

Journal Pre-proof

A central bankers' sentiment index of global financial cycle

Zhen Yu, Wei Liu, Fuyu Yang

PII: S1544-6123(23)00533-0
DOI: <https://doi.org/10.1016/j.frl.2023.104161>
Reference: FRL 104161

To appear in: *Finance Research Letters*

Received date : 5 May 2023
Revised date : 20 June 2023
Accepted date : 26 June 2023



Please cite this article as: Z. Yu, W. Liu and F. Yang, A central bankers' sentiment index of global financial cycle. *Finance Research Letters* (2023), doi: <https://doi.org/10.1016/j.frl.2023.104161>.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2023 Published by Elsevier Inc.

A Central Bankers' Sentiment Index of Global Financial Cycle

June 20, 2023

Abstract

We propose a novel Central Bankers' Sentiment Index (CBSI) to measure the global financial cycle (GFC) using text analysis on 6,514 central bankers' speeches. We find that the CBSI outperforms the conventional measures in capturing the GFC by tracing historical events and identifying turning points. Our empirical evidence further demonstrates the comparative advantages of CBSI in reflecting the capacities of central banks to aggregate financial system information and intervene in financial market operations. Our findings provide new insights into a more accurate measurement of the GFC and also contribute to a better understanding of the impact of central bank speeches.

JEL classification: G100, G150, E32

Keywords: Global financial cycle; Sentiment; Central bankers' speeches

1 Introduction

The growing relevance of sentiment in economic and financial research has given rise to a new research field, *sentometrics* (Kearney and Liu, 2014; Larsen and Thorsrud, 2019; Gentzkow et al., 2019; Larsen and Thorsrud, 2019; Algaba et al., 2020; Shapiro et al., 2022; Helmi et al., 2023). To analyse the sentiment embedded in various forms of central bank communication, a significant body of literature suggests applying *sentometric* analysis to the information conveyed by central banks through different channels. These channels include interest rate announcements, minutes of monetary policy committee meetings, speeches delivered by central bank governors, and published reports, among others, see Cieslak and Schrimpf (2019), Armelius et al. (2020), Correa et al. (2021), Apel

et al. (2022), Bazot et al. (2022), and Gorodnichenko et al. (2023). In Stolbov et al. (2022) and Petropoulos and Siakoulis (2021), it is shown that the sentiment conveyed in central bank communication captures the movements in financial cycle indicators, which include credit, asset prices, exchange rates, and interest rates at both the national or global levels.

Motivated by this literature, we propose constructing a Central Bankers' Sentiment Index (CBSI) following a text analysis approach to measure the GFC. Based on a pre-defined dictionary by Loughran and McDonald (2011), we obtain the sentiment scores for 6,514 speeches from 2002Q1 to 2021Q4. These speeches are published by eight central banks, including the Federal Reserve System, European Central Bank, Bank of Japan, Bank of England, Reserve Bank of Australia, Bank of Canada, Swiss National Bank, and Monetary Authority of Singapore. The CBSI is achieved by extracting a common factor from the aggregated sentiment scores using a generalized dynamic factor model (GDFM). As far as we know, this is the first study to use central bankers' speeches to construct a sentiment index of GFC.

To assess the effectiveness of CBSI in reflecting the GFC, we compare its performance to that of the conventional measures. The previous studies widely use the Volatility Index (VIX) to measure the GFC directly (Bruno and Shin, 2014; Rey, 2015; Cerutti et al., 2019a; Wang and Liu, 2023). Given that the VIX measures global risk, which is the primary driver of cross-border capital flows that manifest in the GFC, VIX is arguably a reasonable measure to proxy the GFC. However, since the subprime crisis of 2008, country-specific determinants, rather than global risk, have been prominent in accounting for global capital flows (Fratzscher, 2012). As a result, the VIX is no longer as closely linked to capital flows as it was before. To make up for the disadvantage of the VIX, a growing body of literature uses the common factors extracted from the financial variables to measure the GFC indirectly. These financial variables are relatively sensitive to the global financial system, including leverage (Jordá et al., 2016), house price (Potjagailo and Wolters, 2023), credit (Jordá et al., 2019), capital flow (Cerutti et al., 2019b), interest rates (Del Negro et al., 2019), equity price (Miranda-Agrippino and Rey, 2020). Following this literature, we extract a common factor using a set of financial variables as an indirect measure (FGFC) of the GFC. Then we conduct a series of pairwise comparisons between the CBSI, VIX and

the FGFC from different perspectives.

We find that the CBSI has three significant comparative advantages. First, the comparisons based on the historical events and turning points intuitively show that the CBSI outperforms the VIX and FGFC in tracing extreme events that had strong impact on the global financial system. In contrast, the widely-used VIX and the FGFC are not able to consistently reflect the global financial conditions. Second, the comparisons based on concordance index and generalized forecast error variance decomposition suggest that the CBSI contains more information than the VIX and FGFC. Third, the comparisons based on concordance indices between the CBSI and each financial variable demonstrate that the CBSI is able to reflect the global financial condition comprehensively and timely because it effectively integrates information from the global financial system.

We make a significant contribution to the extensive body of work in international finance and macroeconomics that focuses on global financial cycles, global financial conditions, and global financial surveillance. Our contribution lies in providing a sensitive and reliable measure of the GFC. The novel CBSI not only aggregates the relevant information from the global financial system, as expressed through central bankers' sentiment, but also reflects the ability of central banks to intervene in financial cycles while conducting macroeconomic regulations and maintaining financial stability.

