

Communicating financial stability in monetary policy reports: a text-mining experiment in postcommunist countries

Financial stability in inflation reports

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Łukasz Kurowski and Paweł Smaga
*SGH Warsaw School of Economics, Collegium of Management and Finance,
Warsaw, Poland*

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Abstract

Purpose – Financial stability has become a focal point for central banks since the global financial crisis. However, the optimal mix between monetary and financial stability policies remains unclear. In this study, the “soft” approach to such policy mix was tested – how often monetary policy (in inflation reports) analyses financial stability issues. This paper aims to discuss the aforementioned objective.

Design/methodology/approach – A total of 648 inflation reports published by 11 central banks from post-communist countries in 1998-2019 were reviewed using a text-mining method.

Findings – Results show that financial stability topics (mainly cyclical aspects of systemic risk) on average account for only 2% of inflation reports’ content. Although this share has grown somewhat since the global financial crisis (in CZ, HU and PL), it still remains at a low level. Thus, not enough evidence was found on the use of a “soft” policy mix in post-communist countries.

Practical implications – Given the strong interactions between price and financial stability, this paper emphasizes the need to increase the attention of monetary policymakers to financial stability issues.

Originality/value – The study combines two research areas, i.e. monetary policy and modern text mining techniques on a sample of post-communist countries, something which to the best of the authors’ knowledge has not been sufficiently explored in the literature before.

Keywords Monetary policy, Financial stability, Text-mining, Inflation

Paper type Research paper

Introduction

The global financial crisis (GFC) which started in 2007 has proven that maintaining price stability alone is not sufficient to ensure macro-financial stability. Consequently, authorities widened the mandates of many central banks to explicitly mitigate systemic risk. Thus, currently, central banks face dual objectives. Increasingly more researchers investigate how

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to include financial stability considerations in the conduct of monetary policy to achieve effective *policy mix* and coordination between those policies. Most researchers focus on using the “hard” approach that is embedding systemic risk indicators into existing monetary policy frameworks (in the Taylor rule, see [Friedrich, Hess, & Cunningham, 2019](#)), otherwise called “integrated inflation targeting” framework (see [Agenor & da Silva, 2014](#)).

In contrast, we studied the complementary (“soft”) form of the *policy mix* in the form of increasing the degree to which monetary policymakers analyze systemic risk issues in inflation reports (IRs), which are the key communication tools. To date, such a “soft” approach to *policy mix* has been present in the literature only to a limited extent. This research problem is relevant for central banks in postcommunist countries, because after the GFC their inflation-targeting frameworks became more flexible in order to maintain the economy’s stability ([Hałka, 2015](#)). Thus, we aimed to perform an empirical cross-country analysis of 11 postcommunist countries to gain insight into the extent to which IRs (published in 1998–2019) cover financial stability issues. Therefore, we asked two research questions:

- Q1. Is the “soft” approach to the *policy mix* used in practice?
- Q2. Did the GFC increase the degree to which systemic risk-related issues were discussed in IRs?

We focused on the understudied sample of postcommunist countries, as there is already some evidence of GFC’s material impact on the communication of major central banks, among others, ECB and Fed ([Nerghe, Lee, Groenewegen, & Hellsten, 2015](#); [Grostal et al., 2015](#)). The existing literature provides a relatively small number of studies of central banks’ documents that used text-mining techniques from linguistics. Moreover, such studies usually focused on a single central bank, mainly the ECB or the Fed. The novelty of our study lies in the application of text mining to the IRs in a group of postcommunist countries. Thus, our two main contributions to the literature include (1) assessing how often monetary policy (in inflation reports) analyses financial stability issues in postcommunist countries, as well as (2) combining two research areas (i.e. monetary policy and modern text mining techniques). To the best of our knowledge, scholars have not explored these issues sufficiently.

The structure of the article is as follows. In [Section 2](#), we will review the relevant literature. [Section 3](#) will focus on data and methodology. [Section 4](#) will provide a discussion of the results, and [section 5](#) – conclusions.

Literature review

We attempted to bridge the gap between the two research areas reviewed below. The first area of studies analyses the integration of financial stability objectives into monetary policy frameworks. The second one is a much smaller area and includes research using text-mining techniques aiming to analyze written forms of central banks’ external communication.

Monetary and financial stability policies, as well as their objectives, are materially intertwined. Both policies impact bank lending and funding conditions, the balance sheet structure of banks and their profitability, as well as their risk appetite ([Beyer et al., 2017](#)). For instance, an excessive and prolonged period of expansive monetary policy puts pressure on bank interest income, fosters overindebtedness of the non-financial sector, promotes the search for yield behavior and higher leverage ([ESRB, 2021](#)) and increases the overall stress in the financial market ([Maddaloni & Peydró, 2013](#); [Gersl, Jakubik, Kowalczyk, Ongena, & Peydró, 2015](#); [Heider, Saidi, & Schepens, 2019](#)). Furthermore, a more restrictive interest rate policy increases credit risk and the cost of bank market funding and might induce destabilizing capital inflows into the domestic financial system. Therefore, there is a need to incorporate financial stability concerns into the process of monetary policy decision-making

to avoid (or at least limit) the potential negative side effects of the central bank's monetary policy on the financial system.

Numerous studies focus on evaluating the abovementioned "hard" approach to *policy mix* by including various financial variables in the Taylor rule equation (apart from the output gap and inflation); predominantly credit growth and credit channel variables (see [Christiano, Motto, & Rostagno, 2010](#); [Verona, Martins, & Drumond, 2017](#)). Most researchers find that the interest rate policies of main central banks indeed respond to financial variables ([Friedrich et al., 2019](#)). These studies aim to explore the significance of financial variables in the central banks' interest-setting behavior. In turn, we aimed to verify if financial stability topics are also significant in the "soft" approach.

