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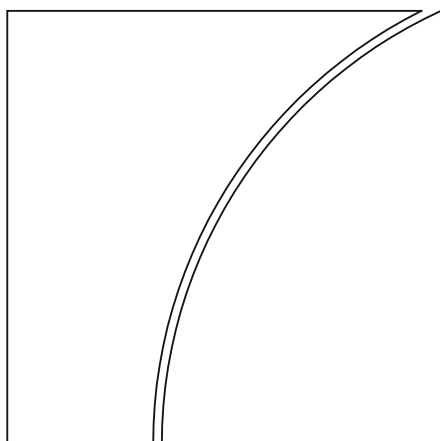
by Boris Hofmann, Xiaorui Tang and Feng Zhu

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Central Bank and Media Sentiment on Central Bank Digital Currency:
An International Perspective[1]

Boris Hofmann[2]

Bank for International Settlements

Basel, Switzerland

Xiaorui Tang[3]

Hong Kong University of Science and Technology,

Clear Water Bay, Kowloon, Hong Kong SAR

Feng Zhu[4]

CICC Global Institute,

Hong Kong SAR

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[2] boris.hofmann@bis.org
[3] xiaorui.tang@connect.ust.hk
[4] feng3.zhu@cicc.com.cn

Abstract:

This paper examines the sentiments of central banks and the media regarding central bank digital currencies across 15 major global economies. Leveraging large language models, we develop jurisdiction-level central bank digital currency sentiment indices derived from central bank publications and news articles on a daily basis. Our findings reveal significant divergences between central bank and media sentiments, with notable variations over time and across jurisdictions. Analyzing the interplay between these sentiments, we observe that central bank sentiment tends to exert a stronger influence on media sentiment than the reverse. Additionally, we identify substantial cross-border sentiment spillovers, where sentiment in leading economies shapes sentiment in other regions. Through an event study approach, we demonstrate that cryptocurrency and equity markets primarily respond to shifts in central bank sentiments. Specifically, more positive central bank sentiments on central bank digital currency are associated with negative impacts on cryptocurrency market returns and the stock performance of banking and payment-related firms.

Keywords: Central bank digital currency (CBDC); central bank communication; media sentiment; large language model (LLM); financial market.

JEL Codes: E58, G12, G18.

1. Introduction

Central Bank Digital Currency (CBDC), the digital representation of central bank money, has emerged as a pivotal focus for central banks in recent years, driven by rapid digital innovation within financial systems (BIS, 2021, 2022, 2023). Numerous central banks are actively exploring CBDCs, with some advancing to more developed stages of their implementation.[1] This growing interest is evident in the increasing volume of central bank publications and media coverage on the subject (Figure 1).

[Insert Figure 1 here]

Despite its importance, the interplay between central bank and media sentiments on the issue remains underexplored albeit media commonly plays a key role in shaping public perceptions (e.g., Entman, 1989).[2] This paper aims to fill this gap by studying central bank and media sentiments on CBDC across a group of 15 economies, applying large language models to central bank and media publications. Additionally, we use topic modeling to uncover dominant themes in their communications, such as financial inclusion and financial stability. Our analysis focuses on five key questions: (1) Do central bank and media sentiments and topics align or differ? (2) Who plays a leading role in shaping views—central banks or the media? (3) Are there global spillovers in sentiments across jurisdictions? (4) Do central bank and media sentiments predict the progress of CBDC projects? (5) How do these sentiments influence financial markets?

Our key findings are as follows. First, there are notable divergences in sentiment and focus between central banks and the media. While media generally express more positive views and emphasize technological and crypto-related aspects, central banks focus more on payment system implications. Second, central bank and media sentiments influence each other, with central bank sentiment having a stronger effect on future media sentiment than the reverse. Third, the sentiments of leading central banks—such as the Federal Reserve, European Central Bank (ECB), and People's Bank of China (PBoC)—exert significant spillover effects on the

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[1] According to the Central Bank Digital Currency Tracker by Atlantic Council, as of June 2023, 130 jurisdictions are exploring a CBDC, representing 98 percent of global GDP. A number of wholesale CBDC pilots are under way, often involving several central banks in different jurisdictions. As of March 2024, there are four live retail CBDCs, retail pilots in 24 jurisdictions and wholesale pilots in 23 jurisdictions (Auer et al., 2020).

[2] Some central banks have made explicit efforts to collect information on public opinions on CBDCs. For instance, European Central Bank (2021) and Deutsche Bundesbank (2021) have conducted surveys on public views on CBDC.

sentiments of other central banks and media globally. Fourth, a central bank's sentiment serves as a strong predictor of its near-term progress on CBDC projects. Finally, positive central bank sentiment has a negative impact on cryptocurrency returns and the stock prices of banking and payment-related firms. For China we find that positive central bank sentiment has negative effects on leading third-party payment companies' stock returns but positive effects on those of banks, reflecting the particular effect central bank digital currency would have on the Chinese local structure of digital payments.

This paper contributes to two key strands of literature. First, it adds to the growing body of research on the economics of CBDCs. Auer et al. (2020) show that jurisdiction-level progress is positively linked to factors such as digital infrastructure, innovation capacity, financial development, financial inclusion, and public interest. Cong and Mayer (2022), from a currency competition perspective, highlight the influence of first-mover advantage, dollarization, and cryptocurrency growth on policy decisions. Regarding the economic implications, theoretical studies have examined the potential effects on payment and deposit competition, financial stability, and social welfare (e.g., Andolfatto, 2021; Fernández-Villaverde et al., 2021; Kim and Kwon, 2022; Chiu et al., 2023; Keister and Sanches, 2023). Empirically, Burlon et al. (2022) find that major Digital Euro announcements affect Euro Area bank stock prices and loan volumes. Our contribution lies in developing and analyzing jurisdiction-level indices of central bank and media CBDC sentiments and topic exposure using high-frequency data. Additionally, we explore the impact of sentiments on cryptocurrencies and stock markets, particularly in jurisdictions where third-party digital payments play a significant role.[1]

Second, this paper contributes to the growing literature on central bank communication,[2] particularly in the newly emerging literature on sentiment in central bank communications based on natural language processing (e.g. Hansen and McMahon 2016; Hansen et al., 2018;

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[1] As such, this paper is also loosely related to the literature on the valuation of cryptocurrencies, showing that changes in CBDC negatively impact cryptocurrency returns. This literature explores cryptocurrency price dynamics from theoretical perspectives, featuring the network effect of adoption, production costs and fiat currencies. See Liu and Tsyvinski (2020) and Corbet et al. (2018) for a review of relevant papers. Theoretically, Schilling and Uhlig (2019) and Benigno et al. (2022) analyze the interaction between cryptocurrency prices and monetary policy. On the empirical side, Liu and Tsyvinski (2020) examine the cryptocurrency return predictability of a large set of factors, finding that cryptocurrency returns are strongly affected by user adoption, momentum, and investor attention. Auer and Claessens (2018) find that cryptocurrency regulations impact cryptocurrency price, volume, and user base.

[2] A large literature documents that central bank communication impacts inflation expectations, asset prices and public understanding of economic concepts, and therefore helps achieve monetary policy objectives (e.g. Blinder et al., 2008; Blinder et al., 2022; Dräger et al. 2016).

Ehrmann and Talmi, 2020; Gorodnichenko et al., 2023; Pfeifer and Marohl, 2023).[1] We extend this literature to the area of CBDC sentiments. Our analysis stresses the special role of media communication on central bank policies. Berger et al. (2011), Rybinski (2019), and Picault et al. (2022) provide evidence that the media reporting related to central bank policy decisions is highly responsive to central bank communication but still contains idiosyncratic information that could affect market expectations. Lee (2014) and Hayo and Neuenkirch (2015) find that news media play an intermediation role between the government and the public, while the direct interaction between the government and the public is less significant. Our study enriches this literature by analyzing the interrelation and interactions of media and central bank sentiment on CBDC.

The remainder of the paper is structured as follows. The next section discusses data sources and sample construction. Section 3 introduces the natural language processing methodology that we adopt to construct sentiment measures and presents descriptive results on the distribution of sentiments over time and across jurisdictions. Section 4 examines the interaction between media and central bank sentiment. Section 5 analyzes cross-border spillovers of sentiments, while Section 6 focuses on the link between our sentiment measures and CBDC projects. Section 7 estimates the financial market impacts of central bank and media sentiments. Section 8 concludes.

2. Data

We collect central bank publications and news articles related to CBDC from January 2016 to June 2022. We focus on 15 economies: United States, Euro Area (including the ECB and the largest member jurisdictions Germany, France, Italy, Spain), China, Hong Kong SAR, United Kingdom, Switzerland, Japan, Canada, Australia, South Korea, Singapore, India, Thailand, Mexico, and Brazil.[2] Table A2 provides the data sources and searching strategy for the central bank publications.

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[1] This literature exploits computational linguistic techniques to analyze monetary policy statements, minutes, transcripts and central banker speeches. Classical rule-based or unsupervised methods were used to quantify the sentiment, policy stance, or topics from central bank documents (Hansen and McMahon 2016; Hansen et al., 2018; Ehrmann and Talmi, 2020), while recent work exploits pretrained deep learning models to improve the classification performance (Gorodnichenko et al., 2023; Pfeifer and Marohl, 2023).

[2] There are very few news articles discussing CBDCs before 2016, so we select 2016 as the start year.

For central bank publications, the sample consists of speeches and other official documents, which are put together in two steps. First, we collect speeches with keywords related to CBDC for 46 jurisdictions from the BIS central bankers' speeches database[1] (Auer et al., 2020) and keep the 202 speeches that come from our sample economies. Second, we perform a comprehensive search for CBDC-related keywords on central bank official websites in both English and the native languages, using built-in search functions of each website to perform the search and then Google Translate to translate non-English articles into English.[2] Table A1 provides the specific sources and search terms we use to collect central bank textual data from central bank websites.

We manually classify the web pages by content type, keeping speeches, news/press releases, conference transcripts, central bank annual/monthly reports, project reports, and blogs. We drop academic papers, staff working papers, technical reports (except for project reports), workshops/slides/presentations, public comments, and irrelevant web pages (program/agenda/schedule/calendar, glossary, bibliography, author profile, recruitment, etc).[3]

To construct the media sample, we search for "((CBDC or Central Bank Digital Currency) or [project name]) and ([jurisdiction name])" in Dow Jones Factiva and collect the raw texts of the articles.[4] We perform the search in both English and major native languages of a jurisdiction and then translate non-English articles to English. We exclude news digests, press releases, securities filings and articles from official government sources, and remove duplicated or empty articles.

One concern is that some articles refer to multiple jurisdictions, with some mentioned jurisdictions not appearing in the passages referring to CBDCs. To tackle this problem, we remove articles that meet all of the following conditions: (1) multiple jurisdictions appear in

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[1] www.bis.org/cbspeeches/.

[2] For native language searches, we use Google Translate to translate our English search terms into the native language. For instance, for Germany, search for the following keywords on https://www.bundesbank.de/: CBDC, Central Bank Digital Currency, digital euro, Digitale Währung der Zentralbank, and digitaler Euro. Considering variation in the quality of built-in search engine across jurisdictions, we perform sanity checks and remove web pages where (1) no CBDC-related terms exist in the main content, (2) no publication dates are clearly specified, or (3) the publication date is not in our sample period. For China, we perform searches for PBoC publications on the government official website (https://www.gov.cn/) rather than PBoC website (http://www.pbc.gov.cn/english/), since the search function did not work on the English website of PBoC at the time of access.

[3] We also drop the speeches that were added to the sample in the first step in order to avoid double counting.

[4] Factiva is an integrated news database that combines over 32,000 sources from 200 countries/regions in 28 languages. For instance, we search for "((CBDC or Central Bank Digital Currency) or Digital euro or Project Stella) and (Euro Area or Euro Zone or ECB or European Union or EU)" for Euro Area.

the article, (2) CBDC-related terms do not appear in the title, and (3) CBDC-related terms and jurisdiction names do not appear in the same paragraphs. If multiple jurisdictions are mentioned, for each mentioned jurisdiction, we only keep paragraphs which contain both CBDC-related terms and the jurisdiction name.[1]

Another concern is that media articles may just report what central banks published without revealing their own views. To mitigate this concern, we follow Picault et al. (2022) by removing those parts of an article that directly disseminates central bank communications from the media sample. Specifically, we use part-of-speech (POS) tagging and dependency parsing (DP) to identify the subject of each sentence and remove all sentences when the subject is a central bank or a speaker in the BIS central banker speech database.[2] We check how this adjustment affects media sentiment scores in Section 3.1.

We further drop central bank publications and media articles with very short CBDC-related paragraphs (less than 40 words). Our final central bank publication sample includes 1,243 distinct publications, and the media sample includes 28,831 distinct news articles. Figure 2 shows that attention to CBDC exhibits considerable cross-jurisdiction heterogeneity, with the largest media coverage in China, the Euro Area and the United States. By far the largest number of CBDC-related central bank publications are in the Euro Area.

[Insert Figure 2 here]

3. Measuring central bank digital currency sentiment and topics

We extract CBDC views from central bank publications and news articles by constructing two sets of measures – sentiment scores and topics.

3.1 CBDC sentiment

The sentiment measure aims to capture to what extent the views expressed in a publication about CBDC is positive or negative. We use large language models (LLMs) to build a CBDC-sentiment classifier.[3] We randomly sample 3,000 sentences that contain CBDC-related terms

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[1] Jurisdiction names also include central bank names and abbreviations.
[2] We also remove sentences where the subject is a pronoun and the previous sentence's subject is a central bank or central bank official.
[3] A widely adopted measure is a count-based approach that calculates the proportion of positive/negative words in each article with an equal weighting or a TF-IDF (Term Frequency-Inverse Document Frequency) weighting, where the positive/negative

and CBDC project names,[1] manually label their CBDC-specific sentiment as positive / negative / neutral and fine-tune a set of pre-trained language models with the labelled dataset. A sentence is labelled as positive if it discusses the advantages of CBDCs, a central bank's intention to issue a CBDC, or the progress of CBDC projects; negative if it discusses the risks or disadvantages of CBDCs, or suggests no necessity or specific plans of a central bank to issue a CBDC; neutral for other cases, including sentences that mention equally on positive and negative sides of CBDCs. Table A3 presents examples of sentences that are labelled as positive/negative/neutral.