As a forward-looking indicator, we argue that the CBSI outperforms conventional measures of the GFC, e.g. the VIX, in effectively capturing the movement of GFC and identifying its turning points. Supported by the results of our Forecast Error Variance Decomposition exercise, we propose that the CBSI can be utilized for predicting the evolution of the financial climate or monitoring the stability of the global financial system.

Additionally, our research contributes to the literature on the use of communication as a powerful toolkit by central banks (Han et al., 2022; Jarociński, 2022; Wang et al., 2022). The results from our Forecast Error Variance Decomposition exercise indicate that extensive information from the financial system can be effectively incorporated into central bankers' speeches. By applying sentometric techniques to central bank communication, we have developed a novel sentiment index, i.e. CBSI, which can be utilized to capture financial stability, financial stress, and forecast financial market turbulence. Our findings further under-

score the essential role of communication by central banks (Correa et al., 2021; Petropoulos and Siakoulis, 2021; Stolbov et al., 2022).

The rest of the paper is organized as follows. Section 2 describes the methodologies and data. Section 3 presents the empirical findings, and Section 4 concludes.

2 Methodologies and Data

2.1 Constructing the CBSI

We collect the texts of 6,514 English-translated speeches from the Bank for International Settlements (BIS) during 2002Q1-2021Q4. The eight representative central banks are selected for their top rankings in foreign exchange reserves and foreign exchange market turnover ¹. Following Armelius et al. (2020), each speech is first transformed into a list of words. Then, based on a predefined dictionary by Loughran and McDonald (2011), a net positivity score, S , is calculated for each speech using equation (1), which represents the sentiment of the central bankers' speeches. Define $Positivity = No.ofPositiveWords/No.ofTotalWords$ and $Negativity = No.ofNegativityWords/No.ofTotalWords$,

$$S = Positivity - Negativity. \quad (1)$$

Fig.1 plots a rolling window moving average of S for the 30 most recent speeches. As seen from Fig.1, the sentiment scores across major central banks exhibit a similar pattern, and the common component of the pattern is exactly the global financial cycle we attempt to capture. To construct a central bankers' sentiment index (CBSI), we firstly quarterly average S for the 8 central banks separately to obtain $S_{i,t}$, where $i = 1, \dots, 8$ and $t = 1, \dots, 80$. Then we propose applying a generalized dynamic factor model (GDFM) from Forni et al. (2017) to

¹China and India were not included in our sample due to data limitations that prevented them from meeting certain requirements, such as having a high share of official foreign exchange reserves, sufficient foreign exchange turnover, and an adequate sample of central bankers' speeches. Moreover, on the Bank for International Settlements (BIS) website, only 57 speech observations were available for China's central bank. Additionally, based on the Currency Internationalization Index, the Chinese currency (RMB) has a lower degree of internationalization compared to other major international currencies. India was not included in our analysis due to the relatively low composition of the Indian Rupee (INR) as official foreign exchange reserves. Additionally, the Rupee is not one of the top ranked currencies based on its over-the-counter (OTC) foreign exchange turnover.

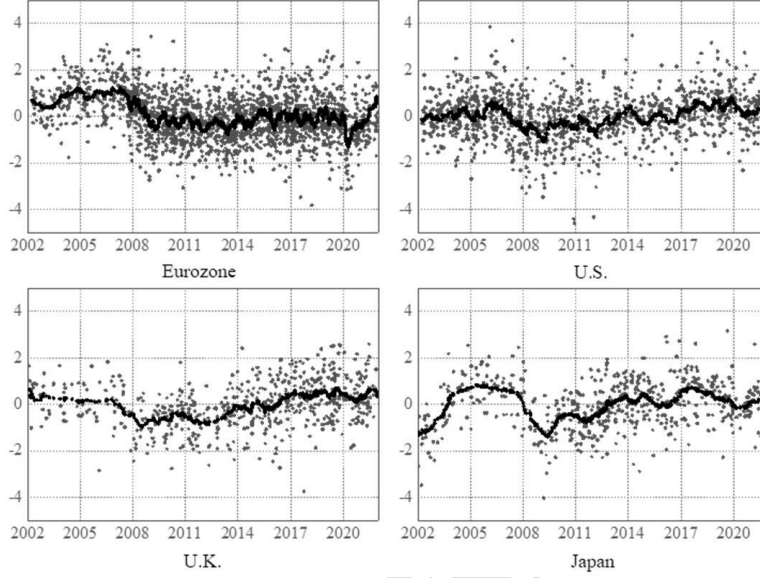


Fig. 1. Rolling average of sentiment scores. The scatter dots represent the sentiment score S of speeches published by central bank. The solid lines show the rolling averages for the most recent 30 speeches of four central banks.

the sentiment score variable $S_{i,t}$. This requires an estimation of a common factor that drives the underlying process of $S_{i,t}$ in a panel setting.