Since the beginning of the twenty-first century, central banks have increased the transparency and quality of their communication, which enhances democratic responsibility and leads to higher monetary policy efficiency – communication became a monetary policy tool in itself ([ECB, 2021](#)). It allows central banks to manage public expectations about the future course of monetary policy using forward guidance ([Amaya & Filbien, 2015](#)), reduce financial market uncertainty and help stabilize the economy ([Haldane, 2017](#)). Surveys of empirical evidence by [Blinder, Ehrmann, Fratzscher, De Haan, and Jansen \(2008\)](#) and [Blinder, Ehrmann, de Haan, and Jansen \(2022\)](#) conclude that communication can be an important and powerful part of the central bank's toolkit, because it can move financial markets, enhance the predictability of monetary policy decisions and potentially help achieve central banks' objectives. Thus, adjusting communication for financial stability purposes could be part of the solution to the *policy mix*, which we explored in our study.

At the same time, research on the text mining of central banks' documents is in a nascent stage of development, as confirmed by the seminal review by [Bholat, Hansen, Santos, and Schonhardt-Bailey \(2015\)](#), who elaborate from a practical perspective on how to apply text mining in central bank research and policymaking. Therefore, our article contributes to the scant literature that seeks to understand the role of financial factors in central bank communication on monetary policy. Subsequently, we may divide the text-mining studies of central banks' communication into two strands: one analyzing the financial market impact of monetary policy communication and the other – the communication's content.

Most text-mining studies on central bank communication mainly aim to determine if communication regarding monetary policy has a material impact on financial markets, and the majority confirm the presence of such causality ([Hendry & Madeley, 2013](#); [Apergis & Pragidis, 2019](#); [Schmeling & Wagner, 2019](#); [Alfieri, Eratalay, Lapitskaya, & Sharma, 2022](#); [Parle, 2022](#)). Another, although quite small, strand of literature analyses the content (quality and quantity) of monetary policy communication. The study most similar to ours is probably that by [Johnson, Arel-Bundock, and Portniaguine \(2019\)](#), who analyzed the content of speeches from the BIS database given by central bankers worldwide between 1997 and 2017. [Johnson et al.](#) indicate that central bankers talked extensively about the GFC in their public speeches at its height (2008–2014), and the peak occurred in 2010. However, over time, the discussion of financial stability topics in these speeches has decreased, paralleling the decline in intensity of the GFC, as confirmed by [Alfieri and Gabrielyan \(2021\)](#). Similarly, [Luangaram and Wongwachara \(2017\)](#) focus on the monetary policy statements of 22 central banks in the 2000–2015 period and note that post-GFC, the topic of the "global factors" (global economy and global financial market) became more prominent. For inflation-targeting central banks in Latin America [Taborda \(2015\)](#) argues that finance vocabulary (limited to "financial crisis," "financial market," "financial stability," and "sub-prime") was the least frequently used cluster of words in the minutes of central bank meetings. Furthermore, [Bulir, Cihak, and Jansen \(2012\)](#) prove that the GFC made the central bank communication less clear and was a major communication challenge. Somewhat contrastingly, [Siklos, Amand, and Wajda \(2018\)](#)

found that during the crisis, central banks' speeches became more focused on issues concerning the financial system and the policy response, but this trend did not last in the post-GFC period.

The outbreak of the COVID-19 pandemic constituted an unexpected exogenous shock to the European economies. Central banks quickly implemented aggressive monetary easing measures to stabilize markets, prevent an increase in market interest rates, ensure a continuous flow of funding to the real economy, and support fiscal pandemic relief programs. Thus, the pandemic shock created challenges for central bank communication policy as it became more intense and less scheduled (In English, Forbes, & Ubide, 2021; Fraccaroli, Giovannini, Jamet, & Persson, 2022). Central banks announced many monetary support measures in the form of press releases after meetings, often organized in extraordinary and ad hoc format. They usually released monetary communication in response to COVID-19 jointly or within a close time widow with announcements of expansive measures by other economic policies, signifying a *policy mix* in communication (Fratto, Vannier, Mircheva, de Padua, & Poirson, 2021). As the IRs are not suited to act as an immediate communication tool, central banks in Europe primarily relied on press releases and media briefings for their external COVID-19-related communication. Scholars observe no significant differences in monetary policy communication in response to the pandemic between central banks from "Western European" and postcommunist countries. Due to the short time series, initial studies report conflicting evidence regarding the materiality of the possible pandemic's impact on central banks' communication (Fraccaroli *et al.*, 2022; Bohl, Kanelis, & Siklos, 2023).

In summary, most studies that apply text mining to central bank communication focus on the impact of minutes or speeches (not IRs) on financial markets and analyze single (or only several) major central banks, such as the Fed or the ECB. Only a handful of studies attempted to assess the relative importance of the content in monetary policy communication. Moreover, many of the studies analyze the pre-GFC period, but the communication strategies of central banks have changed significantly since then. In contrast to reviewed studies, we attempted to contribute to the literature by creating a corpus out of IRs (not monetary policy statements or speeches), focusing on postcommunist countries (not just the ECB or the Fed), and analyzing a much larger dictionary of financial stability terms than the ones used to date. Moreover, we wanted to test whether the GFC had any lasting effect on the IRs' content. We targeted the gap between the text mining of monetary policy documents (as in the studies reviewed above) and the text mining of central banks' financial stability-related communication, which is an understudied research area.