We follow the fine-tuning strategy of Shah et al. (2023) and perform experiments on a set of open-source LLMs, including BERT (Devlin et al., 2018), RoBERTa (Liu et al., 2019), GPT-2 (Radford et al., 2019), Mistral-7B (Jiang et al., 2023) and Llama-3 (Meta, 2024). With the best-performing model for our classification task – RoBERTa-Large (Liu et al., 2019), we build a CBDC-sentiment classifier with a 95.8% in-sample accuracy and 80.2% out-of-sample accuracy, which is close to the state-of-the-art performances of central bank text classification tasks in the literature (Gorodnichenko et al., 2023; Pfeifer and Marohl, 2023; Shah et al., 2023; Hansen and Kazinnik, 2024).[2] We apply this classifier to all sentences with CBDC-related terms and CBDC project names in our sample, and classify each sentence into the class with the highest probability (positive/negative/neutral). We then aggregate the sentence-level classifications to create a document-level measure as follows (similar to Gorodnichenko et al. (2023) and Shah et al. (2023)):

$$sent = \frac{\#positive - \#negative}{\#CBDC\_related}, \tag{1}$$

words are defined by Harvard IV-4 or Loughran and McDonald (2011) dictionaries (the Harvard IV-4 positive/negative word list is a general sentiment dictionary, while the Loughran and McDonald (2011) dictionary is developed specifically for financial texts). The drawback is that this approach cannot differentiate sentiment on CBDC and sentiment on other topics, which makes the measure imprecise especially when only a part of the article is related to CBDC. An improved option is to count the number of positive/negative words that appear within a certain number of words around a central term of focus (Hassan et al., 2019). This approach could better distinguish the agent which the positive/negative words are addressing, but still fails to consider the syntactical structure of texts and could generate considerable false positives. The recent technical advancement of large language models (LLMs) provides a remedy that takes account of context.

[1] To identify sentences with CBDC-related terms, we include sentences with central bank digital currency (CBDC), digital central bank money, digital fiat currency/money, or digital base money (dbm), as well as sentences that include at least one digital currency related term (in set (1)) as well as a modifier from set (2): (1) e-money, digital currency/cash/money, electronic currency/cash/money; (2) official, national, government, sovereign, legal, public, trial. See Table A3 for the list of CBDC project names.

[2] See Table A4 for the experiment results of the best performing model of each LLM. The highest out-of-sample accuracy / F1-score of the classification tasks in Gorodnichenko et al. (2023), Shah et al. (2023), Pfeifer and Marohl (2023) and Hansen and Kazinnik (2024) are 0.84 (3 classes), 0.71 (3 classes), 0.88 (2 classes), 0.61 (5 classes), respectively.

where *#positive* (*#negative*) is the number of positive (negative) CBDC-related sentences, and $\#CBDC\_related$ is the total number of CBDC-related sentences in a document. The CBDC sentiment score ranges from -1 to 1, where 1 corresponds to a positive sentiment on CBDC. With this approach, we calculate time series of jurisdiction-level central bank and media CBDC sentiment scores as well as global aggregates based on simple averages across jurisdictions.

Furthermore, in addition to the overall CBDC sentiment scores, we also calculate scores for wholesale and retail CBDC separately.[1] For the latter, we ignore those ambiguous CBDC-related terms,[2] and focus only on the unambiguous retail/wholesale projects and CBDC-related terms that appear along with the word "retail" or "wholesale" in the same sentence. Table 1 reports descriptive statistics on the different sentiment measures we construct.

[Insert Table 1 here]

Our sentiment measures reveal considerable differences over time in central bank and media sentiments on CBDC as well as notable differences in sentiments across jurisdictions and regions. Figure 3 plots the four-quarter moving averages of the global central bank and media CBDC sentiment measures (left panel) as well as the difference between the two sentiment scores as a direct measure of sentiment divergence (right panel).[3] The figure shows a large positive gap between media and central bank sentiment before 2018Q4 and after 2020Q1. The exception in 2019 was driven by a sharp improvement in central bank CBDC sentiment since the beginning of year. The gap widened again when media sentiment started to rise rapidly since mid-2019. The announcement of Libra, a cryptocurrency project launched by Facebook in June 2019, indicated by the vertical line, appears to have been a key event that boosted the CBDC sentiments of both central banks and media.[4]

[Insert Figure 3 here]

To validate our sentiment measure, we compare our sentiment score with the central bank speech stance measure by Auer et al. (2020) for the same central bank speech sample, which is

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[1] While a wholesale CBDC is a digital means of payment for wholesale payments and settlements of financial institutions, retail CBDC is a digital means of payment for the general public for retail payments.

[2] Our approach above requires the identification of retail/wholesale CBDC-related texts. However, authors may refer to CBDCs in general and do not explicitly state retail or wholesale in many circumstances.

[3] Figure A1 provides the distribution of article level CBDC sentiment of news articles and of central bank publications.

[4] Our findings on media sentiment are not crucially driven by our modelling choices, specifically the purging of articles that appear to just report central bank views, as described in the previous section. Figure A4 compares the quarterly mean media sentiment scores before and after dropping paragraphs that are just disseminating central bank views, showing that they are following similar trends.

based on manual labelling by researchers.[1] Figure A2 suggests that these two measures follow a very similar trend. As shown in Figure A3, while the distributions of speech-level sentiment scores are consistent with the *speech_stance* of Auer et al. (2020), our sentiment measure has larger variation among sample speeches, which might describe more nuanced sentiment differences among documents.

Our analysis also points to important differences in sentiment on wholesale and retail CBDC for both media and central banks (Figure 4). While there appears to be a rather stable positive view on wholesale CBDCs, there is considerable variation in retail CBDC sentiment driving the time-series variations in the overall CBDC sentiment scores. For retail CBDC, central bank sentiment is less positive compared to media most of the time, but the gap has narrowed since 2021. Figure A5 further suggests that the increase in advanced economies' (AEs) sentiments is mainly driven by wholesale CBDC sentiment, while in emerging market economies' (EMEs) sentiments retail CBDC sentiment plays a more important role. Before 2018Q4, EMEs held mostly negative views on retail CBDCs. However, after 2019, retail CBDC sentiment of EMEs rose, while the stance of AEs stayed neutral.

[Insert Figure 4 here]

The global trends in central bank and media sentiments conceal considerable heterogeneity across jurisdictions. Figure 5, left-hand panel, plots the average levels of the CBDC sentiments of central banks and media over the sample period at the jurisdiction level. The chart reveals that central bank sentiments were more dispersed than media sentiments. This is confirmed by the interquartile range of the global sentiment measures, as shown in Figure 5, right-hand panel, which tends to be larger for central bank sentiments than for media sentiments, except in 2019 when central bank sentiments started to trend up. The chart further suggests that dispersion of sentiments across jurisdictions peaked in 2017, dropping significantly since then.

[Insert Figure 5 Here]

Figure 5, left-hand panel, further suggests that there was a systematic regional pattern in the in evolving CBDC sentiments. Specifically, central banks of EMEs, especially Asian EMEs, displayed more positive CBDC sentiments. For central banks with less positive CBDC

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[1] Auer et al. (2020) had 287 speeches in their sample. In our case, we have a larger number of articles, making manual labeling all articles not feasible.

sentiments, the media-central bank sentiment gap tended to be larger.

3.2 CBDC topics

To identify the specific considerations or concerns by central banks and media related to CBDC, we adopt a topic modelling approach. We follow approach of Hanley and Hoberg (2019) and Li et al. (2021) in using two analytical steps: Latent Dirichlet Allocation (LDA; Blei, Ng, and Jordan, 2013) and word embedding (Mikolov et al., 2013). LDA extracts a list of topics and topic exposures of each article by modelling articles as drawn from an underlying probability distribution over topics. Since the topics generated by LDA are not directly interpretable, we utilize word embedding in the second step.

Specifically, we first examine the LDA topics and create a list of topic tokens relevant to the motivations of or concerns with CBDC adoption. We append the list with other relevant topic tokens summarized from the literature. Next, we train a word embedding model (Google word2vec[1]) with our CBDC-related corpus to map each topic token to a vocabulary that appear in similar contexts. We use the vocabulary vector to represent each interpretable topic and generate a dictionary containing the top 100 most relevant terms for each topic (including the seed term). After obtaining the topic vectors, we double check and make sure that the topics are not highly correlated with one another (as shown in Figure A6) and manually examine the list of terms associated with each topic and drop those unrelated terms. Table A5 displays the list of topics as well as the top 10 relevant terms associated with each topic.

Finally, to obtain the topic exposure of each document, we calculate the count of terms in the topic dictionary divided by the total number of terms in CBDC-related paragraphs to measure the exposure to each topic.

Our findings suggest that central banks and the public focus on rather different aspects of CBDC, as reflected by the different distribution of frequent words in CBDC-related media articles and central bank publications (see Figure 6 Panel A). Figure 6 Panel B shows the different distributions of topic exposures by central banks and news media.

The charts suggest that media pay relatively higher attention to CBDC's potential impact

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[1] See https://code.google.com/archive/p/word2vec/.

on the competitive landscape of the currency and payment system, including the potential effects on cryptocurrencies as well as on first mover advantages. By contrast, central banks pay relatively higher attention to the implications for financial inclusion, financial stability and financial institutions as well as to payment, efficiency, security, and privacy. By comparing the mean CBDC sentiment of documents with each dominant topic, we further find that central banks have greater concerns on CBDC security as well as its impact on financial institutions and monetary policy, while media are more concerned about privacy and financial stability implications of CBDC.

[Insert Figure 6 here]

In Figure A7 and A8, we show that topic exposure varies by time and across jurisdictions, while cross-sectional variations are relatively higher than time-series variations. Topic exposures on payment and on financial institutions by central banks remain high within our sample period, while media pay consistently high attention to financial market and cryptocurrency additionally. While concerns with financial markets and financial stability seem to trend up over time, cross-border payment and first mover advantage – which are among topics that motivate CBDCs – are also increasing in their exposures.

The distribution of topic exposures across jurisdictions indicates the relative importance of the CBDC topics perceived by the media and central bank of each jurisdiction. For instance, economies actively involved in multi-jurisdiction CBDC projects are associated with relatively higher topic exposure to cross-border payment, these include Hong Kong SAR, Singapore, and Thailand, among others. The media-central bank differences in topic exposure also vary across jurisdictions. For Switzerland or Hong Kong SAR, there is more similarity in topic exposures between central banks and media than in Brazil or India, for instance.

4. Media and central bank CBDC sentiment interactions

We first examine whether central bank or public media play the leading role in the formation of CBDC views. We address this issue using two approaches. First, we test the direction of central bank-media sentiment interactions by examining who is error-correcting to their divergence, based on a jurisdiction-month panel. Second, we assess the dynamic impacts of

central bank and media CBDC sentiments on each other using high-frequency (daily) event study analyses.

Error correction model

To test for the direction of adjustment to diverging sentiment (error correction), we regress monthly-changes in media and central bank sentiments on lagged central bank-media sentiment differences for each jurisdiction-month pair. To control for confounding news that happen contemporaneously with the publication of the central bank or media articles, we also create a general non-CBDC sentiment measure ($sent_{noncbdc}$) by applying the CentralBankRoBERTa model (Pfeifer and Marohl, 2023) to all sentences in paragraphs without CBDC-related terms and project names. We construct aggregated jurisdiction-level monthly indicators for media and central bank sentiments by calculating the mean sentiment of the articles corresponding to each jurisdiction-month pair. [1] For jurisdiction-month pairs with no news or central bank publications, we set the corresponding sentiment indicators to zero. The empirical model takes the following form:

$$D.sent\_media_{i,t} = \beta_0 + \beta_1(sent\_cb_{i,t-1} - sent\_media_{i,t-1}) + \beta_2 sent\_media\_nonCBDC_{i,t-1} \quad (2)$$
$$+ \beta_3 sent\_cb\_nonCBDC_{i,t-1} + JurisdictionFE + YearMonthFE + \varepsilon_{i,t},$$

$$D.sent\_cb_{i,t} = \beta_0 + \beta_1(sent\_cb_{i,t-1} - sent\_media_{i,t-1}) + \beta_2 sent\_media\_nonCBDC_{i,t-1} \quad (3)$$
$$+ \beta_3 sent\_cb\_nonCBDC_{i,t-1} + JurisdictionFE + YearMonthFE + \varepsilon_{i,t},$$

where $sent\_cb_{i,t}$ ($sent\_media_{i,t}$) is the mean CBDC sentiment score of central bank publications (media articles) of jurisdiction i in month t, and $sent\_cb/media\_nonCBDC_{i,t}$ measures local non-CBDC sentiment associated with jurisdiction i in month t. The detailed definitions of variables are presented in Table A1.

Table 2 reports the results. We find that both media and central bank's monthly changes in sentiments significantly adjust to lagged sentiment differences. The adjustment takes place in a direction that narrows the gap between central bank and media's sentiments, with greater relative adjustment coming from media sentiment. A one-point increase in lagged difference between central bank and media sentiments is associated with a positive 0.65-point change in media sentiment and a negative 0.31-point change in central bank sentiment. These results

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[1] We do not perform this analysis at a higher frequency due to the sparsity of CBDC sentiment in a jurisdiction-day or jurisdiction-week panel. There are a lot of days/weeks where a jurisdiction does not have CBDC-related publications.

suggest that both central banks and media adjust to divergences in their CBDC sentiment in a correcting manner, with media adjusting more strongly than central banks.

[Insert Table 2 here]

High-frequency event study

In the event study analysis, we provide higher frequency evidence on how sentiments as revealed in central bank CBDC publications affect future media sentiments, and vice versa. In Section 5, using the same approach, we explore how CBDC views of different central banks interact with each other, i.e. if there are cross-border spillover effects.

To assess the effect of central bank CBDC sentiment on media sentiment, we examine the change in media CBDC sentiments within a T-day (T=5/10) event window around each central bank publication date on CBDC.[1] Specifically, we regress post-publication media sentiment on central bank sentiment for each central bank publication related to CBDC, controlling for pre-publication media CBDC sentiment and non-CBDC sentiments within the event window:

$$sent\_media\_post\_T_{i,t}$$
$$= \beta_0 + \beta_1 sent\_cb_{i,t} + \beta_2 sent\_media\_prev\_T_{i,t}$$
$$+ \beta_3 sent\_media\_prev\_T\_nonCBDC_{i,t} + \beta_4 sent\_cb\_prev\_T\_nonCBDC_{i,t}$$
$$+ JurisdictionFE + \varepsilon_{i,t},$$

(4)

where $sent\_cb_{i,t}$ is the mean CBDC sentiment score of central bank publications of jurisdiction i on date t, and $sent\_media\_post\_T_{i,t}$ ($sent\_media\_prev\_T_{i,t}$) is the mean CBDC sentiment score of media articles of jurisdiction i within a T-day time window after (before) date t.