We adopt most of the notations and the GDFM specification from Forni et al. (2017), and the underlying process of panel $S_{i,t}$ can be modelled as follows:

$$S_{i,t} = \chi_{i,t} + \varepsilon_{i,t}, \quad (2)$$

$$\chi_{i,t} = \mathbf{B}(L)\mathbf{f}_t = b_{i1}(L)f_{1,t} + b_{i2}(L)f_{2,t} + \dots + b_{iq}(L)f_{q,t}, i \in N, t \in T, \quad (3)$$

where $\mathbf{B}(L) = (b_{i1}, \dots, b_{iq})$ and $\mathbf{f}_t = (f_{1t}, \dots, f_{qt})^T$. The unobservable common component, $\chi_{i,t}$, is driven by an unobservable q -dimensional orthonormal white noise, $\mathbf{f}_t$, which is referred to as the low-dimensional vector of common shocks. The time-varying factor loadings are presented by $\mathbf{B}(L)$, where the lag operator L captures the dynamic relationship between variables. In Forni et al. (2017), the cross-sectional orthogonality conditions are relaxed, which allows the idiosyncratic components $\varepsilon_{i,t}$ to be “weakly” cross-correlated, and hence a contemporaneous

correlation among $S_{i,t}$. In this paper, we estimate the unobservable high dimensional common factor $\mathbf{f}_t$ as the CBSI, using the method proposed by Wu and Zaffaroni (2017). Based on the minimum description length (MDL) principle proposed by Hallin and Liška (2007), $q = 1$ number of factor is selected in the GDFM specification in equation (3).

2.2 Constructing the FGFC

Extensive research has shown that the financial variables, such as leverage, house prices, credit, capital flows, long-term interest rates, and equity prices, are closely associated with the global financial system. In particular, the co-movement of these variables, as suggested by Rey (2015), is an important measure of the global financial cycle. Table 1 presents the definitions of the financial variables included in this study. To effectively track the GFC, our sample consists of financial variables from nine countries. These countries have currencies with a high share of official foreign exchange reserves, indicating a significant degree of currency internalization. Also, these nine countries demonstrate significant participation in the international financial market and possess a high level of financial development, which is measured by their foreign exchange turnover.

Similarly, we use the GDFM to extract the common factor from these financial variables. Denoting these financial variables as $\mathbf{F}_{i,t}$, we can estimate an unobservable common factor, Φ_t , which drives the underlying process of panel $\mathbf{F}_{i,t}$, using equation (4) and equation (5).

$$\mathbf{F}_{i,t} = \mathbf{x}_{i,t} + \epsilon_{i,t}, \quad (4)$$

$$\begin{aligned} \mathbf{x}_{i,t} &= \mathbf{B}(L)\Phi_t = b_{i1}(L)u_{1,t} + b_{i2}(L)u_{2,t} + \dots + b_{iq}(L)u_{q,t}, \\ i &\in N, t \in T, \end{aligned} \quad (5)$$

where $\mathbf{F}_{i,t} \in \mathbb{R}^{6 \times 1}$ is a vector of observed financial variables for country i at time t . Hence, Φ_t , capturing the co-movements of these six key financial variables across countries, can serve as a measure of the global financial cycle, denoted by FGFC.

Table 1: Definitions of the Financial Variables. Financial variables from nine countries, denoted as $F_{i,t}$, are obtained from BIS, OECD, IMF, Wind databases and Singapore Department of Statistics. Some financial variables are not available for the entire European Union. We have included the Germany and France instead of the European Union, because both of them are the core countries of the European Union, and both rank high in foreign exchange reserves and foreign exchange market turnover.

Variable Name	Definition	Form	References
Leverage	Credit-to-GDP ratios	Growth rate	Jordá et al. (2016)
House price	House price index	Growth rate	Potjagailo and Wolters (2023)
Credit	Credit to private non-financial sector from all sectors	Growth rate	Jordá et al. (2019)
Capital flows	Total liabilities and assets for investments	Growth rate	Cerutti et al. (2019a)
LT rates	Long-term interest rates	Difference	Del Negro et al. (2019).
Equity prices	Dow Jones Industrial Average Index Nikkei 225 Index FTSE 100 Index Deutsche Boerse DAX Index S&P/TSX Composite Index Swiss Market Index Straits Times Index S&P/ASX 200 Index CAC 40 Index	Growth rate	Miranda-Agrippino and Rey (2020) Bekaert and Mehl (2019)

3 Empirical Findings

3.1 A Comparison Based on the Historical Events and Turning Points

In this section, we evaluate the performance of CBSI, VIX and FGFC in tracing the GFC. Fig.2 plots our CBSI, VIX, and the FGFC, corresponding to historical events that significantly affected the global financial conditions. We observe

that all three series exhibit similar patterns for most of the sample periods, but the CBSI and VIX performance better than the FGFC in response to extreme historical events such as the September 11 attacks, the subprime mortgage crisis, the European crisis, and the COVID-19 pandemic, reacting more sensitively and moderately. This is likely due to that there is typically a time delay between data collection and data announcements by the Bureau of Statistics in all countries, most financial variables can at best be a realization or estimation of past financial conditions. In contrast, central bank communications through speeches not only have a direct and immediate impact on financial markets (Gorodnichenko et al., 2023) but also convey medium-term predictions about the global and local economies (Petropoulos and Siakoulis, 2021). Therefore, the sentiment components contained in the CBSI are more responsive and rapid in capturing crises and extreme events in global financial markets. This finding is also supported by the conclusion of Correa et al. (2021) that central bankers adjust the sentiment in their communications prior to financial crises.