Data and methodology

For comparative purposes, we focused on central banks in postcommunist countries that adopted the inflation-targeting strategy and published IRs as a main communication tool. We selected postcommunist countries as our sample based on the review by Grostal *et al.* (2015). Namely, we selected countries with regularly published IRs that have a similar structure (i.e. include assessment of macroeconomic developments along with GDP and inflation projections, serving as a basis for monetary policy decisions). Regarding the language, we were limited to IRs published in English. Furthermore, we only included IRs with sufficient length of publication record to ensure robust research results during the long research period (1998–2019). Consequently, our sample consisted of IRs written by the central banks in 11 postcommunist countries: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Moldova, Montenegro, Poland, Romania, Serbia and Ukraine. These countries publish IRs or, alternatively, other reports under different names that have the same content and structure as an IR.

Furthermore, we included Sweden in the sample, as an example of a country with the *leaning-against-the-wind* monetary policy. It acted as a control country to create a reference basis for interpreting the results of postcommunist countries. As the world's oldest central bank, Riksbank often serves as a model example of a robust monetary policy framework and a source of best practices for “younger” central banks (e.g. the ones in our sample). Riksbank implements restrictive monetary policy proactively and preemptively, driven by the accumulation of macrofinancial imbalances and not just purely by inflation outlook. Riksbank has been explicitly using such policy since 2010 to counter systemic risks stemming from household's excessive indebtedness and high debt-to-income ratio (Svensson, 2018).

We classified our sample of postcommunist countries into three groups of countries on the basis of geographical proximity, namely, Central Europe (CZ, HU and PL), Eastern Europe (EE, LT and UA) and Southern Europe (BG, MD, ME, RO and RS).

We focused on IRs, because according to the literature review, they are a relatively less researched area of central banks' communication (as opposed to speeches and minutes). Hammond's (2012) survey of 27 inflation-targeting central banks reveals that communication is an integral part of an inflation-targeting framework and the main vehicle of communication is the IR. Hammond (2012) notes that all 27 central banks publish such reports, and in the vast majority of cases, they do so quarterly. A typical IR usually presents the central bank's assessment of macroeconomic conditions, inflation and growth projections which are directly linked to monetary policy decisions and shape/anchor inflation expectations, as well as interest rate paths. Moreover, a typical IR often includes the main upside and downside risks to the projections and alternative scenarios. Another primary purpose of IRs is to clarify the rationale behind recent monetary policy decisions and contribute to forward guidance. Therefore, IRs are the single most important document for central banks following an inflation-targeting strategy, which implies that IRs are worth investigating.

In our sample, central banks in postcommunist countries (see Table 1) publish IRs mostly on a quarterly basis or three times a year. Central European countries (CZ, HU and PL) and Sweden have longer experience with IR publications than other countries in the sample. Moreover, apart from issuing IRs, almost all central banks in our sample also publish financial stability reports (FSRs). Therefore, whether a bank publishes a separate FSR or not does not affect how much it might be inclined to include financial stability considerations in the IRs.

Furthermore, in Figure A1 in the Appendix, we showed the average number of words in the reports in a given year in individual groups of countries, which seems to be gradually increasing over time. On average, Central European countries publish the longest IRs. After the GFC, we observed a slight growth in the length of IRs in Central and Eastern European countries. However, Sweden began publishing shorter reports at a higher frequency in 2015.

We used the text-mining method (Voyant Tools, available at <https://voyant-tools.org>) to verify how often monetary policy discusses financial stability. At the initial stage, each IR in each country in our study constituted a separate text corpus, for which we verified the frequency of words related to the stability of the financial system (a word count approach).

Our dictionary comprised three clusters of financial stability words: cyclical aspects of systemic risk (c_t), structural aspects of systemic risk (s_t) and general stability words (g_t), which we could not clearly assign to a given aspect of systemic risk. We created a comprehensive dictionary on the basis of financial stability concepts used in macroprudential recommendations issued by the European Systemic Risk Board, national financial stability reports and the authors' expert knowledge gained from working at the central bank. Ultimately, we selected 107 words (39 cyclical, 27 structural and 41 general) allocated to three groups, as presented in Table 2. We divided the dictionary into groups based on the

Country	Report name	Publication years	Number of inflation reports analyzed in a given year	Total number of IRs reviewed in a given country	Is a financial stability report published?
Bulgaria	Economic Review and Macroeconomic Forecast	2004	3	63	No
		2005–2019	4		
Czech Republic	Inflation Report	1998	1	84	Yes, from 2004
		1999–2018	4		
		2019	3		
Estonia	Estonian Economy and Monetary Policy	2006–2015, 2019	2	34	Yes, from 2003
		2016–2018	4		
Hungary	Inflation Report	2000, 2002–2018	4	78	Yes, from 2000
		2001, 2019	3		
Latvia	Macroeconomic Developments Report	2009, 2019	1	29	Yes, from 2003
		2010	3		
		2011–2014	4		
		2015–2018	2		
Moldova	Inflation Report	2010–2018	4	39	No
		2019	3		
Montenegro	Inflation Report	2007, 2010, 2013–2018	3	32	Yes, from 2010
		2008, 2011	2		
		2009	1		
Poland	Inflation Report	1998	1	69	Yes, from 2000
		1999, 2004–2005, 2008–2018	3		
		2000–2003, 2006–2007	4		
		2019	2		
		2002–2005	2		
Romania	Inflation Report	2006–2018	4	60	Yes, from 2006
		2019	3		
		2006, 2019	3		
Serbia	Inflation Report	2006, 2019	3	54	Yes, from 2005
		2007–2018	4		
Sweden	Inflation Report	1997–2005	4	91	Yes, from 1999
		2006	3		
		2007–2014	3		
		2015–2018	6		
Ukraine	Inflation Report	2019	4	15	Yes, from 2016
		2016–2018	4		
		2019	3		

Table 1.

