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Microblogging money: Exploring the world's central banks on Twitter

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Abstract

This article looks into global central bank messaging on the Twitter social media platform. At the end of 2021, a total of 122 central banks and monetary authorities had registered accounts on Twitter. At that time, approximately two-thirds of world's central banks and monetary authorities were using Twitter. Drawing on a database of central bank tweets up to the end of 2021, we document Twitter interactions of central banks by such measures as influence, connections and hashtag use. In addition to similarities among central bank strategies, we also find striking differences in influence and willingness to connect with the public. Tweeting activity during the Covid-19 pandemic provides insight in central bank crisis responses.

Keywords: central banks, communications, Twitter, Covid-19

JEL code: E58

We thank Esa Jokivuolle and participants of seminars at the Bank of Finland, the Singapore Monetary Authority and the University of St Andrews for their useful comments. Responsibility for any remaining errors or omissions naturally lies with us. As widely covered in the media, Twitter's new main shareholder, Elon Musk, rebranded the social media platform as "X" in July 2023. Since the name of the platform was Twitter during the period our study, however, we stick with Twitter consistently throughout.

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1. Introduction

The Twitter microblogging platform gives institutional users the possibility of distributing information to citizens in real time and engaging with them directly without the intermediation of traditional gatekeeper news channels. The platform also comes with well-recognised downsides such as fake accounts disseminating false information or subjecting users to engineered attacks. Notably, 70 % of central banks have Twitter accounts, suggesting that these downsides are not a major concern for institutions that can only be effective if they preserve trust and credibility.

Central banks are generally adept at communicating with financial markets and experts as their behaviour determines interest rates and market-based inflation expectations. Conventional means of communication include official statements, press releases, as well as interviews or speeches of senior staff and experts. Such messaging is often technical and targeted at market participants or experts. The wider public audience remains largely tuned out of central bank communications.¹

Aware of this issue, central banks have sought to increase the scope of communication over the past decade. Rationales for communication with the public at large fall into two categories. First, as the overwhelming majority of inflation-targeting central banks maintain operational independence from the political process, clear communication with the public is seen as part of their duty of accountability and preserving democratic legitimacy.² Second, accessible central bank communication improve the effectiveness of monetary policy. Household inflation expectations, for example, often differ from those of market participants. Boosting citizen understanding of central bank policies helps anchor inflation expectations and smooth the path forward for monetary policy measures.³ By getting their message to a wider audience, central banks reduce the twin deficit of trust and understanding (Haldane, 2017).

Social media and other forms of digital communication can be powerful instruments for promoting interaction between central banks and citizens. By using social media channels, central banks can embrace the modern media environment which is characterised by the decline of print media, fast-paced news cycles and consumers who increasingly distrust traditional media and get their news instead via social media. Social media, especially Twitter, offer central banks a channel to supplement their outreach as non-experts rarely seek out information from central bank websites or publications.

Twitter enhances dialogue. Central bank organised question-and-answer sessions allow central bankers or expert staff to chat with Twitter users. Twitter also gives central banks a

¹ According to Haldane and McMahon (2018), the typical Bank of England publication assumes the reader possesses at least undergraduate-level reading skills.

² See discussion of Dincer and Eichengreen (2014) on the rise of central bank transparency and independence.

³ See, for example, Binder (2017), Jung and Kühl (2021) and Coibion *et al.* (2022).

possibility to employ visual information such as infographics and short videos to set out central bank policies in an accessible and understandable manner.

Twitter's simplicity and straightforwardness make it an attractive communication tool. The operating principles of traditional media (printed newspapers, broadcast news) are subject to country-specific factors, which is not the case with social media. Twitter provides the same functionalities everywhere. If a central bank communications officer wants to publicise, say, the outcome of a central bank forecasting exercise, the hurdles of getting the message through the traditional media vary from country to country. With Twitter, regardless of location, millions of Twitter users can view a summary of the bank's findings or a link to the forecasting publication at the central bank's website with a few clicks.

While the ways social media challenge conventional media and provide opportunities to circumvent media laws and regulations are outside the scope of this paper, we believe it is worth noting that social media platforms offer citizens and organisations standardised communication tools with identical functionalities and operative principles no matter where used or accessed. Dincer and Eichengreen's (2014) extensive study demonstrates that transparency and degree of independence varies enormously across central banks. So does the political and media landscapes in which they operate. Keeping these factors in mind, we analyse how the central banks of rich and poor countries with different degrees of independence use Twitter in communication. Given that all the central banks have access to the same functionalities of Twitter, we explore the ways Twitter is similarities and differences in central bank use. We also take the Covid-19 pandemic as a case study of in central bank messaging during a real crisis. Despite the global nature of the pandemic, the communication approaches of central banks during the crisis were surprisingly diverse.

Our paper builds on a comprehensive dataset of central bank tweets that contains all the tweets of all the world's central banks with Twitter accounts during our observation period. We explore central banks' Twitter interaction such as connections, use of hashtags and influence. Our comparative analysis uncovers similarities in central bank strategies as well as several striking differences in both influence and willingness to connect with the public. The differences in central bank Twitter use cannot be attributed solely to such factors as income level or the digital literacy of a national population.

In section 2, we review related literature from efficacy of central bank communication in general to the effects of central bank Twitter use. Section 3 describes how we collected the central bank tweets and some basic database features. The fourth section assesses use and influence of central bank Twitter accounts. Section 5 considers difference in activity and engagement. Section 6 looks at evidence on the networks formed by these accounts. Section 7 discusses central bank Twitter activity during a crisis (the Covid-19 pandemic), and section 8 concludes.

2. Related literature

The role and scope of traditional central bank communications concerning monetary policy is well-established and covered by large bodies of empirical and theoretical literature.⁴ The communication activities of central banks have grown further since the global financial crisis, with many central banks now seeking to communicate in ways that engage a broader swath of the public. Despite the growing strand of literature on the rationale and mechanics of communication with the wider public,⁵ only a small number of papers address central bank digital communication on social media platforms, and Twitter in particular.

One strand of the relevant literature on central banks and social media explores the effectiveness and impact of central bank announcements and actions on market sentiment and asset prices using Twitter-based metrics. Masciandaro *et al.* (2020) show that central bank communication on Twitter can affect asset prices. Azar and Lo (2016) demonstrate that the contents of tweets referring to the Federal Open Market Committee can be used to predict returns.

High-frequency identification is also applied in a paper by Bianchi *et al.* (2019), which explores the impact of president Donald Trump's tweets on the Federal Funds Rate and share prices. The authors assert that market participants did not perceive the Fed as fully independent as the pressure imposed by Trump on the Fed to pursue more expansionary monetary policies via his then-favourite communication channel affected market expectations.

The second strand of literature asks whether Twitter can serve as an efficient and meaningful communication channel for central banks given the many concerns expressed over Twitter's potential for spreading misinformation and amping up debate intensity by acting as an echo chamber. Ehrmann and Wabitsch (2020) show that Twitter traffic can be responsive to the ECB's communication. For example, ECB president Mario Draghi's famous "Whatever it takes" speech in London on July 26, 2012 raised an ongoing discussion on Twitter. Ehrmann and Wabitsch argue that tweets by non-experts are more likely to contain stronger language than expert tweets, and that inflammatory messages of non-experts tend to get retweeted more often. However, despite the view of Twitter as a hostile environment, the authors demonstrate that Twitter also can foster factual and moderate discussion among non-experts.

