oil
ARMA Order	(5,4)	(4,3)	(2,5)	(3,2)	(2,3)	(5,5)
GARCH Order	(2,2)	(1,2)	(1,1)	(1,1)	(1,1)	(2,1)
Ljung-Box	2.279	4.152	6.491	0.002	10.468	10.865
	[0.96]	[0.77]	[0.44]	[1.00]	[0.10]	[0.09]
ARCH-LM	0.001	12.217	5.018	0.001	3.361	9.498
	[1.00]	[0.05]	[0.64]	[1.00]	[0.86]	[0.15]
A-D	[0.25]	[0.11]	[0.21]	[0.49]	[0.51]	[0.56]
CvM	[0.20]	[0.32]	[0.46]	[0.11]	[0.28]	[0.27]

C.3 Results of the Vine Copula Models

We next analyze the dependence structure among filtered S&P 500 returns, oil returns, and gold returns in two subperiods. To determine the root node of the first tree of the C-vine copula, we use the vine structure selection criterion proposed by Czado et al. (2012), which identifies the S&P 500 as the root node in both subperiods. This suggests that the S&P 500 has the strongest overall pairwise dependencies with the other two assets. Given the vine tree structure, we then estimate each pair of constant copulas from six commonly used bivariate copula families: the normal, Student's *t*, Frank, Clayton, Gumbel and SJC copulas. The normal and Frank copulas are used to model the tail independence, the Student's *t* copula to model the symmetric tail dependence, the Clayton and Gumbel copulas to capture asymmetric tail dependence, and the SJC copula to model both symmetric and asymmetric tail dependence. To accommodate possible negative dependence between asset returns, we also consider the 90° rotated versions of the Clayton, Gumbel and SJC copulas, denoted by R-Clayton, R-Gumbel and R-SJC, respectively. The best-fitting pair-copulas are selected according to the AIC criterion.

Table C.2 presents the selected pair-copula families in the constant vine copula structure for both the pre- and post-announcement periods. The table includes the maximum likelihood estimates of copula parameters with their asymptotic standard errors shown in parentheses. All the parameters are significant at the 1% level. For the pair of gold and stock returns, Student's *t* copula is chosen as the best-fitting copula in both subperiods. The correlation coefficient of the Student's *t* copula is negative in the pre-announcement period, but positive in the post-announcement period. For the pair of gold and oil returns, Student's *t* copula with a negative correlation coefficient is selected as the best-fitting copula in the pre-announcement period, while the Gumbel copula is chosen in the post-announcement periods. For the conditional copula of gold and oil returns given stock returns, the 90° rotated Clayton copula and Gumbel copula are selected as the best-fitting copulas in the pre- and post-announcement periods, respectively. These results suggest that gold played a different role in the two subperiods. Before the announcement, gold served as a safe haven against extreme losses in the stock or oil market. However, after the announcement, gold prices fell along with stock or oil prices.

Table C.3 presents the selected pair-copula families in the GAS-based vine copula structure

Table C.2: Fitted Pair Copulas for the Constant Vine Copula Model

Note: The table presents the selected pair copula families, their parameter estimates (par1 and par2), with asymptotic standard errors in parentheses, and AIC values of the constant vine copula models for five-minute stock, oil and gold returns, denoted by S, O, and G respectively. The sample period is split into two subperiods: the pre-announcement period (January16 to March 11) and the post-announcement period (March 12 to April 30). The AIC is employed for the pair copula selection. *** indicates rejection of null hypothesis at the 1% level.

	C(O, S)	C(G, S)	C(G, O)	C(O, G|S)
Panel A: Pre-announcement period				
Family	Student's *t*	Student's *t*	Student's *t*	R-Clayton
par1	0.449***	−0.467***	−0.263***	−0.098***
	(0.010)	(0.010)	(0.011)	(0.017)
par2	10.000***	10.000***	10.000***	
	(0.911)	(0.840)	(0.832)	
AIC	−1651.099	−1821.483	−500.718	−37.773
Panel B: Post-announcement period				
Family	Frank	Student's *t*	Gumbel	Gumbel
par1	2.467***	0.160***	1.067***	1.029***
	(0.092)	(0.014)	(0.010)	(0.010)
par2		10.000***		
		(0.751)		
AIC	−793.725	−85.636	−52.329	−9.316