The analyzed sample of inflation reports

Note(s): The number of reports in 2019 includes all reports published until the end of August 2019

Source(s): Authors' own elaboration on the basis of central banks' websites

consensus in the literature. Namely, we distinguished two main dimensions of systemic risk, commonly used by central banks (BIS, 2010):

- (1) cyclical dimension defined as a build-up of systemic risk over time, including mitigating excessive swings in the financial cycle (like credit booms), risk of procyclicality and deleveraging;

Group	Words
Cyclical (c_i)	credit boom, credit bust, credit cycle, credit gap, credit growth, credit policy, credit risk, credit standards, credit survey*, credit*, deleveraging, financial cycle, foreign currency credit*/fx credit*, foreign currency loan*/fx loan*, foreign currency swap*/fx swap*, housing, housing loan*, housing credit*, impairments, indebtedness, lender*, lending, lending cycle, lending policy, lending survey, lending surveys, leverage, loan growth, loan*, mortgage*, overindebtedness/over-indebtedness, procyclical*, property price*, real estate*, real estate price*, propert*, mortgage loan*, bubble, house price
Structural (s_i)	bank* capital, bank* equity, bank* funding, bank* resilience, buffer*, capital adequacy, capital adequacy ratio*, capital ratio*, CET*, common equity, contagion, financial network, illiquidity, interconnected*, LCR, liquidity coverage ratio, liquidity position, liquidity risk, maturity mismatch, net stable funding ratio, NSFRR, riskweight, riskweight*assets, RWA, spillover*, systemic* important, tier
General (g_i)	asset quality, bank* assets, bank* bankruptcy, bank* default, bank* exposure, bank* income, bank* liabilities, bank* profitability, bank* regulation, bank* risk bank*, banking regulations, banking sector, banking supervision, banking system, CRD, credit institution*, cris*, bank* deposits, CRR, financial institution*, financial market* financial sector*, financial stability, financial supervision, financial system*, macroprudential, microprudential, nonperforming*, NPE*, NPL* bank* resolution, return on assets, return on equity, ROA, ROE, stress test*, subprime, systemic risk, LTV/loan-to-value/loan to value, securitization

Note(s): When constructing the dictionary we took into account the issues of stemming or lemmatization, i.e. the symbol “*” at the end of word matches all the words that start with the expression before “*” but have different endings. For example “cris*” contains: crises and crisis. We also included versions of selected words with and without a hyphen

Source(s): Authors’ own elaboration

Table 2. Financial stability words analyzed in inflation reports

- (2) structural dimension, defined as the distribution of systemic risk in the financial system at a given moment, including risk of contagion, interconnectedness and systemically important institutions.

Moreover, we allocated other words associated with financial stability and systemic risk in general to the third group, similarly to the group of words proposed by Fraccaroli *et al.* (2022)

First, following the standard text mining approach (see Hendry & Madeley, 2013; Bholat *et al.*, 2015; Eskici & Koçak, 2018) to “clean up” the corpus of IRs, we removed useless words/stopwords, including, e.g. “a,” “an,” “is” or “the,” as well as special characters, numbers, days of the week, months, the central banks’ names, other words such as percentages, “at,” “which,” “I,” “you,” and so on. We did this to prevent stopwords from creating no content-bearing “noise,” affecting the quality of text mining analysis, as they would artificially increase the denominator of our frequency ratio.

We calculated the frequency of words from a given group in the report as follows (building upon the approach of Taborda, 2015):

$$(c_i \text{ or } s_i \text{ or } g_i) = \frac{(NC_i \text{ or } NS_i \text{ or } NG_i)}{T_i - \text{stopwords}} \quad (1)$$

in which:

NC_i ; NS_i ; NG_i —the total number of words from the defined group (cyclical, structural and general) in particular report i

T_i – the total number of words in particular report i

stopwords – the number of stopwords calculated as $T_i * 0.49$, in which 0.49 is the relation of stopwords to the total number of words in all 648 analyzed documents

Next, we answered whether the number of financial stability words was significant. We conducted the analysis from three perspectives and conducted the following comparisons (also for robustness check purposes):

- (1) frequency of financial stability words in each group (c_i, s_i, g_i) compared to top 10 words in the field of monetary policy most frequently appearing in a given report;
- (2) results obtained for the three mentioned groups (c_i, s_i, g_i) in the postcommunist countries compared to the results for Sweden;
- (3) frequency of the 10 most popular financial stability words compared to the frequency of the 10 most popular monetary policy words.

For calculations in (a) and (b), we created a separate corpora for each country in the sample out of all IRs published by the given national central bank. For calculations in point (c), we created three text corpora corresponding to all reports published in the three groups of countries (Central, Eastern and Southern Europe). Then, we used principal component analysis (PCA) to combine words (top 10 monetary words and top 10 financial stability words) into clusters. We focused on the 10 most popular words because of the interpretation ease, comparability and visualization purposes. Moreover, 10 is a typical number of analyzed top-words or topics used in text-mining studies (Alfieri & Gabrielyan, 2021; Ehrmann *et al.*, 2021; Ferrara *et al.*, 2022). Moreover, we conducted an additional PCA to answer which financial stability word differentiates IRs to the greatest extent. We also calculated the z-score for these top 10 words according to equation (2).

$$z - score_i = \frac{w_i - \bar{w}}{S(w)} \quad (2)$$

in which:

w_i – word's raw frequency

\bar{w} – mean of raw frequencies (of all words in the text corpus)

$S(w)$ – standard deviation of raw frequencies (of all words in the text corpus)