To examine whether central bank views are affected by media views, we regress the CBDC sentiment on each central bank publication on the pre-publication media CBDC sentiment, controlling for pre-publication central bank CBDC sentiment and non-CBDC sentiments within a T-day event window:

$$sent\_cb_{i,t} = \beta_0 + \beta_1 sent\_media\_prev\_T_{i,t} + \beta_2 sent\_cb\_prev\_T_{i,t}$$
$$+ \beta_3 sent\_media\_prev\_T\_nonCBDC_{i,t} + \beta_4 sent\_cb\_prev\_T\_nonCBDC_{i,t}$$
$$+ JurisdictionFE + \varepsilon_{i,t}.$$

(5)

Table 3 reports the results for the event study analysis. At 5% significance level, we find

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[1] For dates with multiple CBDC-related publications by a central bank, we take average of the sentiment measures across publications.

central bank sentiment has a significant positive effect on post-publication media sentiment within all intervals. A one-standard-deviation increase in a central bank's CBDC sentiment is associated with around a 0.20-standard-deviation increase in the media's sentiment on CBDC of the jurisdiction within 5 days after the central bank publication. The effects of pre-publication media sentiment on central bank sentiment are smaller in scale. The results suggest that central banks can steer media sentiment on CBDC via communication. At the same time, they also appear to respond to CBDC sentiments expressed by the media to some extent.

[Insert Table 3 here]

In unreported results, we run similar tests for topic exposures, finding that central bank's topic exposures are significantly and positively associated with media's future exposure on many topics, including payment, cryptocurrency, cross border payment, financial institution, privacy, security, efficiency and dollarization. On the other hand, media have a significant effect on future central bank's topic exposures only for a few topics, including distributed ledger technology, financial inclusion and privacy. These results are consistent with those in Table 3, suggesting that central bank and media's CBDC views significantly affect each other's CBDC views, with the effects of central bank views being stronger than those of media views.

5. Cross-border spillovers of central bank and media CBDC sentiment

Central bank and media views on CBDCs of different jurisdictions may also interact with each other. Similar to monetary policy or financial conditions, [1] there could be cross-border sentiment spillovers in particular from the leading jurisdictions. To test this hypothesis, we adopt a similar event study approach as before and examine sentiment spillovers from three major jurisdictions – United States, the Euro Area, and China – within a T-day horizon. For each publication date by the central bank in focus, we regress the average CBDC sentiment of central banks and media of other jurisdictions within T days after the publication on the sentiment of the central bank in focus. For instance, for the United States, we estimate the following equation:

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[1] See e.g. Hofmann and Takats (2015) and Obstfeld (2015) for evidence on such spillovers.

$$sent\_cb\_post\_T\_other_{i,t} \qquad\qquad (6)$$
$$= \beta_0 + \beta_1 sent\_cb_{j,t} + \beta_2 sent\_cb\_prev\_T\_other_{i,t}$$
$$+ \beta_3 sent\_cb\_prev\_T\_nonCBDC\_other_{i,t}$$
$$+ \beta_4 sent\_media\_prev\_T\_nonCBDC\_other_{i,t} + JurisdictionFE + \varepsilon_{i,t},$$

$$sent\_media\_post\_T\_other_{i,t} \qquad\qquad (7)$$
$$= \beta_0 + \beta_1 sent\_cb_{j,t} + \beta_2 sent\_cb\_prev\_T\_other_{i,t}$$
$$+ \beta_3 sent\_media\_prev\_T\_other_{i,t} + \beta_4 sent\_cb\_prev\_T\_nonCBDC\_other_{i,t}$$
$$+ \beta_5 sent\_media\_prev\_T\_nonCBDC\_other_{i,t} + JurisdictionFE + \varepsilon_{i,t},$$

where jurisdiction j is the United States, the Euro Area or China respectively, while jurisdiction i ($i \neq j$) stands for any jurisdiction other than the United States, the Euro Area or China respectively. $sent\_cb_{j,t}$ is the mean CBDC sentiment score of central bank publications of jurisdiction j on date t, $sent\_cb/media\_post\_T\_other_{i,t}$ ($sent\_cb/media\_prev\_T\_other_{i,t}$) is the mean CBDC sentiment score of central bank publications / news articles of jurisdiction i within a T-day time window after (before) date t.

As shown in Table 4 Panel A, the CBDC sentiment of Federal Reserve, the ECB and the PBoC have significant and positive effects on other central banks' CBDC sentiment. For T=10 days, a one-standard-deviation increase in CBDC sentiment of a Fed/PBoC (ECB) publication is associated with a 0.1 (0.03) standard-deviation increase in the mean CBDC sentiment of other central banks' publications within 10 days after the publication. In Table 4 Panel B, we report the results for media sentiment spillovers, finding that Fed and ECB CBDC sentiments have significant and positive effects on the media CBDC sentiments of other jurisdictions. The results indicate that CBDC sentiments are not only driven by domestic factors as suggested by Auer et al. (2020), but also significantly respond to sentiments elsewhere.

[Insert Table 4 here]

In unreported results, we run the same set of regressions using an expanded sample which includes CBDC publications by regional Feds. The spillover effect of U.S. CBDC sentiments on other central banks is still positive but becomes less significant after including New York Fed, Boston Fed or all regional Feds, implying that CBDC publications by regional Feds may have less significant impacts.

6. CBDC sentiment and CBDC projects

Finally, we examine whether cross-sectional variations in media and central bank CBDC sentiments are associated with the actual progress of CBDC development. We obtain the cross-sectional CBDC project index from Auer et al. (2020) and extend it into a yearly panel by marking the milestones of the CBDC development of each jurisdiction. Then, we examine the link between past CBDC project progress and future CBDC sentiments:

$$sent\_media/cb_{i,t} = \beta_0 + \beta_1 CBDC\_Project\_Score_{i,t-1} + \varepsilon_{i,t}, \tag{8}$$

where $CBDC\_Project\_Score_{i,t}$ stands for $CBDC\_Project\_Overall_{i,t}$, $CBDC\_Project\_Retail_{i,t}$ or $CBDC\_Project\_Wholesale_{i,t}$, which are the overall, retail and wholesale CBDC project scores of jurisdiction i in year t, respectively.

As shown in Panel A of Table 5, the results suggest that the CBDC sentiments of media and central bank are also positively associated with lagged CBDC project scores. In other words, when central banks make progress in their CBDC projects, they also adopt a more positive view on CBDC in their communications going forward. Media sentiment is driven more significantly by progress in retail CBDC projects than that of wholesale projects, implying that media might play an important role in the transmission of central banks' retail CBDC policy to the general public.

Furthermore, we examine whether the CBDC sentiment of central bank or media is more informative with regard to its implications on future CBDC progress. We run ordered Probit regressions to examine the predictability of CBDC sentiment on future CBDC development.

$$CBDC\_Project\_Score_{i,t}^* = \beta_0 + \beta_1 sent\_media_{i,t-1} + \beta_2 sent\_cb_{i,t-1} + \varepsilon_{i,t}, \tag{9}$$

$$CBDC\_Project\_Score_{i,t} = \begin{cases} 0 & if\ CBDC\_Project\_Score_{i,t}^* \leq cut\_1; \\ 1 & if\ cut\_1 < CBDC\_Project\_Score_{i,t}^* \leq cut\_2; \\ 2 & if\ CBDC\_Project\_Score_{i,t}^* > cut\_2. \end{cases}$$

In Panel B of Table 5, we find that future CBDC progress is significantly positively correlated with central bank CBDC sentiments, while only marginally significantly related to media CBDC sentiments. A one-standard-deviation increase in a central bank's mean CBDC sentiment within a year is associated with around 0.6 increase in the CBDC project score of the jurisdiction in the next year. The results imply that central bank CBDC sentiment might contain forward-looking information on future CBDC progress to a greater extent than media sentiment, indicating that rational investors may respond more significantly to changes in

central bank's rather than media's CBDC sentiment. We test this hypothesis in Section 7.

[Insert Table 5 here]

7. Crypto and equity market impact

While none of the jurisdictions in our sample has officially launched a full-fledged CBDC over the period of analysis, financial markets may still be affected by changes in CBDC sentiments of central banks and media. The impact of CBDC sentiments on different asset prices could either be positive or negative, since the adoption of CBDCs may on the one hand disrupt some markets and sectors but also introduce new business opportunities to others. To assess this point, we explore in this section whether CBDC sentiments impact returns of cryptocurrencies and stocks.

To better control for private-sector related news in our market impact analysis, we create a sentiment measure for each of the following topics: commercial bank ($sent_{bank}$), payment ($sent_{payment}$), and cryptocurrency ($sent_{crypto}$). For instance, for commercial bank, we apply a DeBERTa model for aspect-based sentiment analysis (ABSA, Yang et al., 2023) to all sentences containing bank-related terms (excluding "central bank" and central bank names) in the document,[1] and measure bank-specific sentiment for the document by taking the average of the bank sentiment scores of all bank-related sentences in the document.[2] This measure is included in the subsequent regression analysis to control for sector-specific news, in order to better identify the effect of CBDC sentiments on asset returns.

7.1 Cryptocurrencies

We obtain data on Bitcoin and Ethereum prices from Coingecko,[3] and examine the impact of

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[1] The list of topic-related terms are as follows: (1) commercial bank: ['bank', 'banking ', 'financial institution', 'intermediary', 'intermediate', 'intermediation', 'deposit', 'credit'], excluding 'central bank' and central bank names; (2) payment: ['psp', 'third party payment', 'digital payment', 'mobile payment', 'electronic payment', 'e-payment', 'non-cash payment', 'instant payment', 'mobile device', 'qr code', 'credit card', 'debit card']; (3) cryptocurrency: ['crypto', 'bitcoin', 'btc', ' ether', 'virtual currency', 'stablecoin', 'xrp', 'dogecoin', 'libra ', 'tether', 'usdt', 'usdc', ' luna ', 'initial coin offer', ' ico ', 'digital asset', 'virtual asset', 'non fungible token', 'nft']; (4) blockchain: ['blockchain', 'distributed ledger', 'ledger technology', 'dlt', 'smart contract', 'web3', 'decentralized finance', 'defi ', 'dapp']. They are generated by further manually filtering the topic-related key terms in the topic modelling step described in Section 3.2.

[2] Note that we do not apply Yang et al. (2023)'s DeBERTa ABSA model to our main measure (CBDC-specific sentiment) as well, since the model is not trained on CBDC-related texts and tends to classify intentions to issue CBDCs or progress of CBDC projects as neutral. To address this concern, we train our own model for the CBDC sentiment classification task.

[3] https://www.coingecko.com/.

CBDC sentiments of media and central banks on crypto returns within a 3-day ([-1,1]) or 10-day ([-1,8]) time window around the publication date of central bank communication or media articles. We calculate mean CBDC sentiment of all news articles or central bank publications for each day as the main independent variable and run the regressions at the daily level. For days without any news articles or central bank publications, we set the sentiment variable to zero.

$$return\_T_t = \beta_0 + \beta_1 sent\_media_t + \beta_2 sent\_cb_t + \beta_3 sent\_media\_nonCBDC\_global_t \quad (10)$$
$$+ \beta_4 sent\_cb\_nonCBDC\_global_t + \beta_5 sent\_media\_crypto\_global_t$$
$$+ \beta_5 sent\_cb\_crypto\_global_t + \varepsilon_t,$$

where $return\_T_t$ is the T-day cumulative return of BTC or ETH around date t, $sent\_cb/media\_nonCBDC\_global_t$ is the average non-CBDC sentiment of all central bank publications / media articles on date t, and $sent\_cb/media\_crypto\_global_t$ is the average cryptocurrency-specific sentiment in central bank publications / media articles on date t.

Table 6 reports the results. Central bank CBDC sentiment has a significant negative impact on BTC and ETH returns, while media CBDC sentiment does not. A one-standard-deviation increase in mean CBDC sentiment by all central banks within our sample is associated with around 0.8% (1.1%) decrease in 10-day returns of BTC (ETH).

[Insert Table 6 here]

7.2 Stocks

Exposure by industry

We collect equity prices and firm-level fundamentals data from Worldscope. To identify the group of firms that could potentially be affected by CBDC, we first examine the distribution of firm-level exposures to central bank CBDC sentiments for financial and non-financial corporations. To obtain the exposure, we estimate the following time-series regressions for each firm using monthly data from Jan 2016 to Jun 2022:

$$return_{i,t} = \alpha_i + \beta_{i,1} MKT_{c,t} + \beta_{i,2} SMB_{c,t} + \beta_{i,3} HML_{c,t} + \beta_{i,4} MOM_{c,t} + \beta_{i,CBDC} sent\_cb_t + \varepsilon_{i,t}, \quad (11)$$

where $MKT_{c,t}$, $SMB_{c,t}$, $HML_{c,t}$ and $MOM_{c,t}$ are monthly returns of Carhart (1997) four factors of the stock market of jurisdiction c in which firm i is domiciled. We estimate the firm-level exposure to CBDC sentiment ($\beta_{i,CBDC}$) and examine its distribution by industry.

Figure 7 reports the results. In general, firms show significant positive exposures to CBDC sentiment, while financial firms typically have less positive exposures than non-financial firms. By breaking down to specific sub-groups in the financial industry, we find that only commercial banks have a significant negative CBDC exposure, i.e. their stock returns are negatively affected by more positive CBDC sentiment. The results suggest that commercial banks may be negatively affected by CBDCs.

[Insert Figure 7 Here]

Event study on sub-samples

To better identify this effect, we form a sample of stocks in the banking sector, based on the industry group classification in Worldscope. Apart from commercial banks, we also form a separate sample for non-bank stocks related to payment by identifying stocks with "payment" in their business descriptions excluding stocks in the banking sector.

We apply the event study approach similar to the cryptocurrency analysis above, except that we restrict the media / central bank publications to jurisdiction level when constructing the daily sentiment variables, and control for firm-level characteristics as well as firm and year-month fixed effects. We estimate the following equation using a sub-sample of stocks related to either commercial banks or payment firms:

$$
\begin{aligned}
return\_T_{i,c,t} = \beta_0 &+ \beta_1 sent\_media_{c,t} + \beta_2 sent\_cb_{c,t} + \beta_3 sent\_media\_nonCBDC_{c,t} \\
&+ \beta_4 sent\_cb\_nonCBDC_{c,t} + \beta_5 sent\_media\_sector_{c,t} + \beta_6 \, sent\_cb\_sector_{c,t} \\
&+ Firm\_Conrol_{i,t} + FirmFE + YearMonthFE + \varepsilon_{i,c,t},
\end{aligned}
\tag{12}
$$

where $sent\_media_{c,t}(sent\_cb_{c,t})$ is mean CBDC sentiment score of central bank publications (media articles) of the jurisdiction of domicile (c) of firm i on date t, $sent\_media\_sector_{c,t}$ ($sent\_cb\_sector_{c,t}$) is the average sector-specific ("sector" refers to bank or payment) sentiment in the media articles (central bank publications) associated with jurisdiction c on date t.