In addition, as shown in Fig.2, during the period from 2002 to 2004, the downward fluctuations of the GFC, caused by the rate-hike cycle in the U.S. Federal Reserve, are accurately captured by the declines in the CBSI and FGFC, while the VIX fails to do so. This observation confirms that the VIX has not consistently reflected global financial conditions, as noted in Fratzscher (2012). Overall, based on its performance in tracking historical events in the GFC, the CBSI demonstrates superior ability compared to the VIX and FGFC.

To identify contraction and expansion periods, we apply the BP Filter (Christiano and Fitzgerald, 2003) as well as the BBQ algorithm (Gerhard and Charlotte, 1971) to the FGFC. The shading in Fig.3 shows the contraction and expansion periods based on the turning points of the cycle component in FGFC.

As shown in Fig.3, the cycle fluctuations of CBSI and FGFC are more strongly synchronized than those between the VIX and FGFC. Specifically, when considering the turning points, the dates of peaks in the VIX cycle components only correspond to the peaks in FGFC before 2008. This finding is consistent with Fratzscher (2012), which suggests that the VIX is no longer strongly connected to the dynamics of global financial conditions since 2008. Explanations can be found in Chow et al. (2020), where it is demonstrated that when the diffusion assumptions in the underlying stochastic process of returns are relaxed, the VIX

generally underestimates the ‘true’ volatility, i.e. the ex-ante standard deviation of log-returns. In particular, the estimation bias of volatility in the VIX significantly increases during volatile markets.

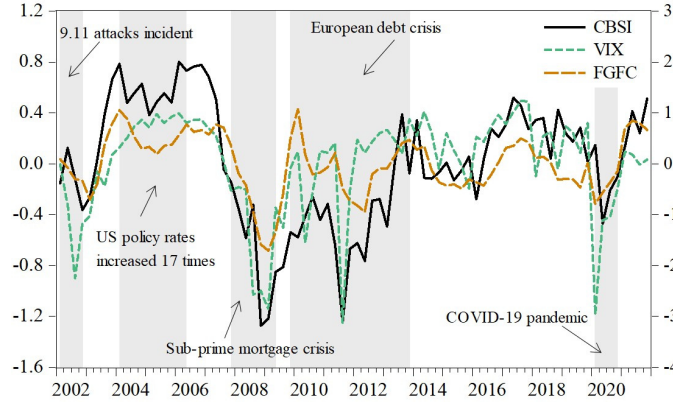


Fig. 2. Three measures of the global financial cycle. This figure plots the constructed central bankers' sentiment index (CBSI), the VIX, and the estimated common factor of financial variables FGFC corresponding to extreme historical events. The grey shaded areas indicate the historical events. The VIX scale is shown on the right y-axis.

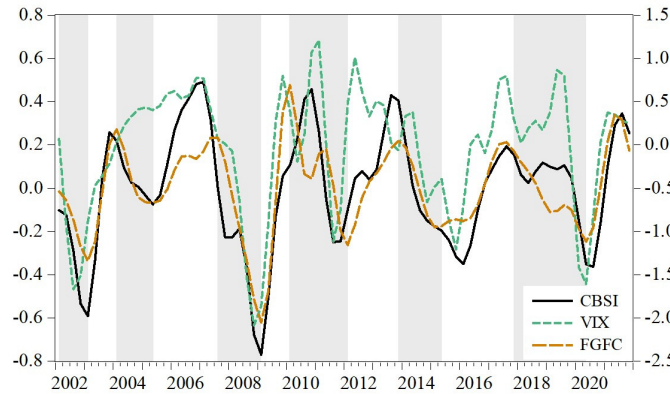


Fig. 3. Cycle components of the CBSI, VIX and FGFC. The grey shaded areas indicate the contraction and expansion periods, which are identified based on the turning points of the cycle component in FGFC. The scale for VIX is shown on the right y-axis.

Our empirical findings demonstrate that the CBSI can effectively serve as a leading indicator for the formation of the GFC. This is visually illustrated by the divergent peaks observed in Figure 3, where the CBSI and FGFC exhibit distinct patterns compared to the VIX. Our result aligns with the findings of Correa et al.

(2021), who provide a clear explanation for why the CBSI outperforms the VIX in capturing these critical turning points in the financial cycle. Specifically, the sentiment communicated by central banks plays a significant role in predicting turning points, particularly those that lead to crisis episodes. Combining the previous result about the failure of VIX in capturing the rate-like cycle in the U.S. Federal Reserve, we argue that it is not prudent to rely solely on the VIX as a measure of the GFC.