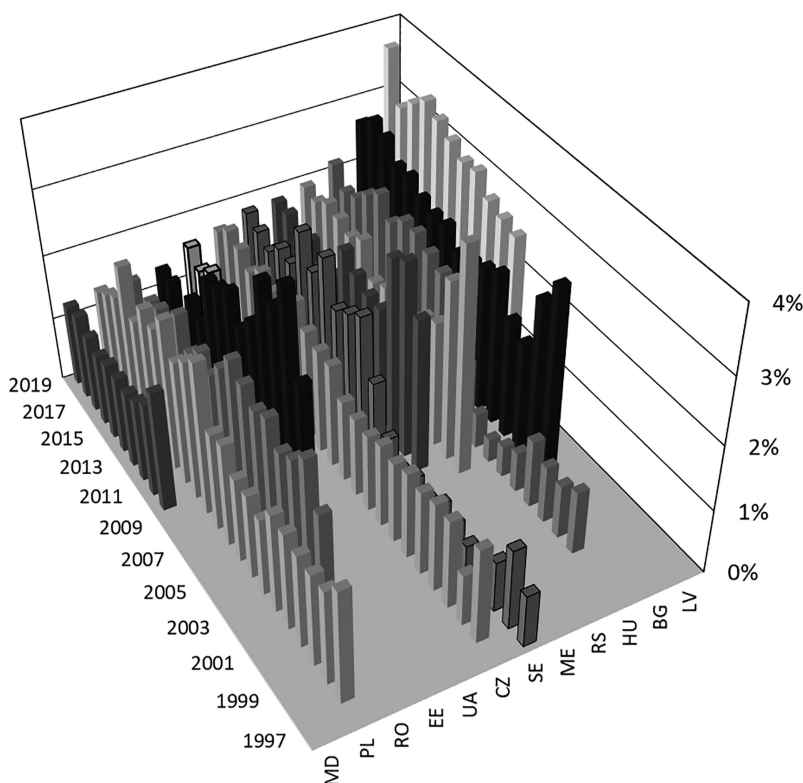
The z-score is a normalized value of the frequency of a particular term compared to other term frequencies in the same document. Thus, the more positive the z-score is, the more often the word occurs in the document compared to the mean of the raw frequencies of all other words.

Results

Country-level analysis

According to the results, the share of all financial stability words (from Table 2) in the total number of words (after the subtraction of stopwords) was on average 1.85% (approx. 2 out of 100 words) in the whole sample. We recorded the largest share in Latvia (3.04%), Bulgaria (2.41%) and Estonia (2.15%), while the lowest share was almost twice as low in Moldova (1.29%), Sweden (1.32%) and Ukraine (1.47%).

In IRs of some central banks, we noticed a moderate increase in the frequency of financial stability words after the GFC (Figure 1):



Source(s): Own elaboration

Figure 1.
The frequency of
financial stability
words in IRs in the
sample countries
over time

- (1) Magyar Nemzeti Bank is involved in reducing the exchange rate risk for FX loans;
- (2) Riksbank explicitly states that it considers the risks to asset prices, property prices and credit volumes in its monetary policy decisions;
- (3) National Bank of Poland includes elements of monetary policy involvement in financial stability in the “Report on Monetary Policy Implementation” (e.g. in 2009);
- (4) Czech National Bank belongs to the small group of central banks that include property prices in the CPI, which could have caused an increase in the frequency of words related to financial stability in IRs after the GFC.

The share of particular groups of financial stability words (cyclical, structural and general, as in Table 2) in the whole corpus shows that the vocabulary from the cyclical and general groups dominates (Figure 2). Monetary policy analyses the structural aspect of systemic risk only to a minimal extent. This could be because monetary policy influences financial stability mainly through the credit channel (impact of interest rates on the credit’s cost and availability). However, we did not directly explore the influence of transmission mechanisms of monetary policy on the structural dimension of systemic risk and nor does the literature explore them to a sufficient extent. Moreover, compared to the impact of cyclical instruments (countercyclical capital buffer for all banks) on macroeconomic conditions, the impact of

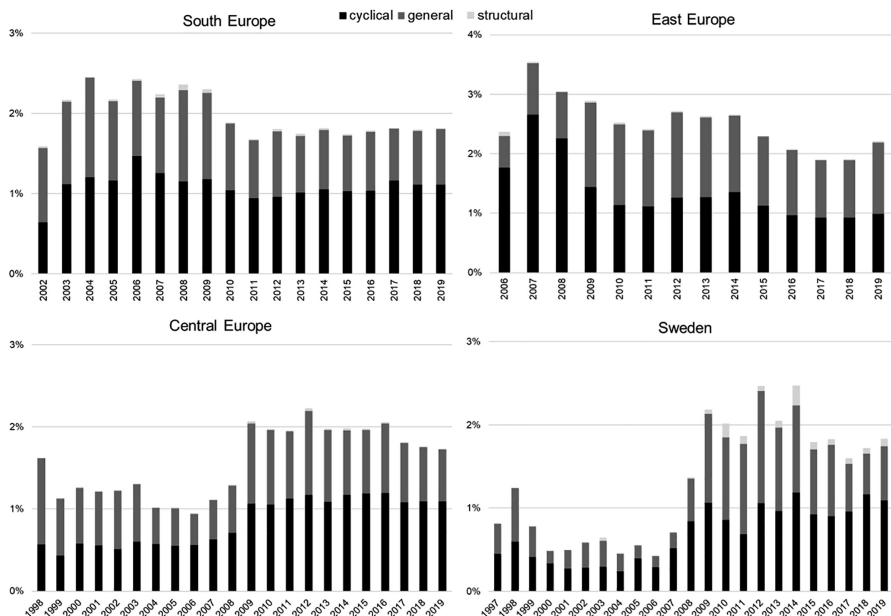


Figure 2.
Cyclical, structural and
general financial
stability words in
inflation reports

Note(s): The figure shows the average frequency of financial stability words in the IRs of a given group of countries