A recent study by Ferrara and Angino (2021) finds that Twitter can be a useful tool for central banks in reaching the public. Their results emphasise that the clarity of central bank communication is a significant and strong predictor of success in the social engagement of a central bank. By focusing on the case of the ECB, they demonstrate that ECB tweets with more

⁴ Blinder (2018) and Haldane (2018) provide extensive literature reviews.

⁵ See, for example Binder (2017), Korhonen and Newby (2020), Ferrara and Angino (2021) and Blinder *et al.* (2022).

difficult language are read, liked and shared by fewer users. Their result is robust in that pre-existent levels of ECB coverage or other related factors do not override the outcome that greater communication clarity is conducive to stronger engagement.

D'Acunto *et al.* (2020) analyse which forms of communication can reach ordinary people and manage their economic expectations effectively. The authors design an experiment in which they show two different tweets by Olli Rehn, Governor of the Bank of Finland, to a group of people for whom they observe several demographic characteristics. One tweet includes information about the policy target ("The ECB will do whatever necessary to minimize the financial damage to citizens caused by the Covid crisis"), while the other deals with policy instruments (information about the size of the Pandemic Emergency Programme PEPP). The authors conclude that communication about a policy target is more accessible to the general public than communication about a monetary policy instrument.⁶

Several other studies confirm that Twitter is beneficial in for institutional information-sharing, including central banks. Based on a panel survey with multiple waves of questions, Boukes (2019) finds that Twitter usage positively influences knowledge acquisition of its users. The more that survey respondents used Twitter, the better informed they were about recent socio-economic events. This finding applied to all users regardless of their level of interest in current affairs.

In our knowledge, only a few papers study central banks' communication in Twitter in comparative manner. Korhonen and Newby (2019), who analyse Twitter use among European central banks, find many differences from bank to bank, and moreover, that these differences are not easily explained by such factors as internet access. In many countries, increased use of Twitter as means of communication can be achieved quite easily if so desired. Kyriakopoulou and Ortlieb (2019) look at a large number of central banks and their Twitter use. They document the way many central banks in emerging economies are active and adept at using Twitter as part of their communications strategy. Conti-Brown and Feinstein (2020) compare the Twitter use of the Federal Reserve to that of a number of other large central banks. Interestingly, they find that regional Federal Reserve banks use Twitter in a more active manner than the Federal Reserve Board, although the Board's tweets are much more likely to be re-tweeted. There are no immediately observable factors that could explain the differences among regional Federal Reserve banks. We return to this theme in the analysis sections.

⁶ D'Acunto *et al.* (2020).

3. Data collection

To retrieve the data, we applied for Twitter’s Academic Research product track.⁷ The Academic Research track, launched in January 2021, was built to serve the needs of the academic research community via free, specialized access to public Twitter data. Researchers can pull up to 10 million tweets per month. We used a command line tool and Python library named `twarc2` to make requests to the Twitter v2 API and archived the data in JSON format.⁸ The data were processed in Microsoft Power Query and visualised in Microsoft Power BI.

3.1 User statistics

Our sample of central banks with a Twitter presence is based on the OMFIF-maintained Twitter list.⁹ After a few adjustments, we ended up with a total of 121 central banks in our dataset. We used Twitter v2 User lookup endpoints to request details such as account creation date, follower counts, location and tweet numbers. For demographic analysis, the Twitter data were merged with the World Bank’s economy, region & income group classification¹⁰ and population data.¹¹ The population of the US Federal Reserve districts was collected from the FRED Economic Data service.¹²

Our database includes the Federal Reserve System and all Federal Reserve banks, as well as the ECB and all 19 euro area central banks. We also include the Bank for International Settlements (BIS), which is sometimes referred to as “the central bank of central banks.”

To analyse relationships between central banks, we retrieved the follower and friend IDs for each central bank using the Twitter v2 Follows lookup endpoints.

3.2 Tweets

We collected all tweets posted by the central banks since the launch of Twitter on March 21, 2006 to December 31, 2021 using the v2 Full-archive search endpoint, which is available exclusively via the Academic Research product track. The number of tweets in our dataset totaled over 790,000.

⁷ <https://developer.twitter.com/en/products/twitter-api/academic-research>

⁸ https://twarc-project.readthedocs.io/en/latest/twarc2_en_us/

⁹ <https://twitter.com/i/lists/1098624897142657027>

¹⁰ <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

¹¹ <https://data.worldbank.org/indicator/SP.POP.TOTL>

¹² <https://fred.stlouisfed.org/release/tables?eid=162983&rid=119>

3.3 Activity

To analyse each central bank's activity on Twitter, we plot the total number of its tweets and public metrics for the tweets by year. Twitter public metrics, including number of likes and number of retweets, are available to all. These measures indicate the response and influence of the tweet, i.e. activity of the central bank with Twitter users.

- Retweets (retweet_count): A count of how many times the tweet has been retweeted. This does not include quote tweets ("retweets with comment").
- Quote Tweets (quote_count): A count of how many times the tweet has been retweeted with a new comment (message). This does not include retweets.
- Likes (like_count): A count of how many times the tweet has been liked.
- Replies (reply_count): A count of how many times the tweet has been replied to.

3.4 Covid-19

The WHO says that the Covid-19 pandemic was the most extreme combined health and economic crisis of the last century. It led to a macroeconomic shock of unprecedented magnitude. The uniqueness and severity of Covid-19 shock forced central banks around the world to take exceptional measures to prevent the collapse of national economies.

For the Covid-19 case study, we filtered out all central bank tweets with pandemic-related hashtags (e.g. #corona, #coronavirus, #covid, #covid19, #pandemic). The first tweets mentioning Covid-19 with a hashtag were sent out on January 27, 2020 by the Central Bank of Ecuador and the Richmond Fed. By December 31, 2021, the central banks had used Covid-19 related hashtags 8,678 times.

We also downloaded the complete Covid-19 dataset¹³ maintained by Our World in Data to see if there was a correlation between the number of covid hashtags and the severity of the pandemic (new confirmed cases).