3.2 A Comparison Based on the Concordance Index

In this section, we use the concordance index defined by Harding and Pagan (2002) in equation.(6) to compare the levels of pairwise synchronization between CBSI, VIX and the FGFC.

$$\hat{I}_{ij} = 1/T \left[\sum_{t=1}^T C_{it}C_{jt} + \sum_{t=1}^T (1 - C_{it})(1 - C_{jt}) \right], \quad (6)$$

where i and j indicate two of the three series, respectively. $\hat{I}_{ij}$ is the degree of concordance between series i and j , capturing the notion of whether i is pro or counter-cyclical with j , which is quantified by the fraction of C_{it} and C_{jt} that are simultaneously in the same state of expansion ($C_t = 1$) or contraction ($C_t = 0$). Fig.4 illustrates the degree of concordance between CBSI and VIX, CBSI and FGFC, as well as between VIX and FGFC over a lag of 0 to 4 periods. The concordance degrees $\hat{I}_{CBSI,VIX}$, $\hat{I}_{CBSI,FGFC}$ and $\hat{I}_{VIX,FGFC}$ indicate that the cycle components of CBSI are synchronized with those of VIX and FGFC. However, both $\hat{I}_{CBSI,VIX}$ and $\hat{I}_{CBSI,FGFC}$ are higher than $\hat{I}_{VIX,FGFC}$ at any lag length, which indicates that the CBSI may contain more information of the GFC than the VIX and FGFC. This can be explained by the intrinsic nature of central bankers' speeches. In an era of economic and financial globalization, the variety of monetary policy tools implemented by central bankers not only focuses on a domestic country's economic health but also the future prospects of the regional or global economy. Central bankers' speeches aggregate all the internal quantitative and qualitative analysis of the current central bank operations and the outlook of the economy (Petropoulos and Siakoulis, 2021). Thus, the CBSI, filtered with text mining tools from central bankers' speeches, contains comprehensive and

significant information regarding the evolution of the GFC. In comparison, the VIX lacks comprehensiveness as it stems from a single market. Although the FGFC integrates information from various financial markets, it only reflects the current financial condition and is not as forward-looking as the CBSI.

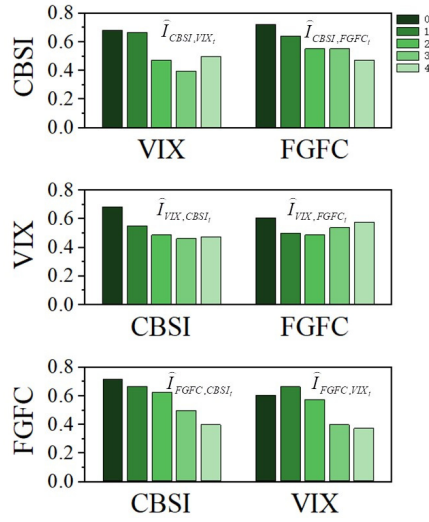


Fig. 4. Concordance index. For example, the upper figure shows the degree of concordance between the CBSI and both the FGFC and VIX in the lag of 0-4 period.

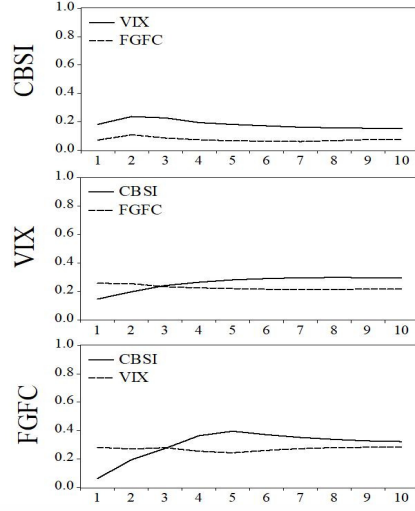


Fig. 5. The results of generalized Forecast Error Variance Decomposition. For example, the upper figure shows the contribution of FGFC and VIX to the variance of CBSI.

3.3 A Comparison Based on the Generalized Forecast Error Variance Decomposition

In this section, we estimate a Vector Autoregression (VAR) model composed of the CBSI, VIX, and the FGFC. Then, using the generalized Forecast Error Variance Decomposition technique proposed by Lanne and Nyberg (2016), we evaluate the information content of each series. Fig.5 demonstrates that the CBSI explains 14.7% and 6.4% of the variances in VIX and FGFC, respectively. At a horizon of 10-period, these proportions increase to 29.7% in the VIX and 32.3% in FGFC. However, at the same horizon of periods, the FGFC explains only 7.7% of the variance in CBSI, while the VIX explains less than 15.4% of the variance

in CBSI. This further confirms that the CBSI is more informative than both the FGFC and the VIX series.

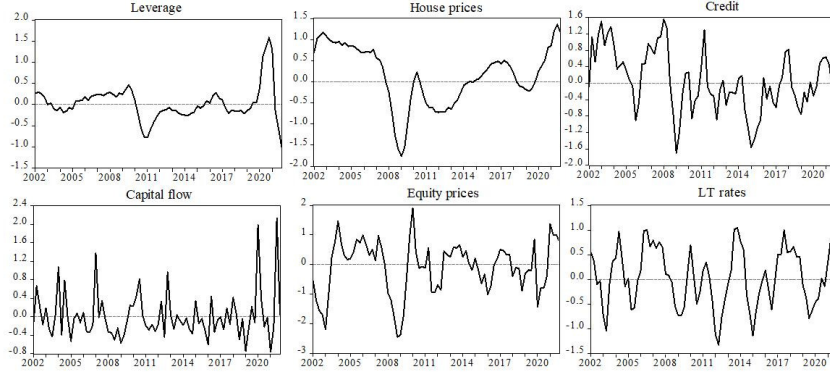


Fig. 6. Six common factors of financial variables in Table 1.