Source(s): Own elaboration

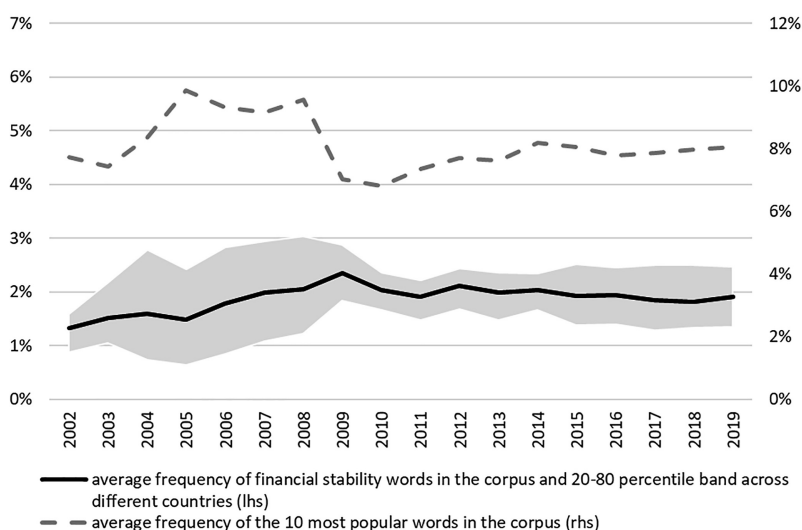
“structural” macroprudential instruments (like a buffer for systemically important institutions) seems to be less apparent, which could, to some extent, justify a lower degree of attention paid to structural aspects of systemic risk in IRs. Figure 2 also confirms that Sweden and Central European countries (but not those in Southern or Eastern Europe) paid more attention to financial stability in monetary policy analyses after the GFC, as compared to the pre-GFC period.

Word-level analysis

We analyzed the relative frequency of financial stability words in an IR. First, we compared the frequency of words in separate groups (cyclical, structural and general) to the frequency of 10 words in the field of monetary policy most commonly found in a given report. These words include growth, inflation, prices, rate, forecast, economic, market, GDP, demand and policy. On average, these are the most frequently used words in IRs (minus the stopwords).

Figure 3 presents the results of relative frequency of financial stability words. The frequency of financial stability words (1.7% on average in 2019) was almost five times lower than the frequency of the 10 most popular words related to the monetary policy in reports in a given country and has not significantly changed within the analyzed time period. Noteworthy, our group of financial stability words consisted of 107 selected words. On the other hand, the frequency of these words in CESEE countries did not differ from the frequency of these words in the Riksbank’s reports.

To additionally verify whether the frequency of financial stability words was high or low, we calculated the frequency of the 10 most popular financial stability words and 10 most



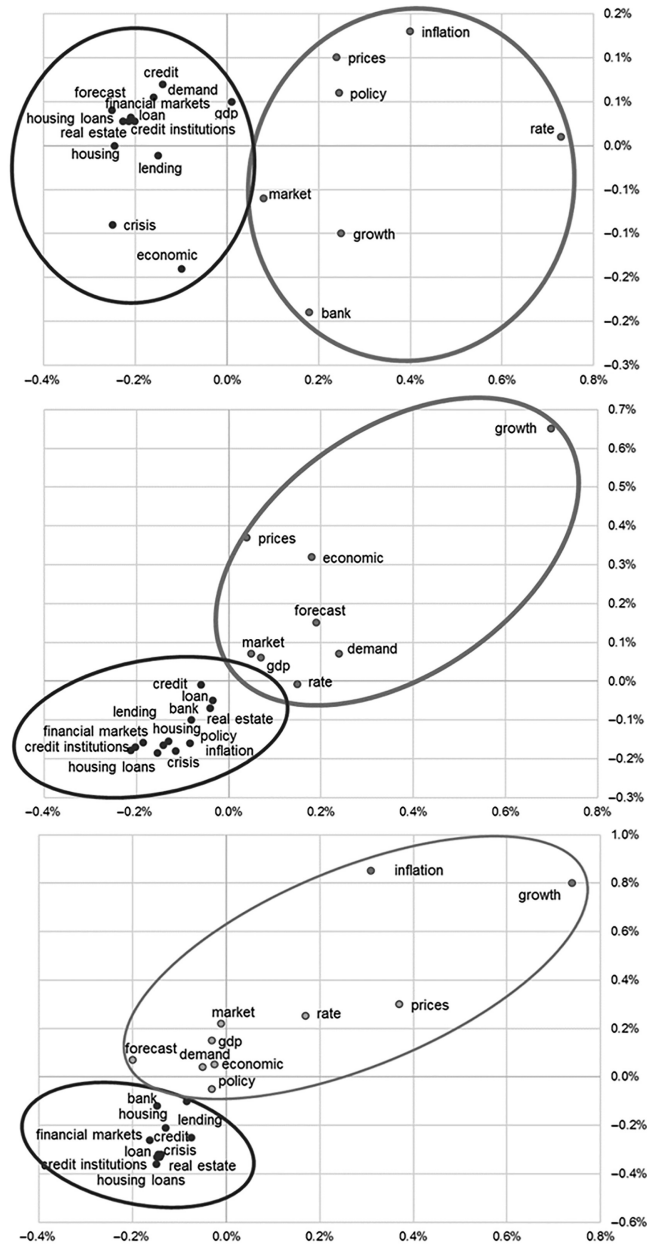
Source(s): Own elaboration

Figure 3. Comparison of financial stability words to the 10 most popular words related to monetary policy

popular monetary policy words and combined them into clusters using principal component analysis, assuming that a given cluster should contain at least two words. We considered each report as a dimension and each word's relative frequency – as a data point. With a large number of reports and words, it is not possible to perform an analysis across so many dimensions. In this case, after standardization, we could use PCA for the words represented by their relative frequency. Consequently, we reduced the number of dimensions to two components, i.e. two groups of separated words – financial stability and monetary policy. Such approach is easy to interpret and in line with the PCA methodology (Jolliffe & Cadima, 2016). Figure 4 presents the results for three groups of countries, i.e. Central Europe, Southern Europe and Eastern Europe (each group of countries constitutes a separate text corpus of IRs). Component I (PC1) and component II (PC2) are in the X and Y axes, respectively. In three groups of countries, namely Central Europe, Southern Europe and Eastern Europe, Component I explained 86%, 77% and 69% of the total variability of documents across terms, respectively, whereas component II was responsible for 6%, 11% and 15% of the variance.