¹³ <https://github.com/owid/covid-19-data/tree/master/public/data>

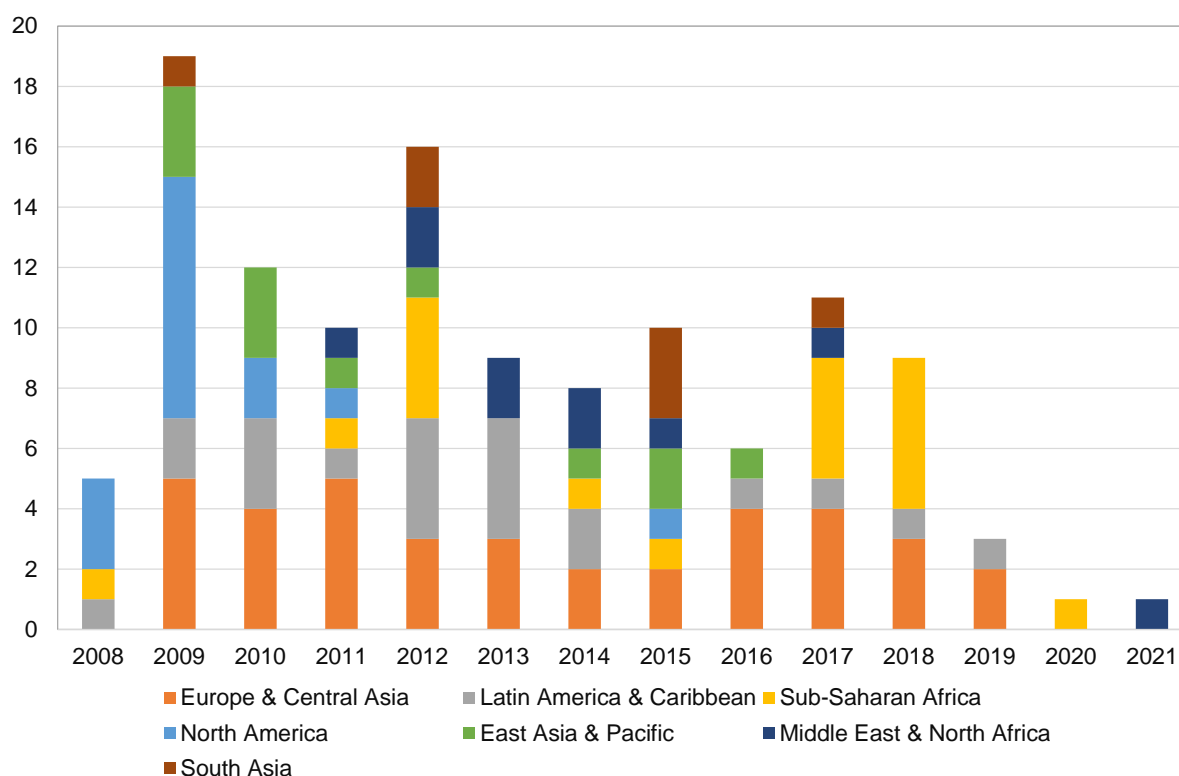
4. Usage and influence

4.1 Which central banks established Twitter accounts and when?

Twitter was founded on March 21, 2006. By September 2007, Twitter had about 550,000 users. A year later it had 2.4 million users.¹⁴

Figure 1 Central banks establishing Twitter accounts by region and year presents the number of central banks establishing Twitter accounts by year and geographical area. The first central bank to join was the Bank of Canada on June 2, 2008. The first tweet published was made by the Federal Reserve Bank of New York on June 10, 2008, the day the FRBNY joined. The third central bank to set up a Twitter account was the Central Bank of Nigeria on September 8, 2008, followed by the Bank of Guatemala on December 19, 2008. All Federal Reserve Banks had joined Twitter by 2011, with the Kansas City Fed bringing up the rear.

Figure 1. Central banks establishing Twitter accounts by region and year.



The first European central bank to join Twitter was the Bank of England (January 13, 2009), followed by Norges Bank (April 28, 2009). The first euro area central bank to set up an account

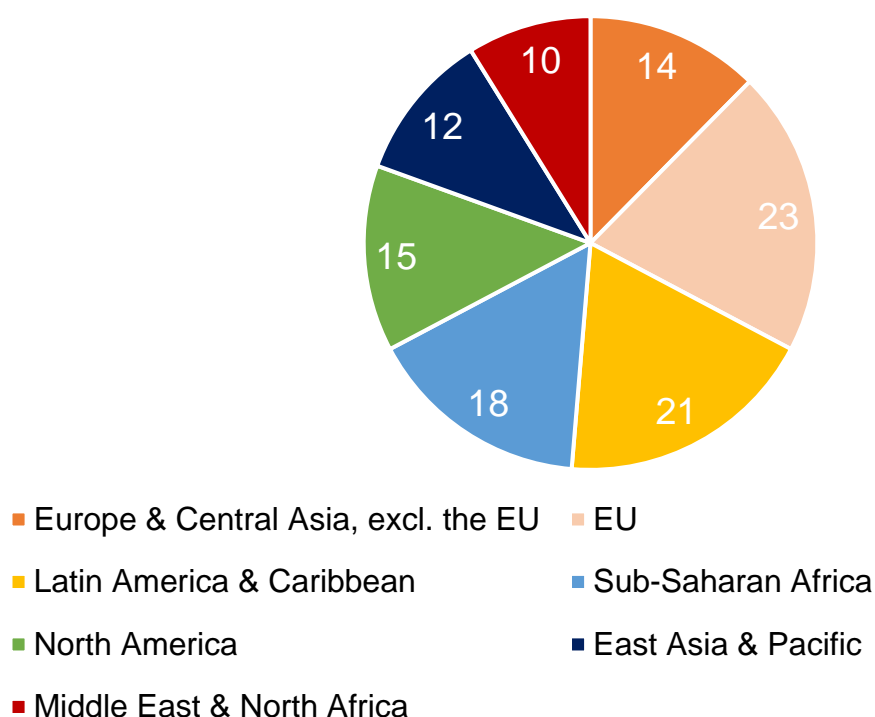
¹⁴ Twitter user statistics are notoriously hard to get as Twitter does not publish user statistics. For early estimates, see Ojeda-Zapata (2008).

was the Central Bank of Austria, Oesterreichische Nationalbank, on September 28, 2009. The ECB established its first account on October 19, 2009, followed by the BIS on June 22, 2010.

In the East Asia & Pacific region, the Reserve Bank of New Zealand, Bank Negara Malaysia and Monetary Authority of Singapore all established Twitter accounts in 2009. Regarding South Asia, the Central Bank of Sri Lanka started to Tweet on July 9, 2009, followed by the Reserve Bank of India and Maldives Monetary Authority in 2012. The first central bank representing Middle East & North Africa to start a Twitter account was Bahrain in 2011, followed by Egypt in 2012 and the Palestine Monetary Authority in 2013.

As of end-2012, there were 62 central banks registered on Twitter (Figure 1). The peak joining years were 2009 and 2012, when 19 and 16 central banks, respectively, established Twitter accounts. The last central bank of our database to join was Bank of Algeria on February 11, 2021.

Figure 2. Central banks on Twitter by region at the end of 2021 (number of central banks in each region).



By the end of 2021, a total of 122 central banks (including the BIS) had Twitter accounts (Figure 2). 31 % of those central banks were in Europe & Central Asia, 18 % in the Latin America & Caribbean region, 15 % in Sub-Saharan Africa, 13 % in North America (including all regional Federal Reserve banks), 10 % in East Asia & Pacific region, 8 % in the Middle East &

North Africa and 6 % in South Asia. The central banks of EU countries that still did not have Twitter accounts as of end-2021 were Bulgaria, Cyprus, Greece and Luxemburg.

Table 1. Ratio of central banks that have established Twitter accounts by the end of 2021 in each region

	Share
North America	100 %
South Asia	88 %
EU	85 %
Latin America & Caribbean	72 %
Europe & Central Asia, excl. EU	60 %
Middle East & North Africa	56 %
East Asia & Pacific	44 %
Sub-Saharan Africa	41 %

Using the World Bank's Regional division (Table 1), all central banks from the region of North America have Twitter accounts. These central banks are the Federal Reserve Board, all 12 regional Federal Reserve banks, the Bank of Canada and the Bermuda Monetary Authority.

A large share of central Banks from South Asia have also registered Twitter account, with the central bank of Nepal as a notable exception. The same applies to the central banks of the Latin America & Caribbean region, although many central banks of smaller Caribbean states still lacked Twitter accounts at the end of 2021. In Europe & Central Asia, some former Yugoslavian countries, microstates without central banks and some Central Asian states did not have Twitter accounts. In addition, the central banks of Bulgaria, Greece, Luxemburg and Belarus did not yet use Twitter.