Table 7 reports the results. We find that, in general, central bank's CBDC sentiment has a significant negative impact on equity returns of both banks and third-party payment providers, reflecting potential negative implications of CBDC for these companies' business models. The impact on bank stocks is more significant, where one-standard-deviation increase in a central bank's CBDC sentiment is associated with around 0.09% decrease in 10-day stock returns of

banks domiciled in the corresponding jurisdiction. Media CBDC sentiment also has a negative effect in the short term, but not as significant as that of central banks.

[Insert Table 7 here]

Cross-jurisdiction heterogeneous effects

The above effects however conceal noteworthy cross-jurisdiction heterogeneity. As an illustration, in Table 8, we present, separately, regression results of bank stock returns on CBDC sentiments for advanced economies and emerging market economies. Stock returns of banks domiciled in advanced economies are significantly and negatively associated with CBDC sentiments of both media and central banks. However, for banks in emerging market economies, the effects are positive and significant for the 3-day time window.

[Insert Table 8 here]

The cross-jurisdiction heterogeneity in the effects of CBDC sentiments on equity returns may depend on the specific CBDC design as well as local payment market competition structure. To dig further into this issue, we examine the impact of PBoC CBDC sentiments on the stock returns of China's Alibaba and Tencent – firms associated with Alipay and WeChat Pay, two of the world's largest third-party digital payment service providers – and Chinese banks within a 3/10-day window. Table 8 reports the results. We find that the stock returns of Alibaba and Tencent are significantly negatively impacted by PBoC and media CBDC sentiments, while bank stock returns are significantly positively associated with such sentiments.

[Insert Table 9 here]

The results suggest that the market expected that the introduction of e-CNY would affect the market competition structure of retail digital payments. As Alipay and WeChat Pay, associated with the tech giants like Alibaba and Tencent, have taken a large market share in third-party digital payments, the introduction of e-CNY could patch up some lost trades or bring new business opportunities to traditional banks, helping to level the playing field with the tech giants in digital payments. Thus, in China's case, a more positive CBDC sentiment appears to be perceived as not boding well for incumbents but to be good news for other emerging or potential players in digital payment including traditional banks.

8. Conclusions

In this paper, we apply large language models (LLM) to create a novel measure of jurisdiction-level central bank / media sentiment on CBDC at daily frequency, using it to investigate the drivers and financial market implications of these sentiments. We document considerable sentiment and topic divergences between central banks and media. Overall, media sentiments tend to be more positive than those of central banks, particularly regarding retail CBDCs. However, this sentiment gap has narrowed over time. Our findings also reveal that media sentiment is more strongly influenced by central bank sentiment than the reverse. Additionally, the sentiments of major central banks have significant spillover effects, shaping both central bank and media sentiments in other jurisdictions.

Furthermore, our analysis suggests that central bank sentiments generally have a significantly negative impact on the returns of crypto assets and stocks of commercial banks and third-party payment service providers. This indicates that investors may view central bank digital currencies as potential substitutes for existing private-sector players in digital payments. At the same time, the impact of CBDC sentiment on banking stocks varies across jurisdictions. It is more negative in advanced economies and more positive in emerging market economies, reflecting differences in the local market structure for digital payments.

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Figure 1. Attention to CBDC: Quarterly aggregated number of news articles (left) and central bank publications (right) on CBDC
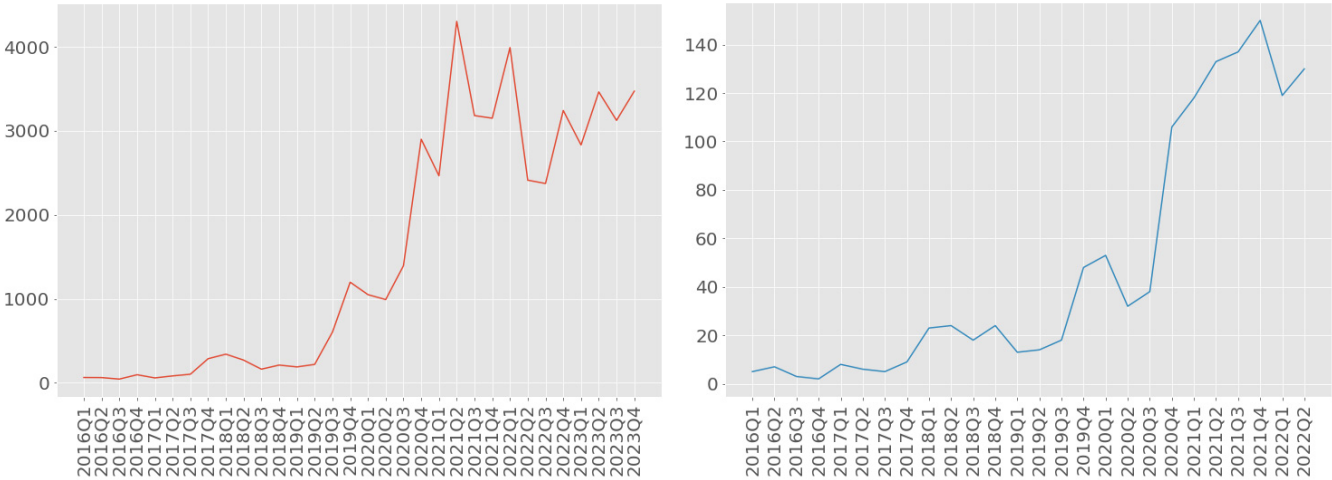

This figure plots the number of news articles (left panel) and central bank publications (right panel) on CBDC on a quarterly basis. The sample covers 15 jurisdictions.

Figure 2. Attention to CBDC: Number of news articles (left) and central bank publications (right) on CBDC by jurisdiction
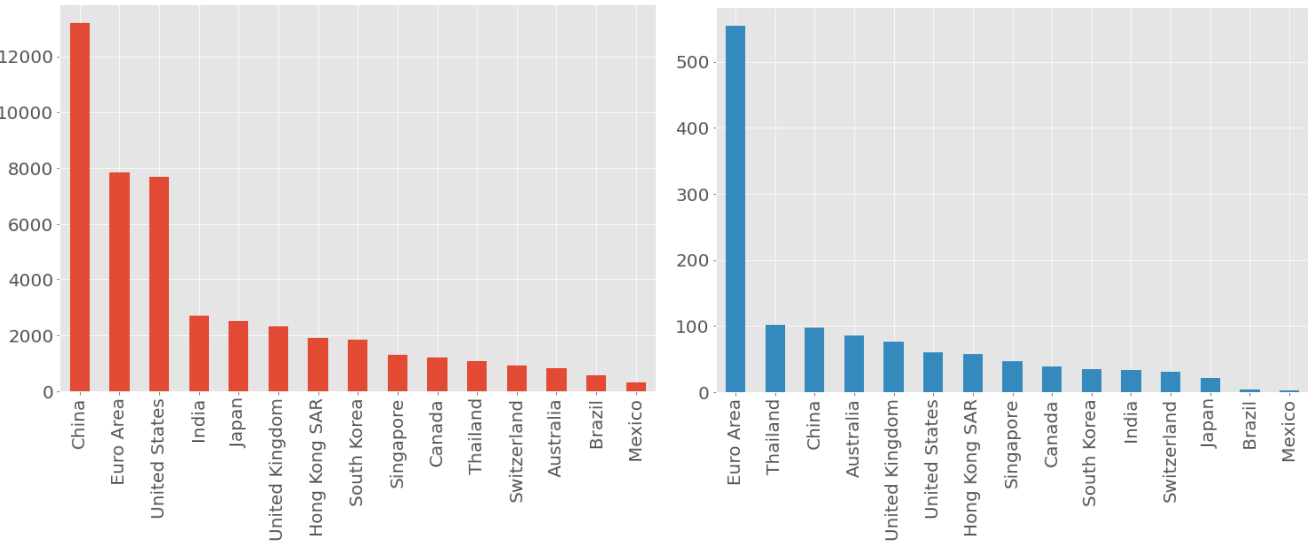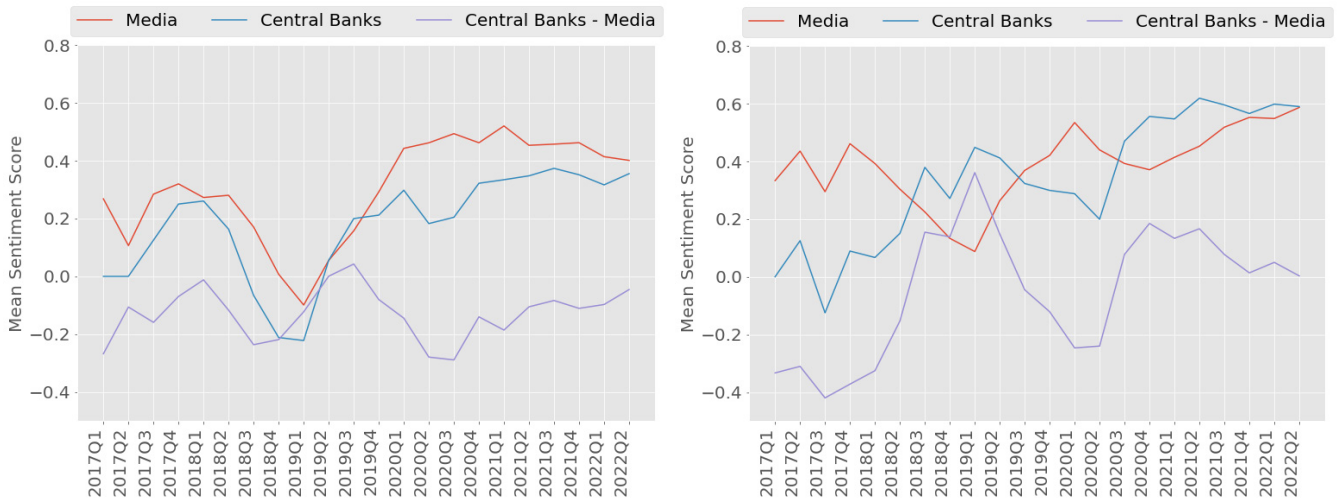

This figure shows the number of news articles (left panel) and central bank publications (right panel) on CBDC by jurisdiction. The sample covers 15 jurisdictions from 2016Q1 to 2022Q2.
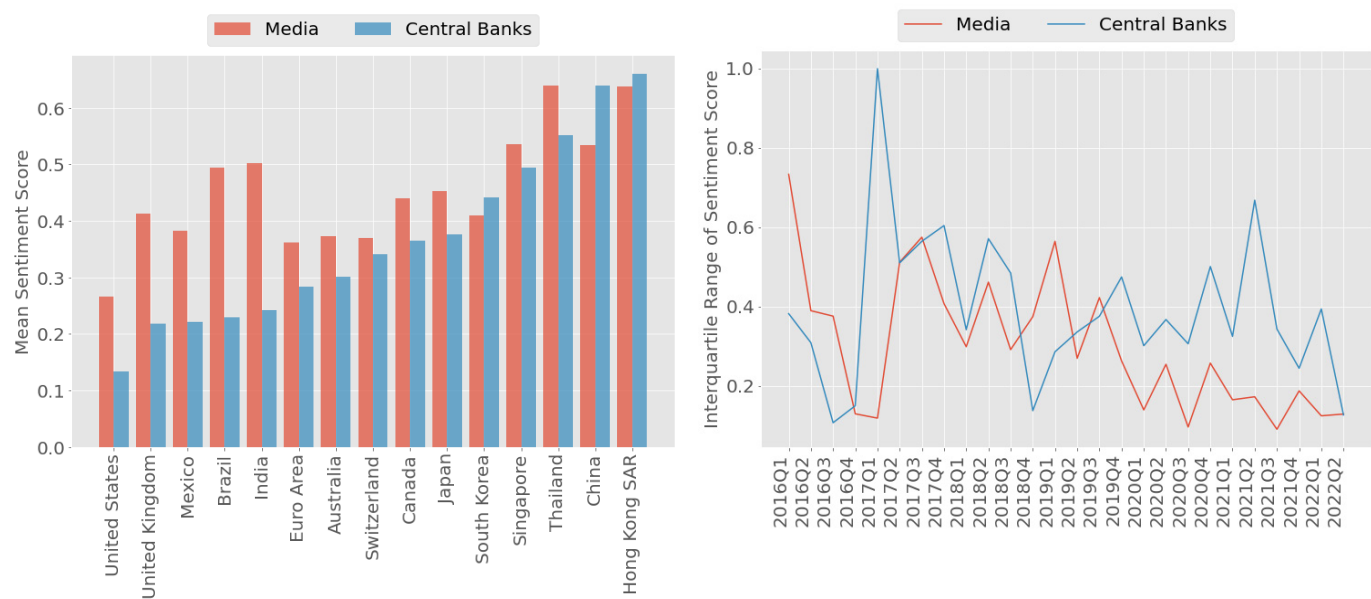
Figure 3. CBDC sentiment
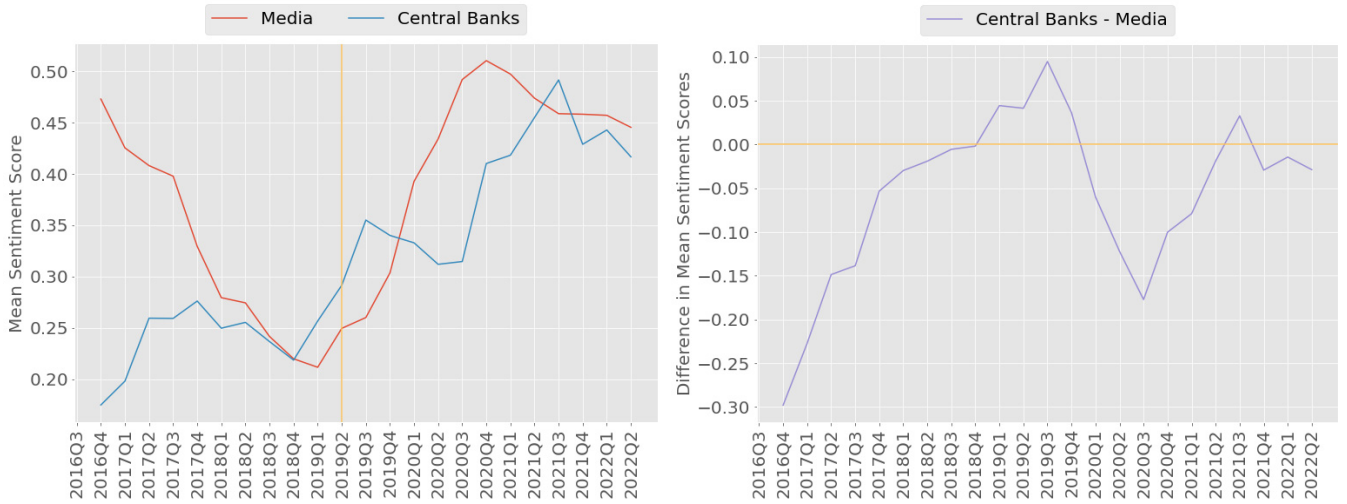
This figure plots the four-quarter moving average of jurisdiction-quarter-level CBDC sentiments, which are aggregated from article-level sentiments by taking average of sentiment scores of all articles/publications associated with a jurisdiction within a quarter. The left panel plots the mean sentiment scores of central banks and media respectively, while the right panel plots the difference between the two. The sample covers 15 jurisdictions from 2016Q1 to 2022Q2.