According to Figure 4, groups of monetary and financial stability words are clearly separated and create individual clusters. The only exception among the financial stability words was the word “bank,” which appeared in the cluster together with monetary words in Southern Europe. The overall conclusion of the analysis at this point is that IRs scarcely analyze financial stability. The differences in z-scores values between financial stability words and monetary words confirm this finding. Figure 5 presents these differences for selected groups of countries and words.

To calculate the z-score, we used all words in IRs without disabling the stopword list. In the analyzed groups of countries (Eastern Europe, Southern Europe and Central Europe) and for the 10 most popular financial stability words and the 10 most popular monetary words, the z-score values were positive, which indicates that those words had a relatively higher frequency compared to the average frequency of all words in the IRs. However, each monetary word had an average higher z-score than any financial stability word. Therefore, the share of financial stability words in IRs was relatively insignificant from the perspective of the IR's content as a whole.



Source(s): Own elaboration

Figure 4. Principal component analysis and clustering for the selected financial stability words and monetary policy words for Southern, Eastern and Central European countries respectively

While indicating the differences between groups of countries shown in Figure 5, we noticed that the top 10 monetary words in IRs from countries in Central Europe (like PL, CZ and HU) had higher z-scores than other groups of countries. It appears that this group of countries

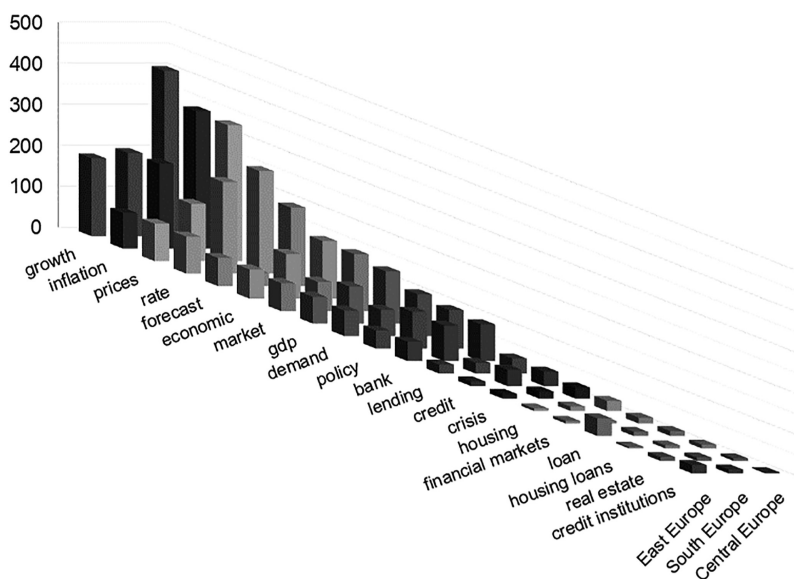


Figure 5. Z-score for top 10 monetary and top 10 financial stability words

Source(s): Own elaboration

focuses on the most important monetary policy issues and domestic economic conditions in their IRs. At the same time, countries in Eastern and Southern Europe raise other issues in IRs in addition to the main monetary policy topic. For example, they devote a significant part to the external environment. Figure 6 (the most popular words out of entire corpus, minus stopwords) confirms such conclusions, as South European and Eastern European countries use words such as “export,” “import,” “global,” “foreign,” or “international” with relatively higher frequency than Central European countries.

When assessing the change in frequency of the 15 most popular financial stability words in time (Table 3) in the full sample, we noticed they reached the highest frequency after the GFC. This means that monetary policy analyzed financial stability to a greater extent in post-crisis periods, which can indicate a “cleaning” approach (i.e. reacting with monetary policy to economic fallout after the crisis materializes) rather than attempting to preemptively incorporate financial stability considerations in its monetary policy analyses in advance. Although IRs included particular financial stability terms before the GFC, terms such as “credit growth” and “real estate” were more frequent from 2006 to 2008.