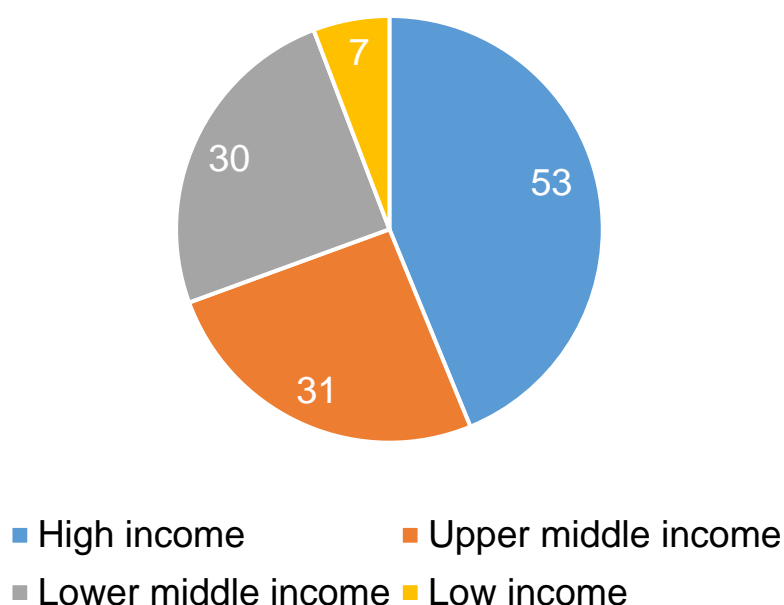
As of end-2021, the central banks in the Middle East & North Africa region not using Twitter included the Bank of Israel, as well as the central banks of Iraq, Syria, Libya, the United Arab Emirates, Oman and Qatar. In East Asia, over half of the central banks did not have Twitter accounts, including the People's Bank of China¹⁵ and the Central Bank of South Korea. Among sub-Saharan central banks, only 41 % had Twitter accounts.

The World Bank divides countries into four income groups. In our database, 53 central banks (including the Federal Reserve Board, regional Federal Reserve banks and the European Central Bank) are located in high-income countries, 31 in upper middle-income countries, 30 in lower middle-income countries and 7 in low-income countries (Figure 3). The number of countries in the four income groups vary, so the share of central banks that had registered on Twitter by the end of 2021 was 55 % for high and upper middle-income countries, 68 % for

¹⁵ Twitter is officially blocked in China, but the People's Bank of China maintains Wechat and Weibo accounts. Choi (2022).

lower middle-income countries and 24 % for low-income countries. Afghanistan is the only low-income country outside Sub-Saharan Africa with a Twitter account.

Figure 3. Central banks with Twitter accounts by income group (Federal Reserve Board, regional Fed banks and ECB included).

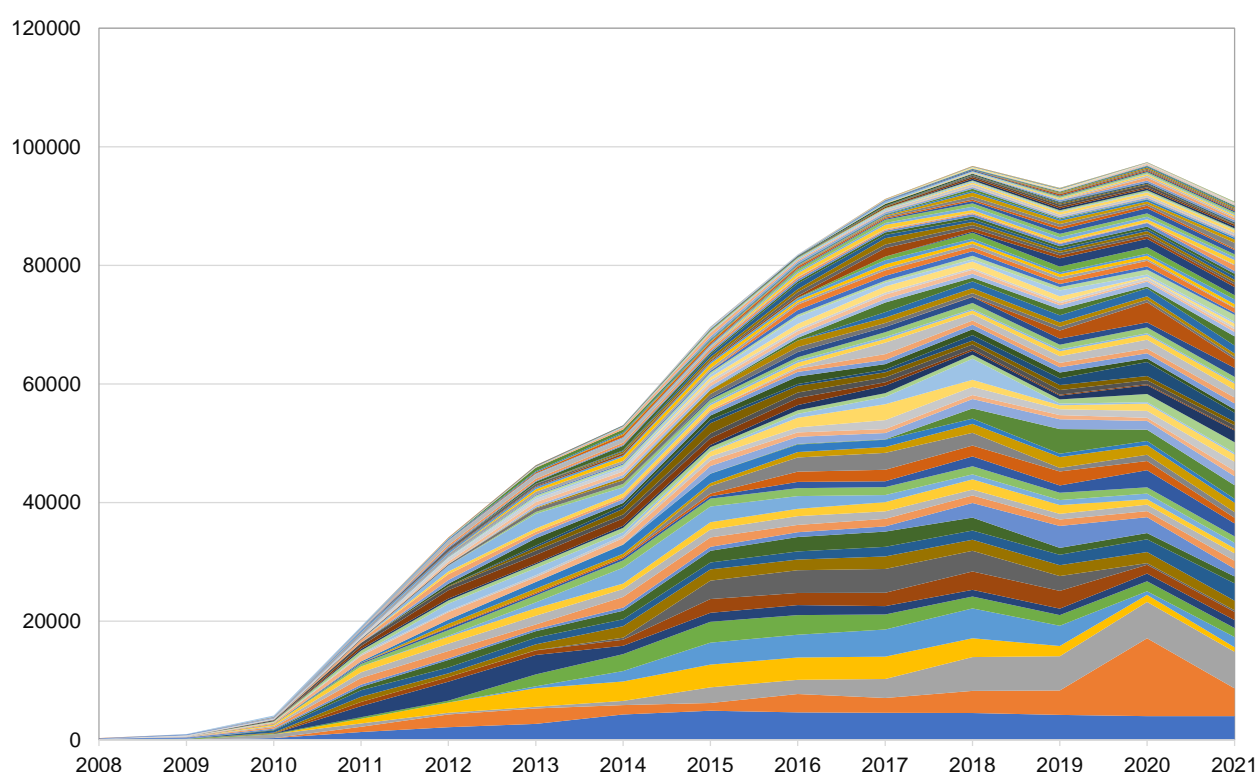


Central banks of high-income countries joined Twitter before banks of upper middle-income countries. The number of accounts created by central banks of lower middle-income countries started to increase rapidly after 2015, and by the end-2021, 61 % of central banks representing lower middle-income countries had Twitter accounts. In contrast, only 11 % of central banks from low-income countries had established Twitter accounts by end-2021.

4.2 Tweeting activity

After a relatively slow start, the central bank Twitter activity began to climb rapidly (Figure 4). By the end of 2010, there were 37 central banks on Twitter that had published 5,343 original tweets. Two years later, the number of central bank accounts had doubled and the number of tweets had risen more than ten-fold. By the end of 2021, a total of 122 central banks had joined Twitter. During that year, they tweeted almost 800,000 times.

Figure 4. Annual central bank tweet activity, 2008–2021.



Tweeting activity of the central banks vary considerably. Measured by total number of tweets, the St. Louis Fed has been the most active with 41,465 tweets between 2010 and 2021, followed by the Central Bank of Ecuador and the Bank of Indonesia (39,747 and 34,476 tweets, respectively). St. Louis Fed activity is explained by statistical updates as it oversees the Federal Reserve Economic Database (FRED). On average, a typical central bank on Twitter posts twice a day.

If measured by the number of tweets, the peak year was 2019. Some central banks, including Ecuador, Indonesia, BIS, the Federal Reserve Board and Egypt, sent more tweets during 2020, the first year of the Covid-19 pandemic, but in general, central bank Twitter activity moderated during the height of the pandemic. This can partially be explained by a smaller number of events.