Figure 4. CBDC sentiment: Retail (left) and wholesale (right) CBDC

This figure plots the four-quarter moving average of jurisdiction-level quarterly CBDC sentiments for retail CBDC (left) and wholesale CBDC (right). The sample covers 15 jurisdictions from 2016Q1 to 2022Q2.

Figure 5. CBDC sentiment by jurisdiction (left) and interquartile range by quarter (right)


This figure plots the jurisdiction-level mean CBDC sentiment scores (left) and interquartile range of jurisdiction-quarter-level mean CBDC sentiment scores by quarter (right). The sample covers 15 jurisdictions from 2016Q1 to 2022Q2.

Figure 6. Topics in CBDC-related context

Panel A. Word clouds of news articles (left) and central bank publications (right) on CBDC

Panel B. Distribution of topic exposure of CBDC-related paragraphs and topic-specific sentiment
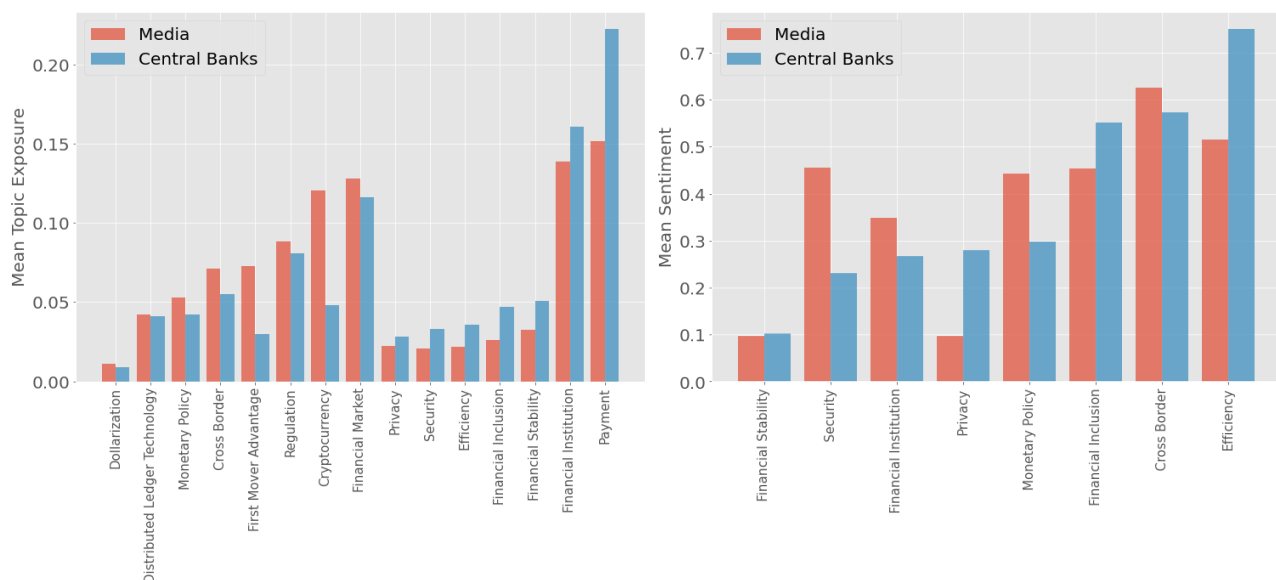
Panel A plots the frequent terms in CBDC-related paragraphs in news articles (left) and central bank publications (right). The larger the term is, the more frequent it is used. The left figure in Panel B plots mean topic exposure of CBDC-Related Paragraphs in news articles and central bank publications of each topic. The right figure of Panel B plots the mean sentiment score of documents by the document's dominant topic. The sample covers 15 jurisdictions from 2016Q1 to 2022Q2.

Figure 7. Distribution of equity risk exposures to central bank sentiment on CBDC by industry
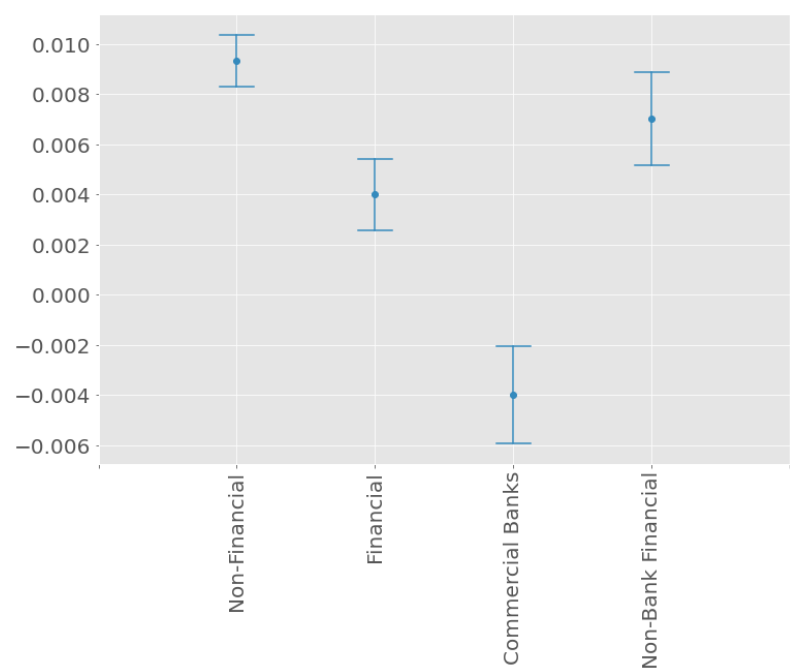
This figure plots the mean exposure (with 95% confidence interval) of global stock returns to central bank CBDC sentiment (β_{CBDC}), estimated from time-series regressions of stock returns on central bank CBDC sentiment, controlling for Carhart (1997) four factors as specified in Eq. (11). The factor returns of sample jurisdictions are obtained from Jensen et al. (2023). The sample period is from 2016Q1 to 2022Q2.

Table 1. Summary statistics of sentiment measures in the jurisdiction-date panel

Variable	count	mean	std	min	median	max
sent_media	10103	0.4378	0.5059	-1.0000	0.5000	1.0000
sent_media_retail	10103	0.2121	0.4400	-1.0000	0.0000	1.0000
sent_media_wholesale	10103	0.0756	0.2751	-1.0000	0.0000	1.0000
sent_cb	888	0.3543	0.4025	-1.0000	0.3207	1.0000
sent_cb_retail	888	0.1837	0.3954	-1.0000	0.0000	1.0000
sent_cb_wholesale	888	0.1455	0.3546	-1.0000	0.0000	1.0000

Table 2. Central bank and media CBDC sentiment: Error-correction regressions

Dependent variable:	D.sent_media		D.sent_cb	
	(1)	(2)	(3)	(4)
L.sent_cb – L.sent_media	0.6523***	0.6566***	-0.3249***	-0.3119***
	(0.0554)	(0.0537)	(0.0458)	(0.0384)
Control	No	Yes	No	Yes
Jurisdiction FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
N	1155	1155	1155	1155
R-sq	0.3939	0.3959	0.2186	0.2474

This table reports the estimation results of Eq. (2) and (3), examining the interacting effects between central bank and media CBDC sentiments using a jurisdiction-month panel. sent_cb (sent_media) is the mean CBDC sentiment score of central bank publications (media articles) of a jurisdiction in month t. Columns (1) and (3) control for jurisdiction fixed effects and year-month fixed effects, while Columns (2) and (4) additionally control for local non-CBDC sentiment scores (sent_media_noncbdc, sent_cb_noncbdc). Variable definitions are provided in Table A1. Standard errors clustered at jurisdiction level are reported in in parentheses. */**/*** denotes p<0.10/p<0.05/p<0.01.

Table 3. Central bank and media CBDC sentiment: Event study

Panel A. Impact of central bank sentiment on future media sentiment

| | Dependent variable: sent_media_post_T | |
| | T=5 | T=10 |
	(1)	(2)
sent_cb	0.2003***	0.1679***
	(0.0497)	(0.0423)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	882	874
R-sq	0.0967	0.0717

Panel B. Impact of pre-publication media sentiment on central bank sentiment

| | Dependent variable: sent_cb | |
| | T=5 | T=10 |
	(1)	(2)
sent_media_prev_T	0.1129***	0.1072***
	(0.0329)	(0.0320)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	888	888
R-sq	0.0295	0.0361

This table reports estimation results of the effect of central bank and media CBDC sentiments on each other. Panel A and Panel B report coefficient estimations of Eq. (4) and Eq. (5), respectively. sent_cb is the mean CBDC sentiment score of a central bank's CBDC publications on a specific date with at least one CBDC publication by the central bank. sent_media_prev_T (sent_media_post_T) is the mean media CBDC sentiments of a jurisdiction within a T-day event window before (after) the date when the jurisdiction's central bank releases a CBDC-related publication. Columns (1) and (2) present regression results for T=5/10 days, respectively. Control variables include non-CBDC sentiment scores (sent_cb_prev_T_noncbdc and sent_media_prev_T_noncbdc), while Panel A (Panel B) further controls for mean media (central bank) CBDC sentiment within T-day time window before the publication event – sent_media_prev_T (sent_cb_prev_T). Variable definitions are provided in Table A1. All sentiment-related variables are standardized. Standard errors clustered at jurisdiction level are reported in parentheses. */**/*** denotes p<0.10/p<0.05/p<0.01.

Table 4. Cross-border spillover effect of central bank CBDC sentiment

Panel A. Spillover to central bank sentiment

	Dependent Variable: sent_cb_post_T_other	
	T=5	T=10
	(1)	(2)
sent_cb_United States/Euro Area/China	0.0173	0.0294***
	(0.0110)	(0.0092)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	5684	5640
R-sq	0.0104	0.0328
sent_cb_United States	0.1069*	0.0886*
	(0.0593)	(0.0472)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	612	612
R-sq	0.0393	0.0457
sent_cb_China	0.0726**	0.0927**
	(0.0303)	(0.0322)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	885	874
R-sq	0.0424	0.0386
sent_cb_Euro Area	0.0121	0.0295**
	(0.0137)	(0.0105)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	4187	4154
R-sq	0.0047	0.0310

Panel B. Spillover to media sentiment

	Dependent Variable: sent_media_post_T_other	
	T=5	T=10
	(1)	(2)
sent_cb_United States/Euro Area/China	0.0342**	0.0445***
	(0.0133)	(0.0122)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	5717	5717
R-sq	0.0840	0.1469
sent_cb_United States	0.1187**	0.0617
	(0.0456)	(0.0421)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	612	612
R-sq	0.0622	0.1255
sent_cb_China	-0.0023	0.0111
	(0.0359)	(0.0269)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	885	885
R-sq	0.0783	0.1190
sent_cb_Euro Area	0.0426**	0.0542***
	(0.0160)	(0.0139)
Control	Yes	Yes
Jurisdiction FE	Yes	Yes
N	4220	4220
R-sq	0.0900	0.1570

This table reports results of the cross-border spillover effects of central bank CBDC sentiments, presenting estimates of β_1 in Eq. (6) and (7) for three jurisdictions: United States, Euro Area, and China Panel A (Panel B) presents results for spillover to central bank (media) sentiments. sent_cb_[C] is the mean CBDC sentiment score of central bank C's CBDC publications on a specific date with at least one CBDC publication by the central bank. sent_cb_post_T_other (sent_media_post_T_other) is the CBDC sentiments of the central banks (media) of other jurisdictions within a T-day event window after the date when central bank C releases a CBDC-related publication. Only jurisdictions with at least one CBDC-related publication within [-90, 90) day window are included. Columns (1) and (2) present regression results for T=5/10 days, respectively. Control variables include sent_cb_prev_T_other, sent_cb_prev_T_noncbdc_other, and sent_media_prev_T_noncbdc_other. For Panel B, additionally control for sent_media_prev_T_other. Variable definitions are provided in Table A1. All sentiment-related variables are standardized. Standard errors clustered at jurisdiction level are reported in parentheses. */**/*** denotes p<0.10 / p<0.05 / p<0.01, respectively.

Table 5. CBDC project score and CBDC sentiment

Panel A. CBDC project score and future CBDC sentiment

Dependent Variable:	sent_media		sent_cb	
	(1)	(2)	(3)	(4)
L.CBDC_project_overall	0.5070***		0.5552***	
	(0.1485)		(0.1451)	
L.CBDC_project_wholesale		0.4050**		0.4469**
		(0.1503)		(0.1629)
L.CBDC_project_retail		0.4614***		0.4622**
		(0.1346)		(0.1968)
N	75	75	75	75
R-sq	0.2086	0.1847	0.2290	0.1943

Panel B. CBDC sentiment and future CBDC project score

Dependent Variable:	CBDC_project_overall			CBDC_project_retail	CBDC_project_wholesale
	(1)	(2)	(3)	(4)	(5)
L.sent_media	0.1607*		0.0492		
	(0.0867)		(0.0913)		
L.sent_cb		0.6352***	0.6237***		
		(0.2003)	(0.2057)		
L.sent_retail_media				-0.0673	
				(0.1239)	
L.sent_retail_cb				0.2215	
				(0.2129)	
L.sent_wholesale_media					0.1071
					(0.1587)
L.sent_wholesale_cb					0.8161**
					(0.3293)
N	75	75	75	75	75
pseudo R-sq	0.0108	0.1230	0.1239	0.0186	0.1618

Panel A reports estimation results on whether the cross-sectional variation in CBDC sentiment can be explained by past CBDC project progress, estimating Eq. (8). Columns (1)-(2) examine the determinants of CBDC sentiment by media, while Columns (3)-(4) examine the determinants of CBDC sentiment by central banks. Panel B reports estimation results of the predictability of CBDC sentiments on next-year CBDC project scores, estimating Eq. (9). Variable definitions are provided in Table A1. All sentiment and fundamental variables are standardized. Standard errors clustered at jurisdiction level are reported in parentheses. */**/*** denotes p<0.10 / p<0.05 / p<0.01, respectively.