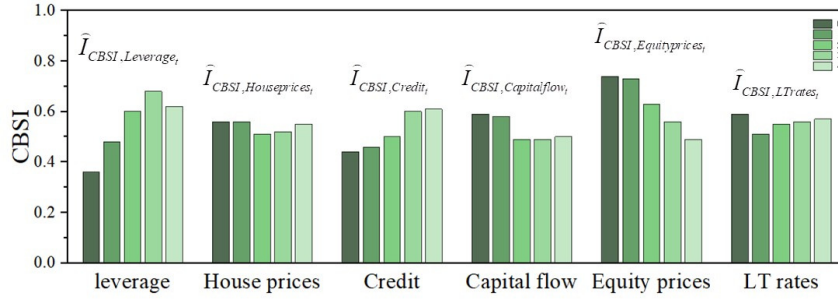


Fig. 7. Concordance index. The figure indicates the degree of concordance between the CBSI and leverage, house prices, credit, capital flow, equity prices and LT rates in the lag of 0-4 period, respectively.

3.4 A Comparison with Other Measures

Using the GDFM, we estimate six separate common factors for the financial variables in Table 1, as plotted in Fig.6. We observe low-frequency fluctuations in the leverage and house prices, which is consistent with the findings of Claessens et al. (2012) and Borio (2014). In contrast, credit, equity prices, long-term interest rates and capital flows fluctuate more frequently, as suggested by Potjagailo and Wolters (2023) and Del Negro et al. (2019).

Fig.7 shows the concordance indices between the CBSI and each financial common factor. The relatively high degrees of concordance between the CBSI

and each financial common factor within 4 periods of lag indicate that CBSI is able to reflect changes in global financial conditions in a timely manner because it effectively integrates information from the global financial system. Our results are well aligned with the existing literature, and our empirical findings provide further support for the substantial connection between central bank communication and a wide variety of financial cycle variables, such as credit (Tiberto et al., 2020), house prices (Binder et al., 2023), currency markets (Dossani, 2021), capital flows (Correa et al., 2021), interest rates (Smales and Apergis, 2017), and equity prices (Neuhierl and Weber, 2019).

4 Conclusion

We propose the Central Bankers' Sentiment Index (CBSI) as a novel measure of the global financial cycle, derived from the sentiment scores of 6,514 central bankers' speeches of 8 central banks from 2002 to 2021. Compared with the conventional measures of the global financial cycle, the CBSI performs better for tracing significant historical events. The analysis of turning points demonstrates the comparative advantage of CBSI and also indicates that it is not prudent to rely solely on the well-know VIX as a measure of the global financial cycle. The high degrees of concordance show that the CBSI is strongly synchronized with each comparable measure and contains more information, which is also confirmed by the results of a Forecast Error Variance Decomposition exercise. Further evidence from the pairwise concordance index between the CBSI and financial variables suggests that the CBSI is able to reflect changes in global financial conditions in a timely manner because it effectively integrates information from the global financial system. Overall, the CBSI is a sensitive and reliable measure of the global financial cycle. We recommend considering the CBSI as a basic measure of the global financial cycle or global financial condition in future research. The CBSI can also be useful for monitoring the stability of the global financial system and should be incorporated into the global surveillance toolbox.

References

- Algaba, A., Ardia, D., Bluteau, K., Borms, S., Boudt, K., 2020. Econometrics meets sentiment: An overview of methodology and applications. *Journal of Economic Surveys* 34, 512–547. URL: <https://doi.org/10.1111/joes.12370>.
- Apel, M., Blix Grimaldi, M., Hull, I., 2022. How much information do monetary policy committees disclose? evidence from the fomcâs minutes and transcripts. *Journal of Money, Credit and Banking* 54, 1459â1490. URL: <https://doi.org/10.1111/jmcb.12885>.
- Armeliu, H., Bertsch, C., Hull, I., Zhang, X., 2020. Spread the word: International spillovers from central bank communication. *Journal of International Money and Finance* 103, 102116. URL: <https://doi.org/10.1016/j.jimonfin.2019.102116>.
- Bazot, G., Monnet, E., Morys, M., 2022. Taming the global financial cycle: central banks as shock absorbers in the first era of globalization. *The Journal of Economic History* 82, 801–839. URL: <https://doi.org/10.1016/j.intfin.2022.101692>.
- Bekaert, G., Mehli, A., 2019. On the global financial market integration “swoosh” and the trilemma. *Journal of International Money and Finance* 94, 227–245. URL: <https://doi.org/10.1016/j.jimonfin.2019.02.001>.
- Binder, C., Kuang, P., Tang, L., 2023. Central bank communication and house price expectations. NBER working paper , 31232 URL: <https://doi.org/10.3386/w31232>.
- Borio, C., 2014. The financial cycle and macroeconomics: What have we learnt? *Journal of Banking & Finance* 45, 182–198. URL: <https://doi.org/10.1016/j.jbankfin.2013.07.031>.
- Bruno, V., Shin, H.S., 2014. Cross-border banking and global liquidity. *The Review of Economic Studies* 82, 535–564. URL: <https://doi.org/10.1093/restud/rdu042>.
- Cerutti, E., Claessens, S., Puy, D., 2019a. Push factors and capital flows to emerging markets: why knowing your lender matters more than fundamentals. *Journal of International Economics* 119, 133–149. URL: <https://doi.org/10.1016/j.jinteco.2019.04.006>.