Activity of the central bank does not correlate with the size of the country it represents. The Central Reserve Bank of El Salvador is the sixth-most active central bank and the Bank of Finland the ninth-most active, even if both represent countries with small populations.

Table 2. Top 30 central banks on Twitter, average annual tweet volume.

	Central bank	Average number of tweets, annually	Sum of all tweets
1	St. Louis Fed	3 455	41 465
2	Central Bank of Ecuador	3 613	39 747
3	Bank Indonesia	2 873	34 476
4	Bank of Mexico	2 473	27 208
5	Central Reserve Bank of El Salvador	2 766	24 897
6	Richmond Fed	1 575	22 048
7	Banque de France	1 757	19 326
8	Bank of Finland	1 570	18 834
9	Reserve Bank of India	1 785	17 854
10	European Central Bank	1 464	17 564
11	Bank for International Settlements (BIS)	1 441	17 292
12	Central Bank of Colombia	1 422	17 066
13	New York Fed	1 040	14 553
14	San Francisco Fed	1 169	14 028
15	Atlanta Fed	1 136	13 631
16	Chicago Fed	1 132	13 588
17	Central Bank of the Dominican Republic	1 339	13 386
18	National Bank of Romania	1 130	12 428
19	Minneapolis Fed	909	11 813
20	Central Reserve Bank of Peru	873	11 344
21	Central Bank of Republic of Argentina	1 611	11 277
22	Kansas City Fed	1 072	10 717
23	Bank of England	954	10 496
24	Central Bank of Cuba	1 282	10 253
25	Central Bank of Morocco	1 224	9 790
26	Philadelphia Fed	729	9 482
27	Cleveland Fed	728	9 466
28	State Bank of Pakistan	1 350	9 451
29	Central Bank of Venezuela	934	9 336
30	Czech National Bank	754	9 048

The Twitter activity of Latin American countries stands out immediately. Our database shows that 25 central banks had tweeted over 10,000 times by the end of 2021. Of those, eight were central banks in South or Central America, eight Federal Reserve banks and five European central banks.

4.3 Engagement and influence

Our large dataset facilitates comparison of central bank Twitter engagement. While there are as yet no standardised definitions of Twitter influence or methods for measuring influence, and new influence measures and classifications are regularly proposed, we apply Twitter influence measures from the survey of Riquelme and González-Cantergiani (2016) and the early work of Cha *et al.* (2010). These authors propose multiple criteria for measuring user influence and impact. We focus on those measures relevant to institutional Twitter users.

Number of followers is perhaps the simplest and most straightforward measure of influence and popularity as it directly indicates the size of a central bank's audience. On February 9, 2022, for example, the Reserve Bank of India had the highest number of followers, 1.5 million, among the central banks surveyed. Next came the central bank of Mexico with 862,000 followers, just ahead of the Federal Reserve, the Bank Indonesia, and the Central Bank of Nigeria. Saudi Central Bank had 715,000 followers, while the ECB has 660,000. Altogether the world's central banks on that day had roughly 12.4 million followers. Although a Twitter follower of any central bank can be located around the world, in relation to the population of the country, the Maldives Monetary Authority had the highest ratio of followers (4.0 %), followed by central banks of Saudi Arabia (2.1 %) and Kuwait (1.8 %).

In any case, follower count *per se* is not a particularly good measure for determining influence. Some central bank followers may not be active, and the central bank may attract a large number of bot accounts. Bot accounts typically perform message amplification tasks such as liking tweets or retweeting content.

The *following/follower ratio*, another widely applied measure of influence, is sometimes referred to as a *reach score*. This analysis method cannot be directly applied into this study because central banks are institutions, not natural persons. Central banks mainly follow each other, governmental organisations and their staff. This has a direct impact on the following/follower ratio in that central bank institutional accounts generally are following a small number of accounts and have a large number of followers. Thus, the central bank network position is similar to that of a *celebrity account* in that it typically has a low following/follower ratio.

Riquelme and González-Cantergiani (2016) capture Twitter user influence and popularity by summing up visible actions such as likes, replies, retweets and quotes (retweet with an added comment). Following their approach, we define for every central bank (*i*) an *Activity Index* as the sum of original tweets and replies, i.e. each user's visible actions:

$$\text{General Activity}(i) = OT + RP + RT + QT + FT$$

where *OT* stands for the number of original tweets by the central bank, *RP* for replies to a central bank tweet, *RT* for retweets of the central bank's original tweet, *QT* for quote tweets (tweets retweeted with a new comment) and *FT* for likes.

By this measure, the Central Bank of Ecuador stands out as the most popular central bank. Its tweets over the years have been liked, replied and shared over 3.4 million times. Two other central banks (Saudi Arabia and Cuba) surpass the million milestone for replies, retweets and quotes. The most Twitter-active central banks in 2021 were those of Saudi Arabia, Pakistan and Ecuador (Table 3**Table**).

Table 3. Top 15 central banks in 2021 in terms of Twitter activity.

1	Saudi Central Bank (SAMA)	384 596
2	State Bank of Pakistan	357 039
3	Central Bank of Ecuador	353 159
4	Central Bank of Cuba	250 188
5	Bank Indonesia	229 867
6	Central Reserve Bank of Peru	197 331
7	European Central Bank	148 023
8	Central Bank of Venezuela	126 720
9	Central Reserve Bank of El Salvador	126 654
10	Reserve Bank of India	118 777
11	Bank for International Settlements (BIS)	114 239
12	Central Bank of Brazil	106 721
13	St. Louis Fed	90 774
14	Federal Reserve	83 895
15	Central Bank of Colombia	83 275

We also calculate *Activity Index* omitting retweets and likes, i.e. routine bot amplification tasks.

$$Activity(i) = OT + RP + QT$$

Measured by number of tweets, replies and quotes, the scale of engagement shifts somewhat. Now the ECB is the most active central bank, followed by the Federal Reserve, the St. Louis Fed and the Reserve Bank of India.

Table 4. The sum of tweets, replies and quotes of the 15 most active central banks in 2021.

1	European Central Bank	40 239
2	Federal Reserve	25 317
3	St. Louis Fed	22 236
4	Reserve Bank of India	17 571
5	Central Bank of Nigeria	16 664
6	Bank for International Settlements (BIS)	16 469
7	Bank Indonesia	14 679
8	State Bank of Pakistan	13 457
9	Saudi Central Bank (SAMA)	12 591
10	Central Bank of Venezuela	12 449
11	Central Reserve Bank of Peru	12 112
12	Central Bank of Brazil	11 205
13	Bank of England	10 097
14	Central Bank of Republic of Argentina	8 459
15	Narodowy Bank Polski	8 231

Are the most followed, that is, the most popular central bank accounts, the most engaging? Using a large amount of data collected from Twitter, Cha et al. (2010) reveal two features of user influence. First, the more followers a Twitter account has, the more influential the account holder when measured, for example, by number of retweets or other one-on-one interactions. Second, the authors argue that the most popular accounts on Twitter (those with over one million followers), are not the most influential. Indeed, the link between the account holder's number of followers and one-to-one activity weakens. They call refer to this misperception of follower power as the "million follower fallacy."

To investigate whether the number of followers correlates with a number of tweets, we use the relative order of central bank rankings as a measure of difference. Rank 1 indicates the central bank with the most followers, highest number of tweets or most reactions such as likes, retweets or quotes.