Table 6. Crypto market impact of CBDC sentiment

Panel A. BTC/USD returns

	Dependent Variable: BTC_return_T (%)					
	T=3			T=10		
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	0.0091		0.0473	-0.1647		-0.0578
	(0.1567)		(0.1588)	(0.2928)		(0.2952)
sent_cb		-0.2780*	-0.2845*		-0.8053***	-0.7973***
		(0.1496)	(0.1515)		(0.2893)	(0.2918)
Control	Yes	Yes	Yes	Yes	Yes	Yes
N	2373	2373	2373	2373	2373	2373
r2	0.0088	0.0103	0.0104	0.0048	0.0080	0.0080

Panel B. ETH/USD returns

	Dependent Variable: ETH_return_T (%)					
	T=3			T=10		
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	-0.3320		-0.2742	-0.3875		-0.2447
	(0.2300)		(0.2329)	(0.4824)		(0.4830)
sent_cb		-0.4688**	-0.4309**		-1.0986**	-1.0648**
		(0.2126)	(0.2160)		(0.4710)	(0.4717)
Control	Yes	Yes	Yes	Yes	Yes	Yes
N	2373	2373	2373	2373	2373	2373
r2	0.0083	0.0092	0.0098	0.0059	0.0079	0.0080

This table reports results of the impact of CBDC news and central bank publications on BTH (Panel A) and ETH (Panel B) returns, estimating Eq. (10). sent_cb (sent_media) is the mean CBDC sentiment score of central bank publications (media articles) on date t. BTC_return_T (ETH_return_T) is cumulative return of BTC (ETH) within a T-day time window around date t. Columns (1)-(3) present regression results for T=3 days (t∈[-1,1]), while Columns (4)-(6) present regression results for T=10 days (t∈[-1,8]). Control variables include non-CBDC sentiment scores (sent_media_noncbdc_global and sent_cb_noncbdc_global) as well as cryptocurrency-specific sentiment scores (sent_media_crypto_global and sent_cb_crypto_global). Variable definitions are provided in Table A1. All sentiment-related variables are standardized. Robust standard errors are reported in parentheses. */**/*** denotes p<0.10 / p<0.05 / p<0.01, respectively.

Table 7. Equity market impact of CBDC sentiment

Panel A. Banks

| | T=3 | | | T=10 | | |
| | Dependent Variable: return_T (%) | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	-0.0194***		-0.0188***	-0.0233***		-0.0205**
	(0.0046)		(0.0045)	(0.0080)		(0.0080)
sent_cb		-0.0201***	-0.0196***		-0.0874***	-0.0868***
		(0.0038)	(0.0038)		(0.0086)	(0.0086)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1040468	1040468	1040468	1039370	1039370	1039370
r2	0.0354	0.0354	0.0354	0.1072	0.1074	0.1074

Panel B. Non-bank payment stocks

| | T=3 | | | T=10 | | |
| | Dependent Variable: return_T (%) | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	-0.0016		-0.0018	-0.0199		-0.0185
	(0.0119)		(0.0118)	(0.0269)		(0.0267)
sent_cb		0.0061	0.0062		-0.0493**	-0.0487**
		(0.0108)	(0.0108)		(0.0243)	(0.0241)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
N	563551	563551	563551	562895	562895	562895
r2	0.0116	0.0116	0.0116	0.0312	0.0313	0.0313

This table reports the estimation results of the impact of CBDC news and central bank publications on bank (Panel A) and payment (Panel B) stock returns, estimating Eq. (12). sent_cb (sent_media) is the mean CBDC sentiment score of central bank publications (media articles) of the firm's jurisdiction of domicile on date t. return_T is cumulative return of a stock within a T-trading-day time window around date t. Columns (1)-(3) present regression results for T=3 trading days ($t \in [-1,1]$), while Columns (4)-(6) present regression results for T=10 trading days ($t \in [-1,8]$). Control variables include non-CBDC sentiment scores (sent_media_noncbdc, sent_cb_noncbdc), lagged firm-level characteristics (size, book-to-market, ROA, leverage), as well as bank-specific sentiment scores (sent_media_bank, sent_cb_bank) and bank crisis index for Panel A, and payment-specific sentiment scores (sent_media_payment, sent_cb_payment) for Panel B. Variable definitions are provided in Table A1. All sentiment-related variables are standardized. Standard errors clustered at firm level in parentheses. */**/*** denotes $p<0.10/p<0.05/p<0.01$.

Table 8. Impact of CBDC sentiment on bank stock returns: Cross-sectional heterogeneity

Panel A. Advanced Economies

	Dependent Variable: return_T (%)					
	T=3			T=10		
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	-0.0333***		-0.0324***	-0.0145*		-0.0112
	(0.0048)		(0.0048)	(0.0079)		(0.0079)
sent_cb		-0.0324***	-0.0315***		-0.1166***	-0.1163***
		(0.0050)	(0.0050)		(0.0105)	(0.0104)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
N	866047	866047	866047	865061	865061	865061
r2	0.0389	0.0389	0.0390	0.1224	0.1227	0.1227

Panel B. Emerging Market Economies

	Dependent Variable: return_T (%)					
	T=3			T=10		
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	0.0804***		0.0797***	0.0078		0.0081
	(0.0100)		(0.0100)	(0.0238)		(0.0240)
sent_cb		0.0145**	0.0120**		-0.0039	-0.0042
		(0.0058)	(0.0058)		(0.0128)	(0.0129)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
N	174421	174421	174421	174309	174309	174309
r2	0.0371	0.0368	0.0371	0.1028	0.1028	0.1028

This table reports the estimates of the impact of CBDC news and central bank publications on the stock returns of banks domiciled in advanced economies (Panel A) and emerging market economies (Panel B), estimating Eq. (12). sent_cb (sent_media) is the mean CBDC sentiment score of central bank publications (media articles) of the firm's jurisdiction of domicile on date t. return_T is cumulative return of a stock within a T-day time window around date t. Columns (1)-(3) present regression results for T=3 days, while Columns (4)-(6) present regression results for T=10 day. Control variables include non-CBDC sentiment scores (sent_media_noncbdc, sent_cb_noncbdc), lagged firm-level characteristics (size, book-to-market, ROA, leverage), as well as bank-specific sentiment scores (sent_media_bank, sent_cb_bank) and bank crisis index. Variable definitions are provided in Table A1. All sentiment-related variables are standardized. Standard errors clustered at firm level in parentheses. */**/*** denotes p<0.10/p<0.05/p<0.01.

Table 9. CBDC sentiment and payment market competition: China case

Panel A. Impact of CBDC sentiment on bank stock returns in China

	Dependent Variable: return_T (%)					
	T=3			T=10		
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	0.0465**		0.0451**	0.1056***		0.1077***
	(0.0195)		(0.0196)	(0.0303)		(0.0303)
sent_cb		0.0179***	0.0169***		-0.0215	-0.0239
		(0.0058)	(0.0058)		(0.0153)	(0.0154)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	56689	56689	56689	56689	56689	56689
r2	0.0040	0.0040	0.0041	0.0128	0.0126	0.0128

Panel B. Impact of CBDC sentiment on Alibaba and Tencent stock returns

	Dependent Variable: return_T (%)					
	T=3			T=10		
	(1)	(2)	(3)	(4)	(5)	(6)
sent_media	-0.1553**		-0.1466*	-0.1689		-0.1495
	(0.0119)		(0.0219)	(0.0574)		(0.0589)
sent_cb		-0.0824	-0.0700		-0.1701**	-0.1575**
		(0.0804)	(0.0823)		(0.0062)	(0.0111)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3229	3229	3229	3229	3229	3229
r2	0.0050	0.0043	0.0053	0.0047	0.0049	0.0053

This table reports estimation results of the effect of China's CBDC news and central bank publications on stock returns of banks in China (Panel A) and Alibaba and Tencent (Panel B). sent_cb (sent_media) is the mean CBDC sentiment score of central bank publications (media articles) of China on date t. return_T is cumulative return of a stock within a T-trading-day time window around date t. Columns (1)-(3) present regression results for T=3 trading days (t∈[-1,1]), while Columns (4)-(6) present regression results for T=10 trading days (t∈[-1,8]). For Panel A, control variables include non-CBDC sentiment scores (sent_media_noncbdc and sent_cb_noncbdc), lagged firm-level characteristics (size, book-to-market, ROA, leverage), bank-specific sentiment scores (sent_media_bank, sent_cb_bank) and bank crisis index. For Panel B, control variables include non-CBDC sentiment scores and payment-specific sentiment scores (sent_media_payment, sent_cb_payment). Variable definitions are provided in Table A1. All sentiment-related variables are standardized. Standard errors clustered at firm level in parentheses. */**/*** denotes p<0.10/p<0.05/p<0.01.

Annex

Figure A1. Distribution of article-level CBDC sentiment of news articles (left) and central bank publications (right)
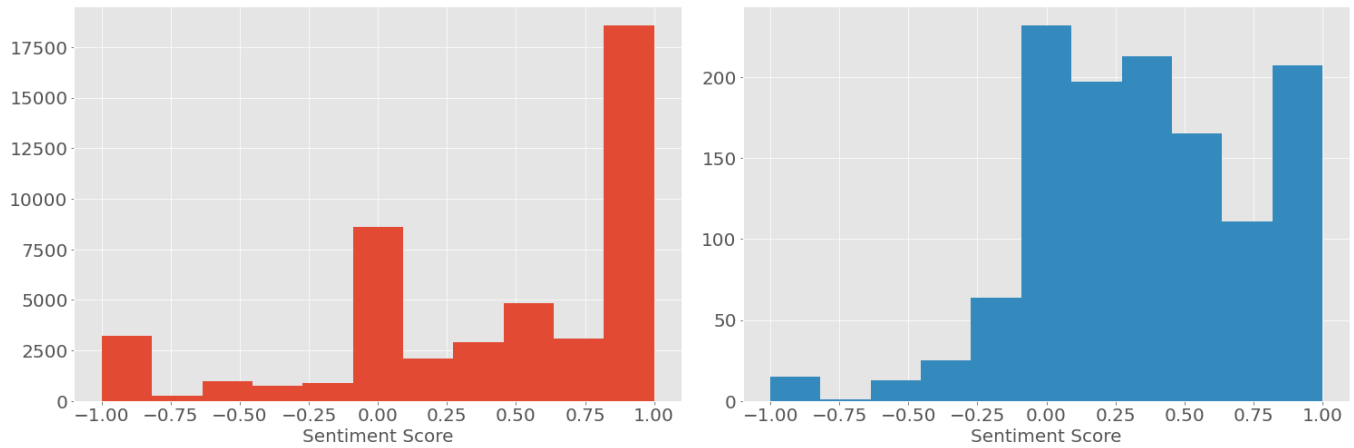

Figure A2. Cumulative sentiment score (sent_cb) and speech stance for the central bank speech sample in Auer et al. (2020)
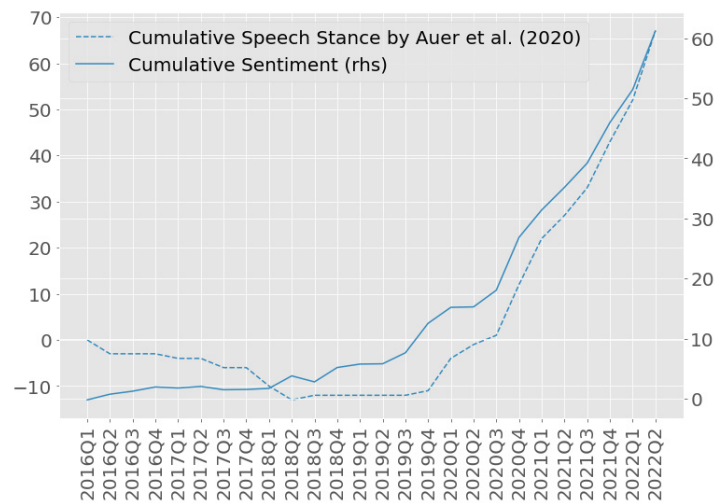