- Cerutti, E., Claessens, S., Rose, A.K., 2019b. How important is the global financial cycle? evidence from capital flows. *IMF Economic Review* 67, 24–60. URL: <https://doi.org/10.1057/s41308-018-0072-x>.
- Chow, K.V., Jiang, W., Li, J., 2020. Does vix truly measure return volatility? *Handbook of Financial Econometrics, Mathematics, Statistics, and Machine Learning*, 1533–1559 URL: <https://doi.org/10.2139/ssrn.2489345>.
- Christiano, L.J., Fitzgerald, T.J., 2003. The band pass filter. *International Economic Review* 44, 435–465. URL: <https://doi.org/10.1111/1468-2354.t01-1-00076>.
- Cieslak, A., Schrimpf, A., 2019. Non-monetary news in central bank communication. *Journal of International Economics* 118, 293–315. URL: <https://doi.org/10.1016/j.jinteco.2019.01.012>.
- Claessens, S., Kose, M.A., Terrones, M.E., 2012. How do business and financial cycles interact? *Journal of International Economics* 87, 178–190. URL: <https://doi.org/10.1016/j.jinteco.2011.11.008>.
- Correa, R., Garud, K., Londono, J.M., Mislang, N., 2021. Sentiment in central banks' financial stability reports. *Review of Finance* 25, 85–120. URL: <https://doi.org/10.1093/rof/rfaa014>.
- Del Negro, M., Giannone, D., Giannoni, M.P., Tambalotti, A., 2019. Global trends in interest rates. *Journal of International Economics* 118, 248–262. URL: <https://doi.org/10.1016/j.jinteco.2019.01.010>.
- Dossani, A., 2021. Central bank tone and currency risk premia. *Journal of International Money and Finance* 117, 102424. URL: <https://doi.org/10.1016/j.jimonfin.2021.102424>.
- Forni, M., Hallin, M., Lippi, M., Zaffaroni, P., 2017. Dynamic factor models with infinite-dimensional factor space: Asymptotic analysis. *Journal of Econometrics* 199, 74–92. URL: <https://doi.org/10.1016/j.jeconom.2017.04.002>.
- Fratzscher, M., 2012. Capital flows, push versus pull factors and the global financial crisis. *Journal of International Economics* 88, 341–356. URL: <https://doi.org/10.1016/j.jinteco.2012.05.003>.
- Gentzkow, M., Kelly, B., Taddy, M., 2019. Text as data. *Journal of Economic Literature* 57, 535–574. URL: <https://doi.org/10.1257/jel.20181020>.

- Gerhard, B., Charlotte, B., 1971. Cyclical Analysis of Time Series: Selected Procedures and Computer Programs. National Bureau of Economic Research. URL: https://ideas.repec.org/b/nbr/nberbk/bry_71-1.html.
- Gorodnichenko, Y., Pham, T., Talavera, O., 2023. The voice of monetary policy. *American Economic Review* 113, 548–584. URL: <https://doi.org/10.1198/016214506000001275>.
- Hallin, M., Liška, R., 2007. Determining the number of factors in the general dynamic factor model. *Journal of the American Statistical Association* 102, 603–617. URL: <https://doi.org/10.1198/016214506000001275>.
- Han, X., Ma, S., Peng, Y., Xie, X., 2022. Central bank communication, corporate maturity mismatch and innovation. *International Review of Financial Analysis* 84, 102392. URL: <https://doi.org/10.1016/j.irfa.2022.102392>.
- Harding, D., Pagan, A., 2002. Dissecting the cycle: A methodological investigation. *Journal of Monetary Economics* 49, 365–381. URL: [https://doi.org/10.1016/S0304-3932\(01\)00108-8](https://doi.org/10.1016/S0304-3932(01)00108-8).
- Helmi, M.H., Catik, A.N., Akdeniz, C., 2023. The impact of central bank digital currency news on the stock and cryptocurrency markets: Evidence from the tvp-var model. *Research in International Business and Finance* 65, 101968. URL: <https://doi.org/10.1016/j.ribaf.2023.101968>.
- Jarociński, M., 2022. Central bank information effects and transatlantic spillovers. *Journal of International Economics* 139, 103683. URL: <https://doi.org/10.1016/j.jinteco.2022.103683>.
- Jordá, Ó., Schularick, M., Taylor, A.M., 2016. Macrofinancial History and the New Business Cycle Facts. Technical Report 22743. National Bureau of Economic Research. URL: <https://doi.org/10.3386/w22743>.
- Jordá, Ó., Schularick, M., Taylor, A.M., Ward, F., 2019. Global financial cycles and risk premiums. *IMF Economic Review* 67, 109–150. URL: <https://doi.org/10.1057/s41308-019-00077-1>.
- Kearney, C., Liu, S., 2014. Textual sentiment in finance: A survey of methods and models. *International Review of Financial Analysis* 33, 171–185. URL: <https://doi.org/10.1016/j.irfa.2014.02.006>.