Table 5. Spearman's rank correlation coefficients, 2021 (all central banks and 20 most-followed central banks).

	All central banks	Top 20
Correlation		
Followers vs. tweets	0.51	-0.17
Followers vs. likes	0.82	0.40
Followers vs. replies	0.87	0.43
Followers vs. retweets	0.77	0.45
Followers vs. quotes	0.84	0.16

It seems that there is a moderately high correlation between the number of followers and tweets: an active central bank can attract many followers. Regarding one-to-one engagement, the correlation is even stronger: central banks with more followers can generate more one-to-one activity such as likes, replies, retweets and quotes.

Limiting our analysis to the 20 most popular central banks, we get a result analogous to that of Cha *et al.* (2010). The correlation between number of followers and tweeting activity disappears and the correlation between likes, retweets and quotes weakens considerably. In particular, when it comes to the 20 most-followed central banks, there is no correlation between number of followers and quotes. We cannot ascertain if this is because automatic bots gravitate towards larger, more popular central bank accounts. If these bots are generally inactive, there would be no correlation between the number of followers and activity among the largest central bank Twitter accounts.

5. Explanations for activity and engagement

In this section, we consider possible explanations for differences in central bank Twitter engagement and activity. After determining whether central banks with high monetary policy transparency are more active on Twitter, we ask if internet penetration in the home country of the central bank has any link to tweeting activity.

Dincer *et al.* (2022) note generally that central bank transparency is “integral to communication” and “an increasingly important policy tool in an environment where central banks attempt to steer inflation and the economy by shaping expectations about future policy.” More specifically, the IMF (2020) five-pillar Central Bank Transparency Code elaborating best communications practices contains a “Transparency in Governance” pillar that includes communication tools and arrangements. The IMF sees social media as a key method for reaching out directly to a general audience.

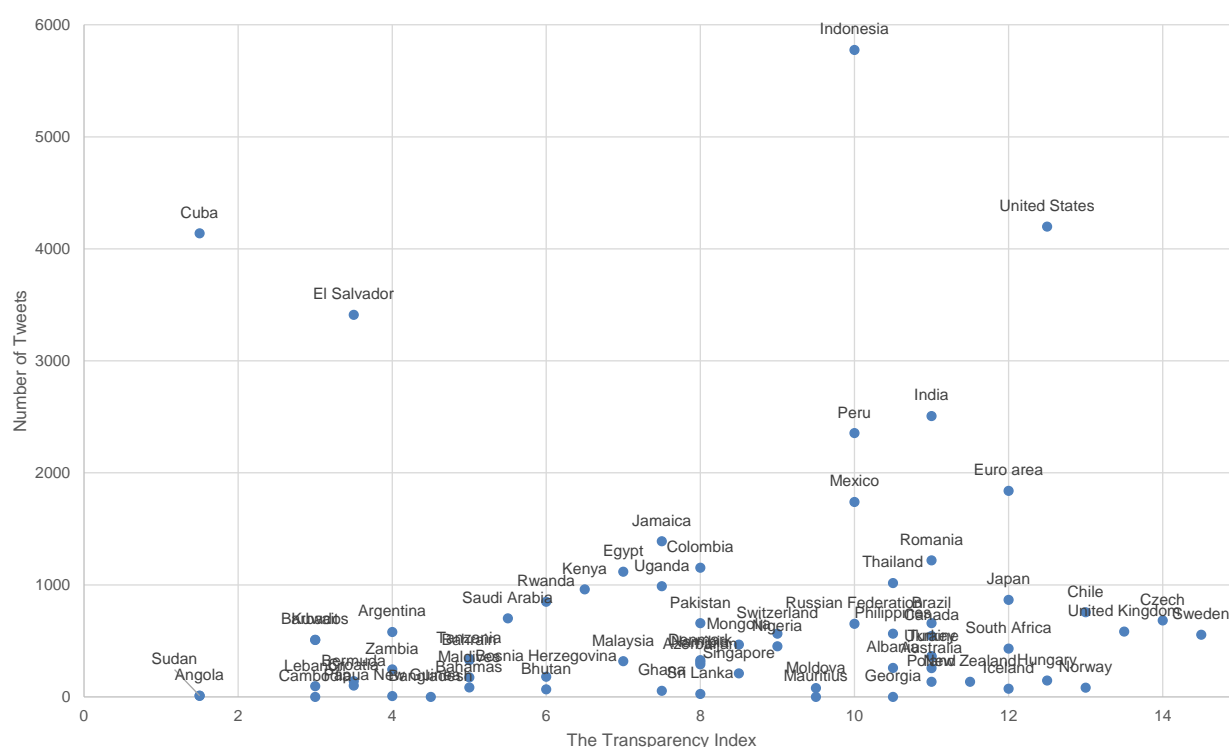
Thus, beyond the reasonable expectation that open and active communication is tightly linked to monetary policy transparency, it would also be manifested in active outreach in social media platforms such as Twitter.

Dincer *et al.* (2022) updated their transparency index in 2019 to provide new estimates of political, economic, procedural, policy and operational transparency for 112 central banks. Overall index scores range from 0 to 15.

The horizontal axis in Figure 5 shows updated transparency index scores as of 2019. The Swedish central bank Riksbank scores 14.5, while low-income countries such as Sudan and Angola post scores below 2. The vertical axis measures the number of each central bank’s tweets in 2019.

As can be seen from the plot, there is no strong correlation (0.2) between transparency index score and Twitter activity. Highly transparent central banks in countries such as Sweden, the Czech Republic, the UK and Norway are nowhere near the most active tweeters. Some South American central banks, as mentioned earlier, tweet regularly but score low on the transparency index.

Figure 5. Central bank transparency scores and tweeting activity.