Figure A3. Distribution of speech-level sentiment scores (sent_cb) when Auer et al. (2020) speech stance equals -1 (left), 0 (middle), and 1 (right)
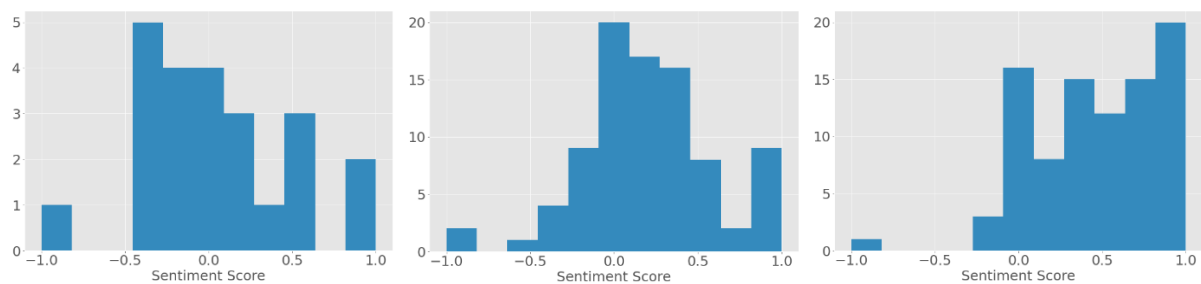
Figure A4. Four-quarter moving average of media sentiment: excluding and not excluding direct communication on CBDC by central banks
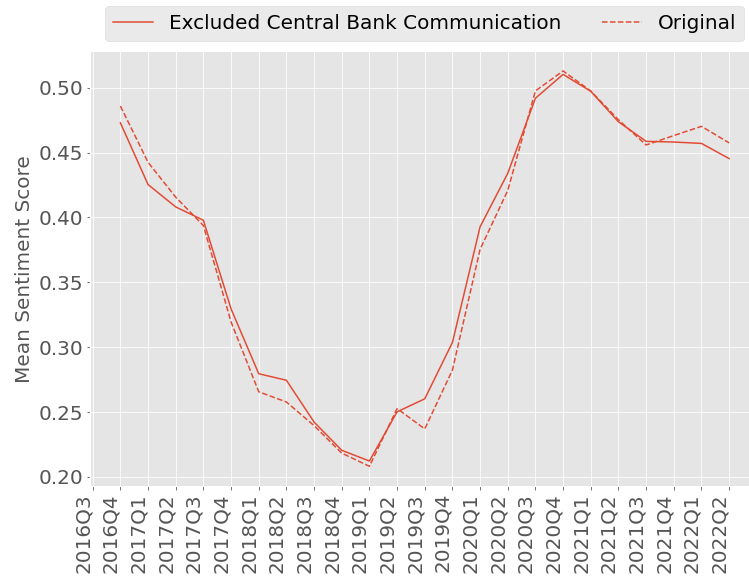
Figure A5. Four-quarter moving average CBDC sentiment: Retail CBDC of advanced economies (upper left panel), retail CBDC of emerging market economies (upper right panel), wholesale CBDC of advanced economies (lower left panel) and wholesale CBDC of emerging market economies (lower right panel)
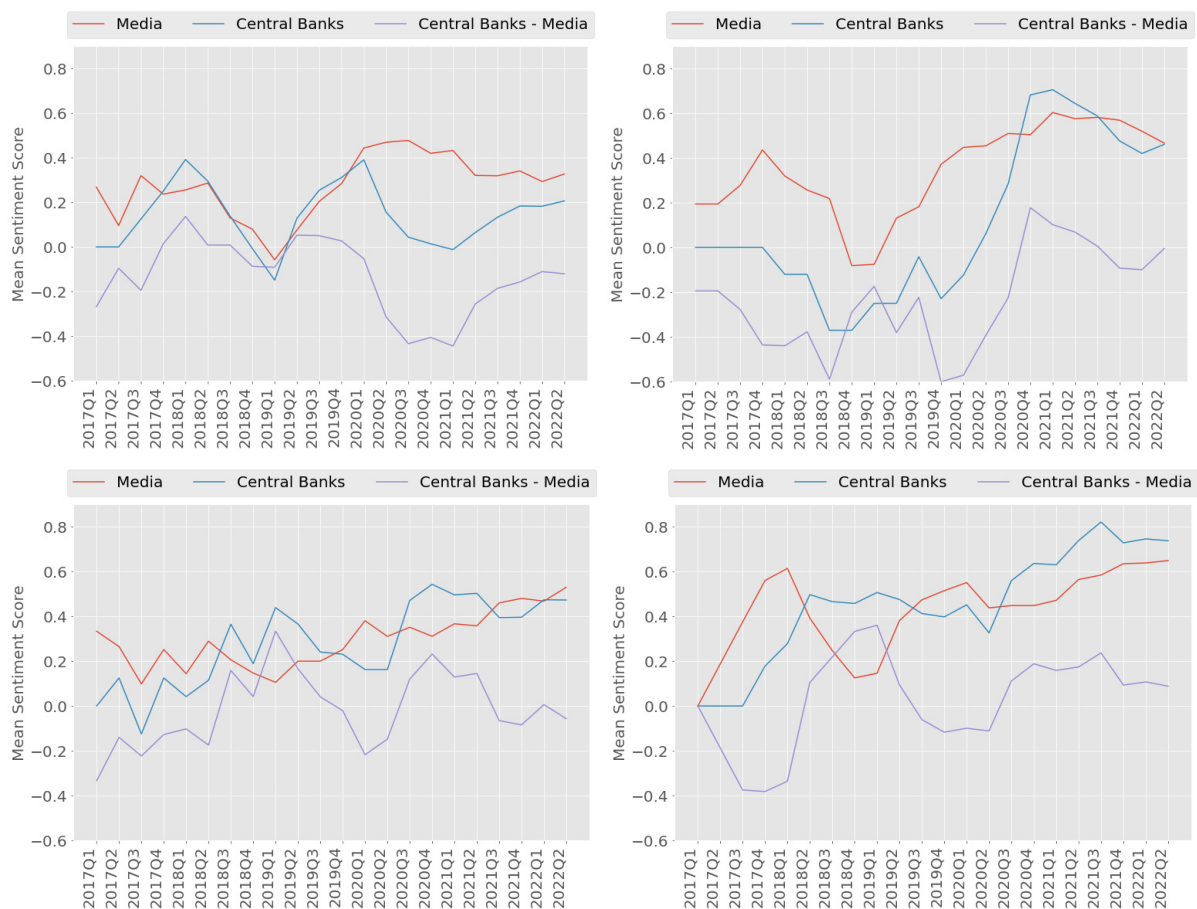
Figure A6. Semantic distances among topics
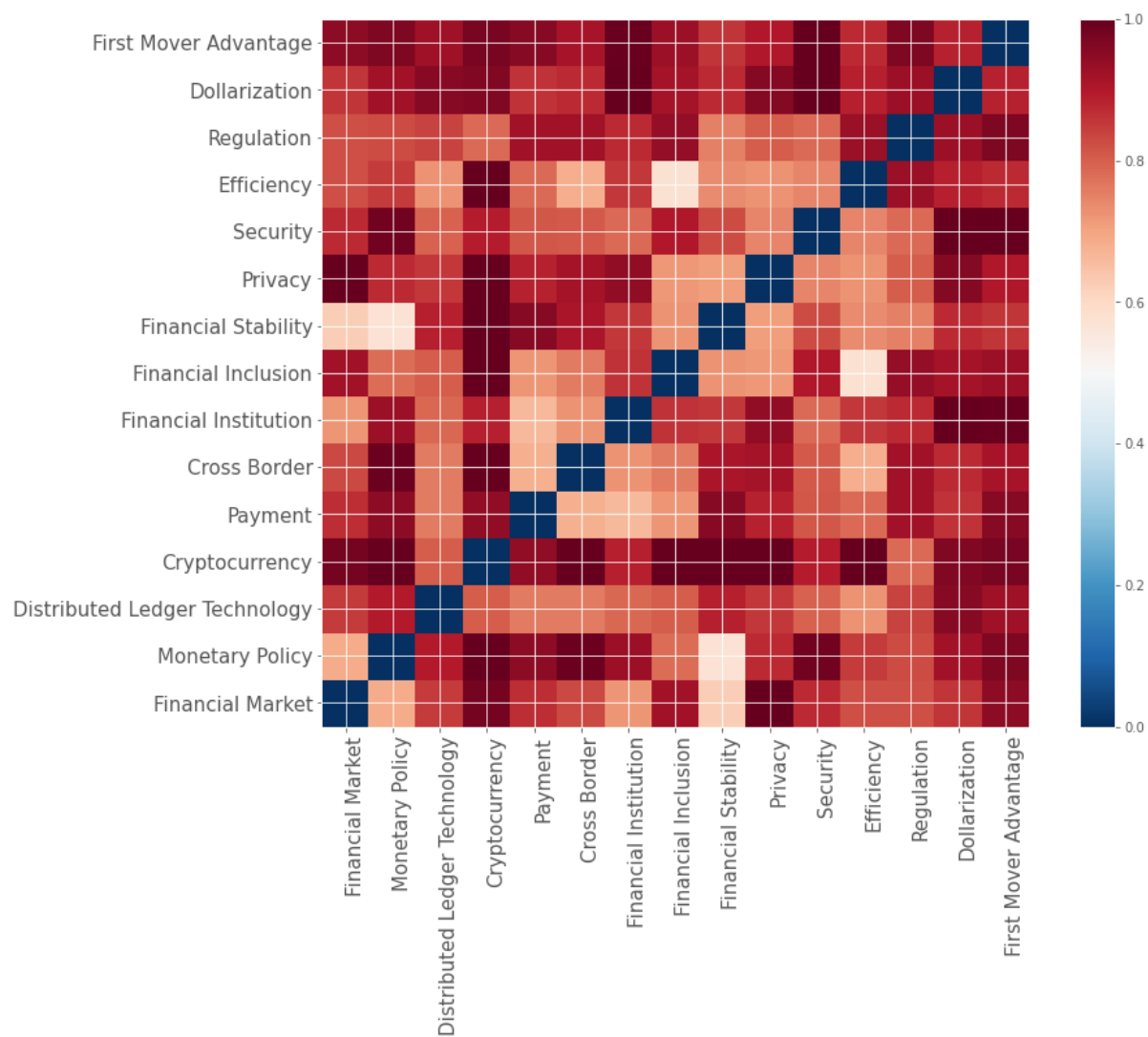
This figure plots the semantic distance between each pair of topics, measured by 1 minus the Pearson Correlation between the word2vec embeddings of the topic terms.

Figure A7. Distribution of topic exposure by year: Media (left) and central bank (right) articles
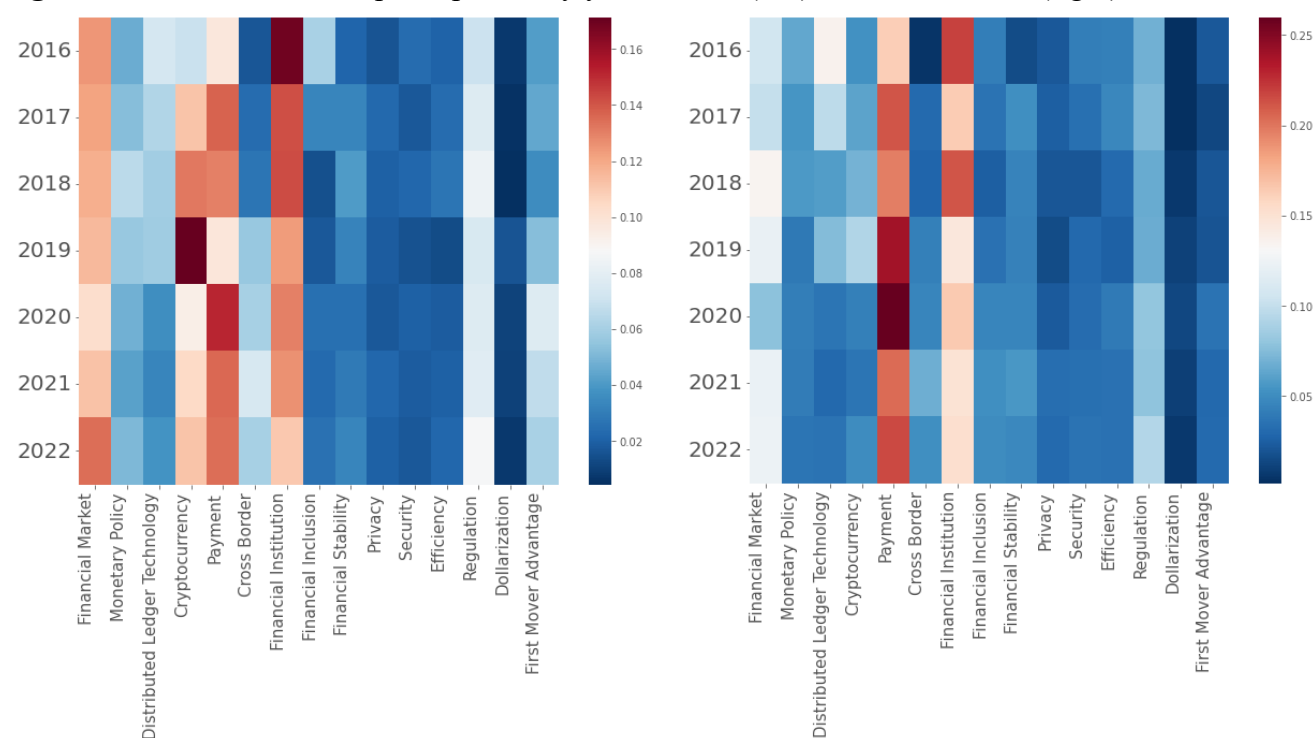
This figure plots the mean topic exposure of CBDC-related paragraphs in news articles (left panel) and central bank publications (right panel) of each topic in each year, covering the 15 sample jurisdictions from 2016Q1 to 2022Q2.

Figure A8. Distribution of topic exposure by jurisdiction: Media (left) and central bank (right) articles
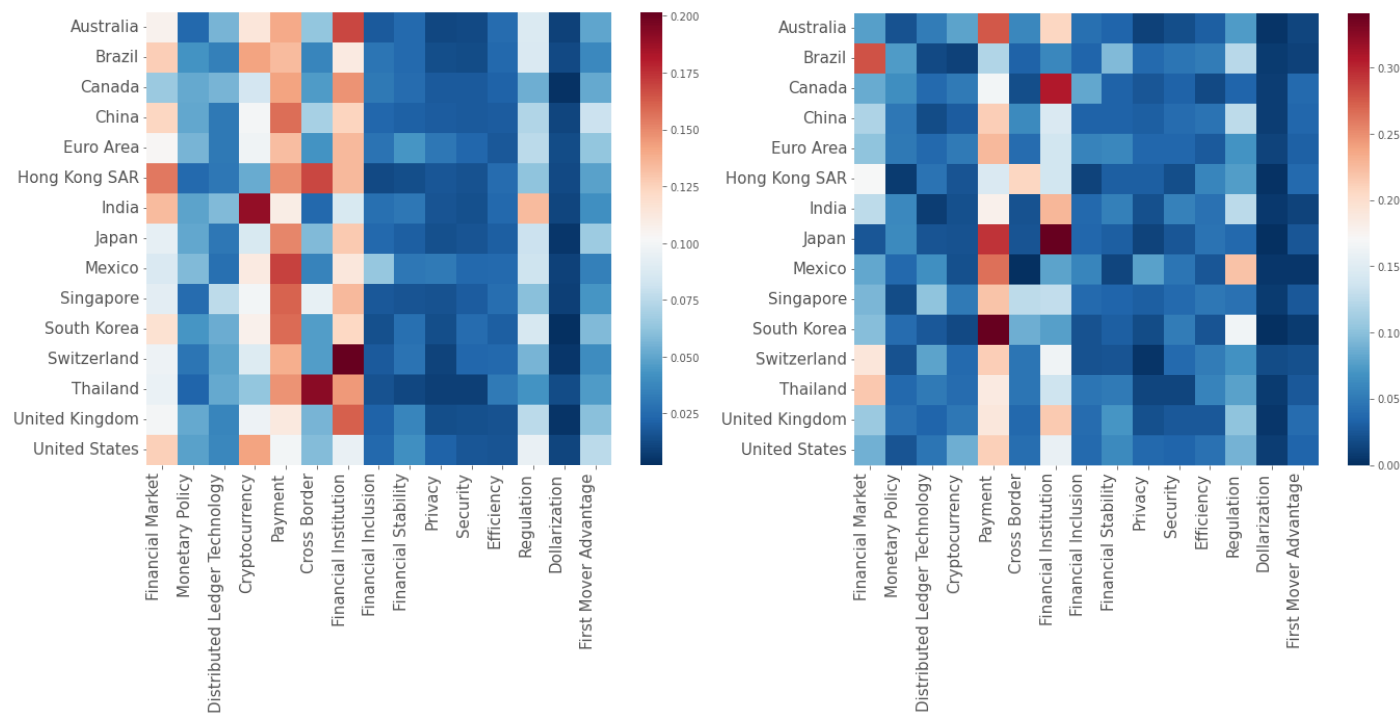
This figure plots the mean topic exposure of CBDC-related paragraphs in news articles (left) and central bank publications (right) of each topic for each jurisdiction, covering the 15 sample jurisdictions from 2016Q1 to 2022Q2.