- Lanne, M., Nyberg, H., 2016. Generalized forecast error variance decomposition for linear and nonlinear multivariate models. *Oxford Bulletin of Economics and Statistics* 78(4), 595–603. URL: <https://doi.org/10.1111/obes.12125>.
- Larsen, V.H., Thorsrud, L.A., 2019. The value of news for economic developments. *Journal of Econometrics* 210, 203–218. URL: <https://doi.org/10.1016/j.jeconom.2018.11.013>.
- Loughran, T., McDonald, B., 2011. When is a liability not a liability? textual analysis, dictionaries, and 10-ks. *The Journal of Finance* 66, 35–65. URL: <https://doi.org/10.1111/j.1540-6261.2010.01625.x>, doi:10.1111/j.1540-6261.2010.01625.x.
- Miranda-Agrippino, S., Rey, H., 2020. Us monetary policy and the global financial cycle. *Review of Economic Studies* 87, 2754–2776. URL: <https://doi.org/10.1093/restud/rdaa019>, doi:10.1093/restud/rdaa019.
- Neuhierl, A., Weber, M., 2019. Monetary policy communication, policy slope, and the stock market. *Journal of Monetary Economics* 108, 140–155. URL: <https://doi.org/10.1016/j.jmoneco.2019.08.005>.
- Petropoulos, A., Siakoulis, V., 2021. Can central bank speeches predict financial market turbulence? evidence from an adaptive nlp sentiment index analysis using xgboost machine learning technique. *Central Bank Review* 21, 141–153. URL: <https://doi.org/10.1016/j.cbrev.2021.12.002>, doi:10.1016/j.cbrev.2021.12.002.
- Potjagailo, G., Wolters, M.H., 2023. Global financial cycles since 1880. *Journal of International Money and Finance* 131, 102801. URL: <https://doi.org/10.1016/j.jimonfin.2023.102801>, doi:10.1016/j.jimonfin.2023.102801.
- Rey, H., 2015. Dilemma not trilemma: The global financial cycle and monetary policy independence. *National Bureau of Economic Research* , 21162 URL: <http://www.kansascityfed.org/publications/research/escp/escp-2013.cfm>.
- Shapiro, A.H., Sudhof, M., Wilson, D.J., 2022. Measuring news sentiment. *Journal of Econometrics* 228, 221â243. URL: <https://doi.org/10.1016/j.jeconom.2020.07.053>.
- Smales, L.A., Apergis, N., 2017. Understanding the impact of monetary policy announcements: The importance of language and surprises. *Journal of Banking Finance* 80, 33–50. URL: <https://doi.org/10.1016/j.jbankfin.2017.03.017>.

- Stolbov, M., Shchepeleva, M., Karminsky, A., 2022. When central bank research meets google search: A sentiment index of global financial stress. *Journal of International Financial Markets, Institutions and Money* 81, 101692. URL: <https://doi.org/10.1016/j.intfin.2022.101692>.
- Tiberto, B.P., Moraes, C.O.d., Corrêa, P.P., 2020. Does transparency of central banks communication affect credit market? empirical evidence for advanced and emerging markets. *The North American Journal of Economics and Finance* 53, 101207. URL: <https://doi.org/10.1016/j.najef.2020.101207>.
- Wang, X., Liu, Q., 2023. Can the global financial cycle explain the episodes of exuberance in international housing markets? *Finance Research Letters* 52, 103366. URL: <https://doi.org/10.1016/j.fr1.2022.103366>.
- Wang, Y., Lucey, B.M., Vigne, S.A., Yarovaya, L., 2022. The effects of central bank digital currencies news on financial markets. *Technological Forecasting and Social Change* 180, 121715. URL: <https://doi.org/10.1016/j.techfore.2022.121715>.
- Wu, W., Zaffaroni, P., 2017. Asymptotic theory for spectral density estimates of general multivariate time series. *Econometric Theory* 34, 1–22. URL: https://ideas.repec.org/a/cup/etheor/v34y2018i01p1-22_00.html.

A Central Bankers Sentiment Index of Global Financial Cycle

Zhen Yu

Professor

*School of Economics, Jilin University, 2699 Qianjin Street, Changchun, 130012,
China.*

E-mail: yuzhen@jlu.edu.cn

Wei Liu (Corresponding Author)

PhD Candidate

*School of Economics, Jilin University, 2699 Qianjin Street, Changchun, 130012,
China.*

E-mail: liuwwweispac@sina.com

Fuyu Yang

Lecturer

University of East Anglia, UK.

E-mail: fuyu.yang@uea.ac.uk.

Acknowledgement

The authors would like to acknowledge the National Social Science Fund of China for the financial support of the study (Grant No. 20BJY022).

Highlights

- We propose a novel Central Bankers' Sentiment Index to measure global financial cycles.
- We construct the CBSI with sentiment component of 6, 514 central bankers' speeches.
- The CBSI has comparative advantage in tracing significant historical events.
- The CBSI contains more information than the conventional measures such as the VIX.
- The CBSI effectively integrates information of the global financial system.

Author Statement

Funding: This work was supported by the National Social Science Fund of China [Grant number 20BJY022].

Conflict of interest: The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval: This article does not contain any studies with human participants or animals performed by authors.

Consent to participate: The authors are all consent to participate.

Consent for publication: The authors are all consent for publication.

Availability of data and materials: The data and materials that support the findings of this study are available from the corresponding author upon request.

Code availability: The code that supports the findings of this study are available from the corresponding author upon request.

Authors' contributions:

Zhen Yu (First Author): Conceptualization, Writing Original Draft, Funding acquisition, Writing Review and Editing.

Wei Liu (Corresponding Author): Conceptualization, Methodology, Data Curation, Visualization, Formal analysis, Writing Original Draft.

Fuyu Yang: Writing Review and Editing, Software, Formal analysis, Investigation.