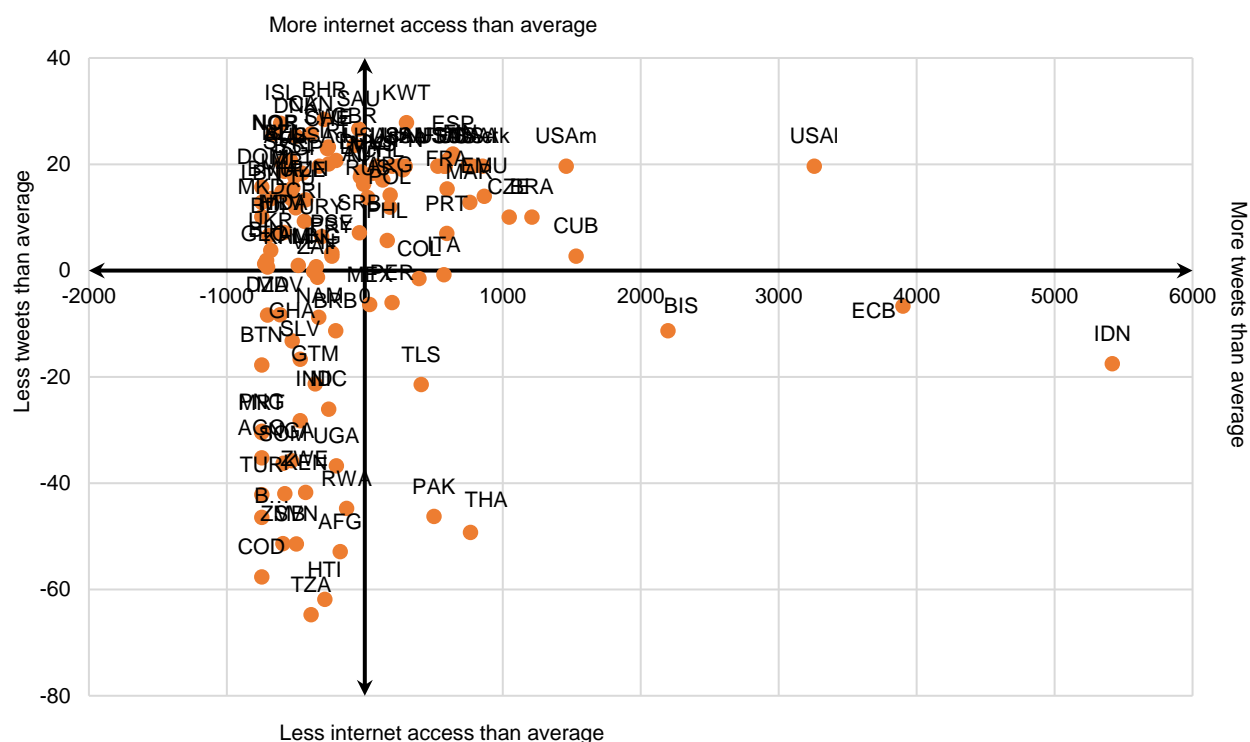


Larsson (2014) explores drivers of European Parliament member Twitter communication outside election periods. He claims, for example, that the demographics and internet access in the politician's home country likely affect engagement. Regarding institutional Twitter accounts, factors such as age or sex are obviously irrelevant, but Larsson (2009) earlier argues that there is a positive correlation between internet access in the politician's home country and the Twitter usage of politicians.

The horizontal axis in Figure 6 measures the difference between the number of central bank tweets and the average of all central bank tweets. The positive side of the x-axis comprises central banks that tweet more often than average, while those on the negative side tweet less actively. The vertical axis measures differences in citizen access to the internet as a percentage point difference from the average. Countries where citizens use the internet more regularly

than average appear on the positive side of the y-axis, while less-than-average internet users are placed on the negative side.

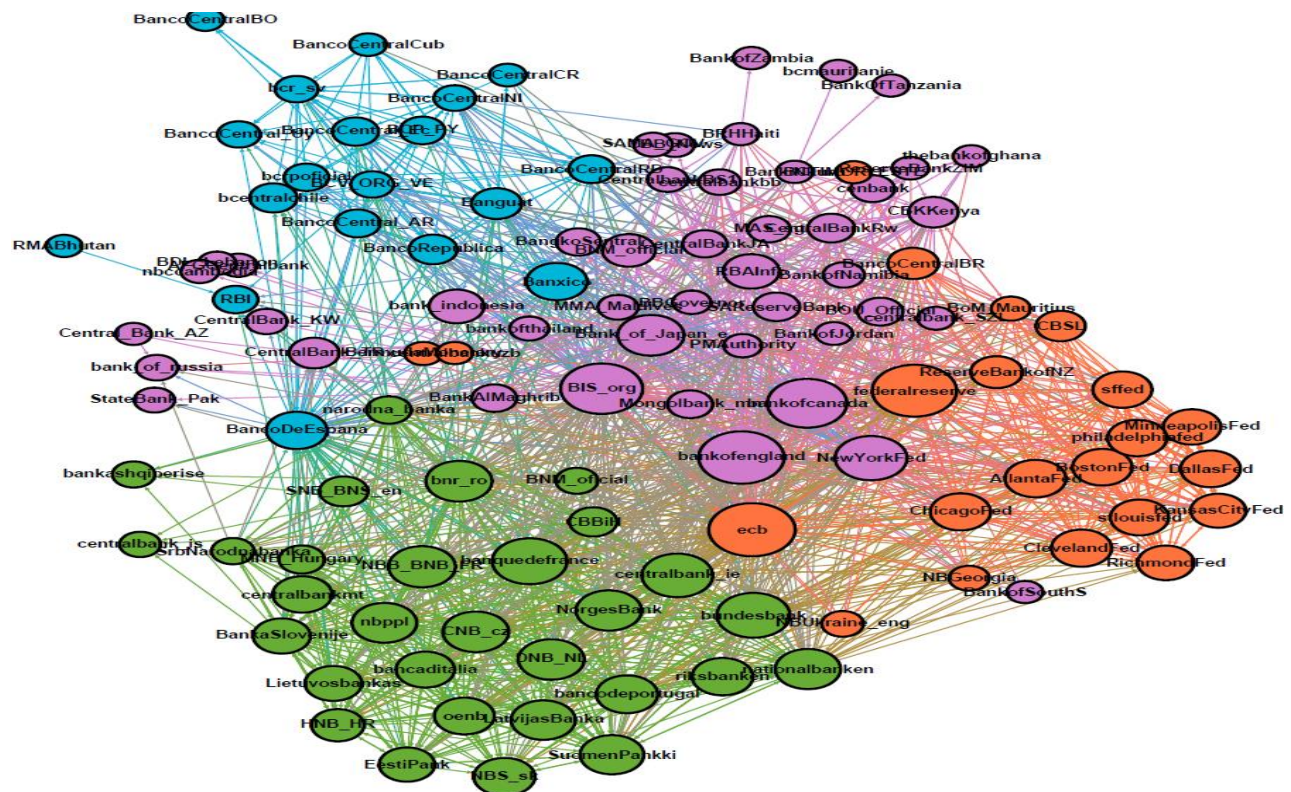
Figure 6. Internet access and number of tweets.



6. Networks of central banks on Twitter

We now track how central bank Twitter accounts interact with each other. For this task, we use GEPHI software to visualize the network of central bank Twitter accounts. Such networks can reveal several interesting factors about central bank cooperation and communication beyond Twitter and other social media.

Figure 7. Networks of central banks following each other.



Such analysis could show both how influential individual central banks are within the central banking community, and whether certain “clubs” of central banks are more connected to each other than usual. Node size denotes the number of followers of a particular central bank. The larger central banks in OECD countries seem to have the most central bank followers, including the ECB, Bank of England, Federal Reserve Board and Bank for International Settlements. On the other hand, central banks of large emerging market countries such as Mexico and India, also seem to attract many followers.

Quite interestingly, the groups, or clubs, identified by the algorithm seem quite plausible and intuitive. These clubs are marked by different colors. Green denotes the European Union/euro area club, where central banks are more likely to follow each other. The orange club consists mostly of regional Federal Reserve banks – and the European Central Bank! While the South American central banks seem to have their own club – with Banco de España. Many former colonies of the UK seem to have their own purple club, although this group is more diffuse. These examples show how geographical proximity, belonging to the same currency area, and colonial links can all affect central bank linkages on Twitter. Presumably, similar factors can also have an effect on other information flows between central banks.