along with their parameter estimates. We follow Almeida et al. (2016) and do not provide the asymptotic standard errors of the parameter estimates for the GAS vine copula models due to computational constraints. Our results show that, for all return pairs, the GAS dynamic copula models outperform their static counterparts. The parameter estimate β indicates that the dependence parameters in the time-varying copula models are highly persistent. Surprisingly, the GAS Gaussian copula and GAS Frank copula are selected as the best-fitting copulas for three out of six pairs. This result is consistent with the findings of Hafner and Manner (2012), who also report similar results. This could be attributed to the fact the Gaussian and Frank copulas with time-varying dependence parameters exhibit stronger tail dependence than their static counterparts, as previously noted by Almeida et al. (2016).

Table C.3: Fitted Pair Copulas for the GAS-Vine Copula Model

Note: The table presents the selected pair copula families, their parameter estimates, and AIC values of the GAS vine copula models for five-minute stock, gold and oil returns, denoted by S, G and O, respectively. Following Almeida et al. (2016), we do not report the asymptotic standard errors of the parameter estimates for the GAS vine copula models. The AIC is employed for the pair copula selection. The sample period is split into two subperiods: the pre-announcement period (January16 to March 11) and the post-announcement period (March 12 to April 30).

Pair	Family	Parameters				AIC
		ω	α	β	θ^{-1}	
Panel A: Pre-announcement period						
C(O, S)	GAS Gaussian	0.004	0.031	0.995		−1885.133
C(G, S)	GAS Student's *t*	−0.006	0.027	0.994	0.052	−1999.550
C(G, O)	GAS Student's *t*	−0.002	0.015	0.995	0.042	−599.413
C(O, G|S)	GAS R-Clayton	−0.008	0.025	0.997		−44.783
Panel B: Post-announcement period						
C(O, S)	GAS Frank	0.042	0.142	0.981		−892.929
C(G, S)	GAS Student's *t*	0.008	0.028	0.972	0.030	−165.133
C(G, O)	GAS Student's *t*	0.035	0.056	0.817	0.021	−71.010
C(O, G|S)	GAS Gaussian	0.025	0.050	0.704		−14.064

Call for Papers

International Monetary Review

International Monetary Review is an internal academic magazine sponsored by International Monetary Institute. Following the principle of including both Chinese and western merits with precise and practical academic spirit, International Monetary Review focuses on the cutting-edge theoretical researches in internationalization of RMB, reform of international monetary system, regional monetary and financial cooperation, China's international financial strategies, and other macro-financial theories and policies.
We welcome submissions by scholars, experts and practitioners in financial industry. Papers and articles should center on key financial issues and follow academic standard and scientific methodology. We welcome quality articles based on data analysis and theoretical model and other insightful articles with standard writing.

Prepare your article

General rule: Submitted manuscripts should be double-spaced texts in 10.5 point font, and formatted for paper of standard size with margins of at least 20mm on all sides. Pages should be numbered, and an abstract (of no more than 200 words), as well as keywords and complete author affiliations, should be included in the paper in the title page. A regular article should not exceed 50 pages.
Mathematics: Equations must be identified by consecutive Arabic numbers in parentheses on the right. Expressions should be aligned and compound subscripts and superscripts clearly marked if there is any potential for confusion.
Figures: Figures must be of professional quality and ready for reproduction. They should be numbered consecutively. Black-and-white versions of figures are required for printing purposes, but color figures can also be supplied for online dissemination.
Tables: Tables should be numbered consecutively throughout the article. Each table must include a descriptive title and headings to columns. Gather general footnotes to tables as "Note:" or "Notes:", and use a, b, c, etc., for specific footnotes. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively, if used.

Reference style

Please follow the EPS Style Guide when preparing your article.
http://eps.ruc.edu.cn/UserFiles/File/EPS%20Style%20Guide.pdf

Further considerations

- Manuscript has been spell-checked and grammar-checked
- References are in the correct format for this journal
- All references mentioned in the reference list are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources

Submit your article

Manuscripts can be submitted via e-mail to imi@ruc.edu.cn


INTERNATIONAL MONETARY INSTITUTE OF RUC
中国人民大学国际货币研究所