Table A1. Variable descriptions

Variable	Description
sent_media, sent_cb	CBDC-specific sentiment of a document, measured by the mean CBDC sentiment of all CBDC-related sentences in the document. Sentence-level CBDC sentiment is measured by a probability-weighted sentiment score (as defined in Eq. (1)) calculated from the output of a fine-tuned classifier based on the RoBERTa-Large model.
sent_retail, sent_wholesale	Sentiment scores constructed by considering retail (or wholesale) CBDC-related terms only.
sent_noncbdc, sent_noncbdc_global	Sentiment of non-CBDC related paragraphs in a document. Measured by the mean sentiment of all sentences in such paragraphs. Sent_noncbdc only includes non-CBDC paragraphs containing the corresponding jurisdiction name, while Sent_noncbdc_global includes all non-CBDC paragraphs. Sentence-level non-CBDC sentiment is measured by a probability-weighted sentiment score (as defined in Eq. (1)) calculated from the output of the CentralBankRoBERTa model (Pfeifer and Marohl, 2023).
Sent_crypto, sent_bank, sent_payment	Crypto/bank/payment-related sentiment scores of a document. Measured by the mean topic-specific sentiment of all sentences containing topic-related terms. Sentence-level topic-specific sentiment is measured by a probability-weighted sentiment score (as defined in Eq. (1)) calculated from the output of a DeBERTa for ABSA model (Yang et al., 2023). The list of topic-related terms are as follows: (1) commercial bank: ['bank', 'banking ', 'financial institution', 'intermediary', 'intermediate', 'intermediation', 'deposit', 'credit'], excluding 'central bank' and central bank names; (2) payment: ['psp', 'third party payment', 'digital payment', 'mobile payment', 'electronic payment', 'e-payment', 'non-cash payment', 'instant payment', 'mobile device', 'qr code', 'credit card', 'debit card']; (3) cryptocurrency: ['crypto', 'bitcoin', 'btc', ' ether', 'virtual currency', 'stablecoin', 'xrp', 'dogecoin', 'libra ', 'tether', 'usdt', 'usdc', ' luna ', 'initial coin offer', ' ico ', 'digital asset', 'virtual asset', 'non fungible token', 'nft'].
Topic_X	The exposure to Topic X of a document. Measured by the document's count of terms in the topic X's dictionary divided by the total number of terms in the document.
sent_media_prev_T, sent_media_post_T, sent_cb_prev_T, topic_X_media_prev_T, topic_X_media_post_T, topic_X_cb_prev_T	The mean jurisdiction-level media (or central bank) CBDC sentiment (or topic exposure) within a T-day event window around the date when a jurisdiction's central bank releases a CBDC-related publication. Sent_media_prev_T (Sent_cb_prev_T) is the average sentiment of the jurisdiction's media (central bank) CBDC sentiment within the [-T,-1] time window. Sent_media_after_T is the average sentiment of the jurisdiction's media CBDC sentiment within the [0,T-1] time window.
sent_cb_prev_T_other, sent_cb_post_T_other, sent_media_prev_T_other, sent_media_post_T_other	The mean CBDC sentiment of central banks (or media) of other jurisdictions within a T-day event window before (or after) the date when a jurisdiction's central bank releases a CBDC-related publication ($t \in [-T,0)$ for "prev" period and $t \in [0,T)$ for "after" period).
CBDC_project_overall, CBDC_project_retail, CBDC_project_wholesale	Overall/retail/wholesale CBDC project scores for a jurisdiction at the end of a year. Extended from the CBDC project scores developed by Auer et al. (2020) to a yearly panel.
return_T (return_3d, return_10d)	Return_3d(t) = closing_price(t+1)/closing_price(t-2)-1 Return_10d(t) = closing_price(t+8)/closing_price(t-2)-1
size	size = ln (1+market equity)
bm	book-to-market ratio = ln (1+book equity / market equity)
roa	return on assets (Worldscope Field 08326).
leverage	leverage = total liability / total assets
bank_crisis	Google Search Volume Index of the search term "bank crisis" from Google Trends.
int_rate	Policy rate of a jurisdiction.

Note: L.[variable] denotes 1-term lagged value of variable. D.[variable] = variable - L.[variable].

Table A2. Data source and searching strategy for central bank publications

Jurisdiction	Link	Search Term	Language
United States	http://www.federalreserve.gov/	CBDC, Central Bank Digital Currency, Digital Dollar, Project Hamilton	English
United Kingdom	http://www.bankofengland.co.uk/	CBDC, Central Bank Digital Currency, Digital Pound	English
Euro Area	http://www.ecb.europa.eu	CBDC, Central Bank Digital Currency, Central Bank Digital Currencies, Digital Euro, Project Stella	English
Germany	https://www.bundesbank.de/en/	CBDC, Central Bank Digital Currency, Digital Euro, Project Stella	English
	https://www.bundesbank.de/de	CBDC, Digitale Währung der Zentralbank, Digitaler Euro, Projekt Stella	German
France	https://www.banque-france.fr/en	CBDC, Central Bank Digital Currency, Digital Euro, Project Stella	English
	https://www.banque-france.fr	CBDC, Monnaie numérique de la Banque centrale, Euro numérique, Project Stella	French
Italy	https://www.bancaditalia.it/en	CBDC, Central Bank Digital Currency, Digital Euro, Project Stella	English
	https://www.bancaditalia.it/	CBDC, moneta digitale di banca centrale, Euro Digitale, Progetto Stella	Italian
Spain	http://www.bde.es/homee.htm	CBDC, Central Bank Digital Currency, Digital Euro, Project Stella	English
	https://www.bde.es/bde/es/secciones/sobreelbanco/	CBDC, Moneda digital del Banco Central, Euro digital, Proyecto Stella	Spanish
China	http://search.english.www.gov.cn/	CBDC, Central Bank Digital Currency, e-CNY, digital yuan, digital renminbi, digital rmb, DC/EP, Multiple CBDC Bridge, m-CBDC Bridge, mBridge	English
	http://www.gov.cn/	CBDC，DC/EP，央行数字货币，中央银行数字货币，数字人民币，数字货币桥	Chinese
Hong Kong SAR	https://www.hkma.gov.hk/eng	CBDC, Central Bank Digital Currency, e-HKD, Inthanon-LionRock, Multiple CBDC Bridge, m-CBDC Bridge, mBridge	English
	https://www.hkma.gov.hk/chi	央行數字貨幣，央行數碼貨幣，數碼港元，數字货币桥	Cantonese
Canada	http://www.bankofcanada.ca/	CBDC, Central Bank Digital Currency, E-dollar, Project Jasper	English
	https://www.banqueducanada.ca	CBDC, Monnaie numérique de la Banque centrale, E-dollar, Projet Jasper	French
Mexico	https://www.banxico.org.mx/indexen.html	CBDC, Central Bank Digital Currency, Digital Mexican Peso, Digital Peso	English
	http://www.banxico.org.mx	CBDC, moneda digital del banco central, Pesos Mexicanos Digitales, Pesos Digitales	Spanish
Brazil	https://www.bcb.gov.br/en	CBDC, Central Bank Digital Currency, Digital Real, Real Digital, Lift Challenge	English
	https://www.bcb.gov.br	CBDC, Moeda Digital do Banco Central, Moeda fiduciária digital, Real Digital	Portuguese

Jurisdiction	Link	Search Term	Language
Japan	https://www.boj.or.jp/en/index.htm/	CBDC, Central Bank Digital Currency, Digital yen, Project Stella	English
	https://www.boj.or.jp	CBDC、中央銀行デジタル通貨、デジタル円、プロジェクト ステラ	Japanese
South Korea	https://www.bok.or.kr/eng/main/main.do	CBDC, central bank digital currency, E-won	English
	https://www.bok.or.kr/portal/main/main.do	CBDC, 중앙은행 디지털 화폐, E-won	Korean
India	https://www.rbi.org.in	CBDC, Central Bank Digital Currency, Digital-rupee, Digital rupee, e-rupee	English
Thailand	https://www.bot.or.th/Thai/Pages/default.aspx	CBDC, Central Bank Digital Currency, Digital Baht, Inthanon-LionRock, Multiple CBDC Bridge, m-CBDC Bridge, mBridge	English
	https://www.bot.or.th/Thai/Pages/default.aspx	สกุลเงินดิจิทัลของธนาคารกลาง, เงินบาทดิจิทัล	Thai
Singapore	http://www.mas.gov.sg/	CBDC, Central Bank Digital Currency, Digital Singapore dollar, Project Orchid, Project Ubin, Project Dunbar	English
Australia	http://www.rba.gov.au/	CBDC, Central Bank Digital Currency, EAUD, E-AUD, Project Dunbar, Project Atom	English
Switzerland	https://www.snb.ch/en/	CBDC, Central Bank Digital Currency, E-franc, Project Helvetia	English
	https://www.snb.ch/de/	CBDC, Digitale Währung der Zentralbank, E-Franken, Projekt Helvetia	German

This table presents the links to the official websites of central banks and CBDC-related search terms in different languages that we use to construct our sample of central bank publications.

Table A3. Example sentences with positive/neutral/negative sentiment labels

Sentence	Type	Sentiment
we are collaborating with the bank of thailand to explore the potential of a blockchain-based central bank digital currency (cbdc) network, with a view towards more efficient cross-border payments.	Central Bank	Positive
a cbdc of this nature would enable the central bank to register transfers between users, thereby providing protection against money laundering and other illicit uses (or those considered illicit by the rulers of the day), depending on the degree of privacy granted to users.	Central Bank	Positive
those are the three main pillars, because if you can create and issue digital currency that could be spent peer-to-peer between parties all around the world, that can settle transactions with merchants in real time, that can allow you to get access to banking services straight through the central bank without going through the commercial banks, that can allow you to earn interest with the central bank rather than with commercial banks — these are just some of the potential benefits of a central bank digital currency — people i think will increasingly gravitate towards the biggest and most ubiquitous currencies in the world.	Media	Positive
a potential inadequacy of traditional competition policy to address competition issues in the cryptocurrency markets can be found, suggesting direct public participation through a central-bank digital currency as a remedy.	Media	Positive
the prior knowledge and opinions needed for a survey on the digital euro can therefore not be readily assumed to exist among study participants.	Central Bank	Neutral
this means that a national cbdc must be carefully designed, issued and distributed, taking into account the diversity and complexity of various systems and institutions – including, for example, how a cbdc should be used in remote areas where internet access is limited.	Central Bank	Neutral
such standards or even more important to the world where there might be a need--need for interoperability and friction free movement between cbdc, private stablecoins, and other payment mechanisms.	Media	Neutral
cbdcs are presently mostly in the hypothetical stage, with some in proof-of-concept programmes.	Media	Neutral
based on our research to date, there is currently no compelling case to issue a cbdc.	Central Bank	Negative
a key concern is that after the introduction of a digital euro, more or fewer deposits could flow out of commercial banks – which in turn could have implications for financial sector intermediation, monetary policy and financial stability.	Central Bank	Negative
morgan stanley's ahaya warned, "central banks' cbdc initiative could unintentionally result in disrupting banking organizations."	Media	Negative
ecb plans for an e-euro are full of risks.	Media	Negative

Table A4. Performance of CBDC sentiment classifiers

Panel A. Best performance of each large language model on CBDC sentiment classification task

Model	Validation		Test	
	Accuracy	F1 Score	Accuracy	F1 Score
BERT	0.7489	0.7491	0.7511	0.7509
BERT-Large	0.7578	0.7576	0.7689	0.7689
RoBERTa	0.7289	0.7341	0.7844	0.7843
RoBERTa-Large	**0.7800**	**0.7788**	**0.8022**	**0.8002**
GPT2	0.6911	0.6894	0.7422	0.7440
GPT2-XL	0.7178	0.7160	0.7400	0.7376
Mistral-7B	0.7200	0.7140	0.7333	0.7279
Llama3-8B	0.6956	0.6920	0.7222	0.7210

Panel B. Confusion matrix of out-of-sample predictions by RoBERTa-Large model

True Label	Predicted Label		
	Negative	Neutral	Positive
Negative	44	12	3
Neutral	9	150	38
Positive	4	20	170

Note: The models are evaluated using the same testing set. Among the 3000 labeled sentences, randomly draw 70% as training set, 15% as validation set and 15% as testing set. For each LLM, we try batch size of [4, 8, 16], learning rate of [1e-4, 1e-5, 1e-6] and a set of seeds. The table reports results of the best performing model for each LLM based on test F1 score. For larger models, including GPT2-XL, Mistral-7B and Llama-3-8B, we only fine-tune the last three layers of the pre-trained model to avoid overfitting.

Table A5. Top 10 relevant terms of each topic

Seed Term	Top 10 Relevant Terms
financial market	market, financial, fmis, capital_flow, finance, foreign_exchange, value_chain, tradfi, risk_aversion, liquidity
monetary policy	monetary_policy_stance, transmission_of_monetary_policy, monetary, effectiveness_of_monetary_policy, price_stability, unconventional_monetary_policy, macroeconomic, interest_rate, inflation_target, monetary_policy_transmission
distributed ledger technology	distribute_ledger_technology_dlt, dlt, blockchain_technology, distribute_ledger, blockchain, smart_contract, ledger_technology, dlt_based, dlt_platform, dlt_distribute_ledger
cryptocurrency	crypto, virtual_currency, bitcoin, cryptos, virtual_asset, crypto_currency, crypto_asset, crypto_assets, stablecoin, icos
payment	payment_system, payment_method, electronic_payment, transaction, instant_payment, remittance, transfer, cashless_payment, settlement, credit_card
cross border	cross_border_payment, international, cross_border_trade, crossborder, facilitate_cross_border, cross_border_transaction, cross_currency, improve_cross_border, overseas, rmb_cross_border
financial institution	institution, commercial_bank, bank, intermediary, service_provider, private_bank, interbank, psps, lender, non_banks
financial inclusion	greater_financial_inclusion, promote_financial_inclusion, improve_financial_inclusion, increase_financial_inclusion, unbanked, inclusion, underbanked, enhance_financial_inclusion, digitalisation, inclusive_finance
financial stability	stability, monetary_and_financial_stability, systemic_risk, systemic, macroeconomic_stability, macroeconomic_and_financial_stability, price_stability, risk, investor_protection, microprudential
regulation	regulatory_framework, legislation, rule, regulatory, regulatory_regime, law, legal_framework, regulate, oversight, guideline
privacy	privacy_protection, anonymity, confidentiality, personal_privacy, data_protection, protect_privacy, personal_data, civil_liberty, traceability, consumer_protection
security	cybersecurity, safety, investor_protection, consumer_protection, integrity, cyber_security, lcp, personal_information_protection, settlement_finality, robustness
efficiency	operational_efficiency, transparency, convenience, improve_the_efficiency, more_efficient, efficient, speed, speed_and_efficiency, improve_efficiency, efficiency_of_cross_border
dollarization	dollarisation, capital_flight, fragmentation, monetary_sovereignty, gain_foothold, spillover_effect, hyperinflation, capital_outflow, euroisation, exchange_rate
first mover advantage	competitive_advantage, advantage, fall_behind, ahead_of_the_curve, upper_hand, supremacy, competitive_edge, critical_mass, dominance, race

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