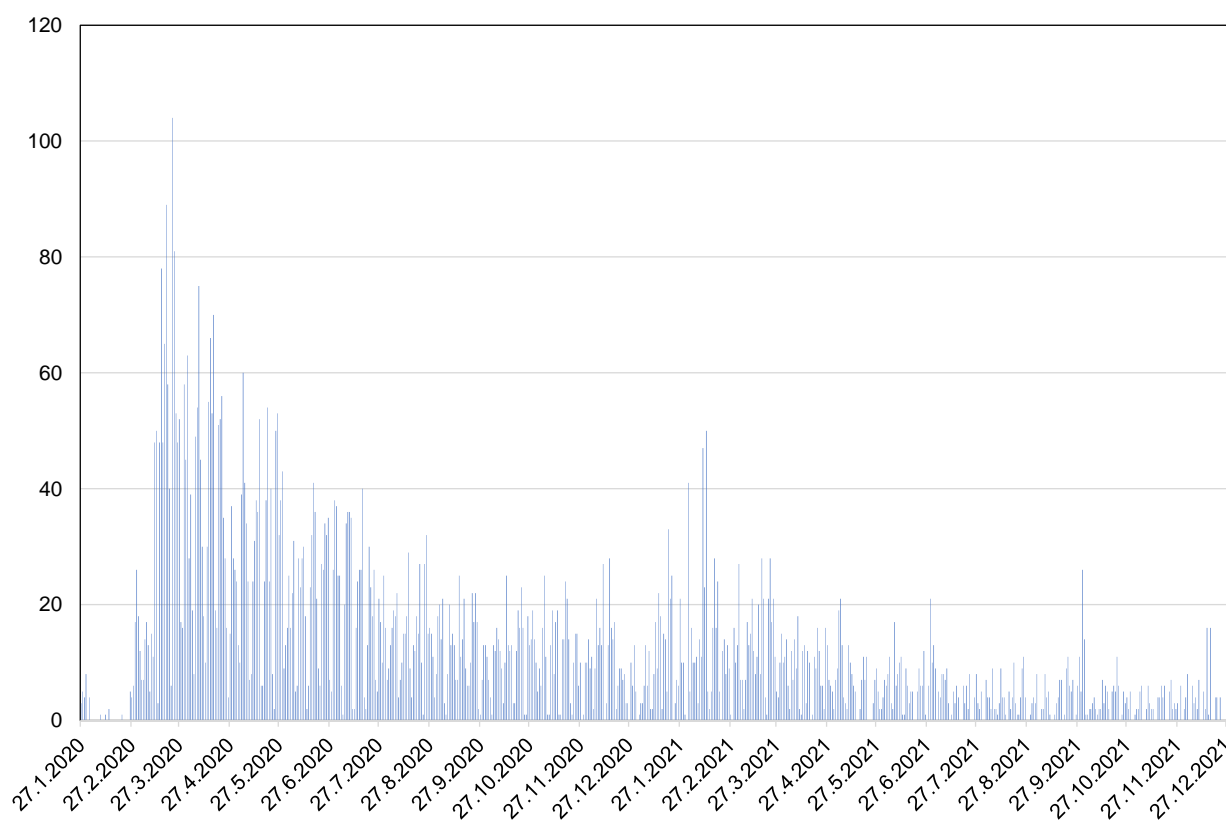
7. Case study Covid-19

The Covid-19 shock had unique and severe impacts across the world. It was a combined health crisis and macroeconomic disruption. It forced central banks around the world to give priority to crisis management and respond with unconventional monetary policy tools. Central banks around the world utilised Twitter as a platform in their crisis communications.

Between January 1, 2020 and December 31, 2021, central banks tweeted about Covid-19 using a Covid-related hashtag a total of 8,678 times (Figure 8). The Central Bank of Ecuador was the first to use a Covid-19 related hashtag on January 27, 2020. The tweet was about a suspected case under analysis by the Ministry of Public Health. With 1,607 tweets, throughout the pandemic, the Central Bank of Ecuador was the most active in tweeting about the virus. Most of its tweets contained public health announcements or encouragement to observe social distancing. Some tweets, sent during the tough days in late March 2020, may have been generated automatically given their vast numbers and tight sending intervals.

Up until mid-February 2020, the Central Bank of Ecuador was the only central bank tweeting about the virus using a Covid-19 related hashtags. The second central bank to use a Covid-19 hashtag was the Richmond Fed, which was announcing the publication of its Spanish Flu article in its EconFocus magazine.

Figure 8. Number of tweets with Covid-19 hashtag per day.



On February 13, 2020, the Central Bank of Cuba alerted its followers about Covid-19 using a hashtag. On the same day, the Central Bank of Philippines announced that it would start temperature scanning at its headquarters. On February 21, Atlanta Fed President Raphael Bostic predicted that the impact of virus on businesses “is going to be a short term hit.” A few days later, Vojtěch Benda, the chief analyst of Czech National Bank, published a tweet that included a link to a paper discussing whether Covid-19 was likely to induce an inflationary or stagflationary shock. At the end of February 2020, the Bank Negara Malaysia was the first central bank to announce Covid-19-related financing facilities on Twitter. On the same day, the Basel Committee discussed and tweeted about financial stability concerns for the banking system related to the coronavirus outbreak.

During spring 2020, central banks actively tweeted using Covid-19 related hashtags. On March 23, 2020, the peak day for Covid-19 tweets, central banks posted 104 Covid-19-related tweets.

Table 6. Number of tweets with Covid-19 hashtags published between February 2020 and end-December 2021.

	Number of COVID-19 related tweets	
1	Central Bank of Ecuador	1 607
2	Cleveland Fed	515
3	Bank for International Settlements (BIS)	479
4	Banque de France	419
5	Banco de España	379
6	Minneapolis Fed	352
7	Banca d'Italia	352
8	Kansas City Fed	352
9	Richmond Fed	325
10	Bank of Finland	301
11	New York Fed	298
12	Deutsche Bundesbank	252
13	San Francisco Fed	251
14	Philadelphia Fed	175
15	Czech National Bank	165
16	Bank of Canada	151
17	Boston Fed	139
18	Chicago Fed	138
19	Oesterreichische Nationalbank (OeNB)	128
20	Bank of Thailand	120

All in all, central banks tweeting activity about Covid-19 with hashtags varied considerably. Out of the 20 most-active central banks tweeting about Covid-19, 18 were located either in Europe and North America and fall into the World Bank’s high-income country grouping. Only

the central banks of Ecuador and Thailand fall into the upper middle-income group. Out of all central banks, only the Central Bank of Ecuador was actively involved in sharing actual Covid-19-related health advice.

8. Concluding remarks

In this paper, we reviewed how the world's central banks have employed the microblogging platform Twitter, which allows institutional users to distribute information to citizens in real time and engage in direct conversation with them. Early-moving banks joined Twitter before 2010, and by late 2021 approximately 70 % of the world's central banks were on the platform.

Building on a comprehensive dataset containing all the tweets of all the world's central banks with Twitter accounts starting from the day Twitter was established, we explore how central banks around the world use Twitter in communication. All central banks, no matter if they are in rich or poor countries and despite varying degrees of independence, have access to the same functionalities of Twitter. We explore the similarities and differences in how Twitter is used by 122 central banks.

Our comparative analysis identifies both similarities in central bank strategies and striking differences in their influence and willingness to connect with the public. While differences in central bank Twitter use cannot be solely explained by such factors as income level or digital literacy of the population, certain factors seem to influence specific clusters of central banks (e.g. income group and geographical location). The communication policies and initiatives of central banks can influence their global visibility on Twitter and specific regional features such as mistrust of traditional media may, as in the cases of certain central banks in Latin America, actually boost central bank Twitter activity and engagement. The increase in central banks Twitter activity during the height of the Covid-19 pandemic mainly reflects their crisis response.

Our results offer modest encouragement as communication with a wider audience becomes more important for central banks. Twitter and similar platforms offer a way to reach members of the public that bypassed traditional gatekeeper media. Smaller central banks with fewer resources, in particular, can adopt policies that allow for relatively large presences on Twitter.

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