Our results confirmed that the crisis period (2008/2009) changed the perception of financial stability in IRs, thus providing a positive answer to the second research question (Q2). Reports after the GFC were clearly distinct (creating separate clusters) from the reports before the GFC. To the greatest extent, the IRs in the sample differentiated through the words related to credit activity (loan*, credit*, lending and credit growth), housing market (housing, real estate and housing loan) and general terms (cris*, financial stability, financial institution, banking sector). These words are associated with the subprime crisis, which underlines the shift in the financial stability analysis in IRs after the GFC. However, for Southern and Eastern European countries, this shift was unfortunately only noticeable within a few years directly after the GFC; more recent IRs in these groups of countries create separate clusters with a lower share of financial stability terms in IRs.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean
15 most popular financial stability words in all IRs	0.32	0.34	0.45	0.47	0.43	0.36	0.36	0.40	0.39	0.47	0.42	0.35	0.42	0.37	0.36	0.33	0.34	0.33	0.31	0.35	0.38
bank*	0.09	0.07	0.12	0.14	0.26	0.25	0.30	0.35	0.32	0.42	0.41	0.42	0.43	0.43	0.43	0.41	0.40	0.38	0.38	0.37	0.32
loan*	0.17	0.17	0.16	0.21	0.22	0.18	0.21	0.18	0.19	0.19	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.12	0.12	0.13	0.16
credit*	0.06	0.05	0.04	0.06	0.05	0.10	0.11	0.10	0.11	0.17	0.16	0.13	0.15	0.15	0.17	0.15	0.13	0.14	0.12	0.13	0.11
lending	0.02	0.02	0.02	0.02	0.01	0.00	0.00	0.03	0.11	0.20	0.19	0.18	0.19	0.12	0.08	0.07	0.05	0.04	0.04	0.04	0.07
cris*	0.03	0.02	0.03	0.03	0.07	0.08	0.05	0.08	0.09	0.09	0.07	0.08	0.08	0.07	0.07	0.08	0.10	0.07	0.07	0.07	0.07
financial markets	0.02	0.02	0.03	0.04	0.02	0.01	0.09	0.12	0.12	0.05	0.03	0.03	0.05	0.04	0.06	0.06	0.07	0.07	0.06	0.07	0.05
real estate	0.05	0.04	0.02	0.03	0.03	0.02	0.04	0.05	0.06	0.05	0.05	0.04	0.05	0.06	0.06	0.05	0.06	0.08	0.10	0.09	0.05
housing	0.02	0.01	0.01	0.02	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.05	0.05	0.08	0.09	0.08	0.05	0.05	0.08	0.04
credit institutions	0.01	0.01	0.01	0.04	0.04	0.04	0.06	0.04	0.04	0.03	0.04	0.06	0.04	0.04	0.05	0.04	0.05	0.05	0.06	0.07	0.04
housing loans	0.03	0.06	0.05	0.05	0.04	0.03	0.01	0.02	0.05	0.04	0.04	0.04	0.05	0.03	0.05	0.04	0.06	0.05	0.04	0.03	0.04
banking system	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.07	0.06	0.05	0.05	0.05	0.06	0.05	0.05	0.04	0.04	0.04	0.04
financial institutions	0.03	0.04	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.04	0.05	0.05	0.04	0.04	0.05	0.04
financial market	0.03	0.02	0.01	0.02	0.02	0.01	0.03	0.03	0.03	0.06	0.04	0.04	0.05	0.04	0.03	0.02	0.04	0.03	0.03	0.03	0.03
banking sector	0.04	0.02	0.03	0.00	0.01	0.00	0.03	0.02	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.06	0.06	0.03
financial sector																					

Source(s): Authors' own elaboration

Table 3. Financial stability words frequency over time

Furthermore, macroprudential instruments (countercyclical capital buffer) affect monetary transmission mechanisms and may also hinder monetary policy (Choi & Cook, 2018). This justifies the need to introduce (and communicate) coordination mechanisms between both monetary and macroprudential policies, including a cross-analysis of their joint and simultaneous impact on both price and financial stability. On the one hand, financial stability considerations were rare in the IRs we analyzed. On the other hand, according to our knowledge, monetary policy topics, also constitute only a small part of financial stability reports in general. Arrangements on interactions between monetary and financial stability policies are unfortunately also missing from many macroprudential and monetary policy strategies published by central banks in Europe.

Conclusions

The central banks' role in ensuring the stability of the financial system increased significantly after the GFC. Therefore, the issue of permanently incorporating financial stability in discussions of the monetary policy decision-making bodies becomes important. Although insufficient and reactive, an alternative approach is to conduct financial and monetary analyses separately.

In this study, we used text-mining tools to verify how often monetary policy refers to financial stability in the content of 648 IRs published by 11 central banks from postcommunist countries (and Riksbank for comparative purposes). We analyzed the research problem from three perspectives – groups of countries, changes over time and the typology of financial stability words. Moreover, we compared the frequency of financial stability words to the most popular monetary words in IRs using principal component analysis and the z-score.

Our results showed that monetary policy discusses financial stability only to a limited extent. On average, approximately 2% of all words (minus the stopwords) in IRs focus on the financial stability area, which is in line with [Taborda \(2015\)](#), who also found the share of financial stability words to be low. Words related to monetary policy and financial stability formed separate clusters and financial stability words did not reflect the overall tone of IRs. Furthermore, there was a noticeable increase in the frequency of financial stability words after the GFC (this particularly applies to CZ, HU, PL and SE). However, their share in the total number of words in the IR remained very low in the post-GFC period. Therefore, we can only partially confirm that the GFC led to an increased, but short-lived focus on financial stability in central banks' monetary communication (Q2), as underlined by [Siklos et al. \(2018\)](#), [Johnson et al. \(2019\)](#) and [Alfieri and Gabrielyan \(2021\)](#). Lastly, we found that when monetary policy discusses systemic risk, words that relate mainly to the cyclical aspect of systemic risk dominate. Concluding, we did not find enough evidence that a “soft” policy mix is visible in postcommunist countries (Q1).

The lack of monetary policy involvement in the analysis of financial stability might indicate a clear separation of mandates between the monetary and macroprudential responsibilities of central banks. However, this may result in the failure to provide a full picture to monetary policymakers, because such an approach would miss the impact of macroprudential instruments on monetary transmission mechanisms and the interconnectedness between financial system and the real economy. Increasing the “soft” policy mix would support better management of systemic risks by central banks and ultimately positively affect the societal level due to improved financial stability and overall economic conditions.

Furthermore, monetary policy communication needs to adapt to evolving trends in digital communication channels and be able to rapidly respond to unexpected shocks like COVID-19 and heightened uncertainty (see [Ehrmann et al., 2021](#)). As indicated by [Glas and Müller \(2021\)](#), communicating clearly becomes more difficult during crisis when monetary policy tends to become increasingly more discretionary and complex. However, it is precisely these times when the general public is looking for guidance and leadership. For central banks, this

increases the importance of communicating via press releases and social media (rather than using ex-post scheduled reports), which constitute the valuable field of future research (Masciandaro, Romelli, & Rubera, 2021). Therefore, communication should be less about what has happened and more about what would be the monetary reaction should an adverse alternative scenario materialize.

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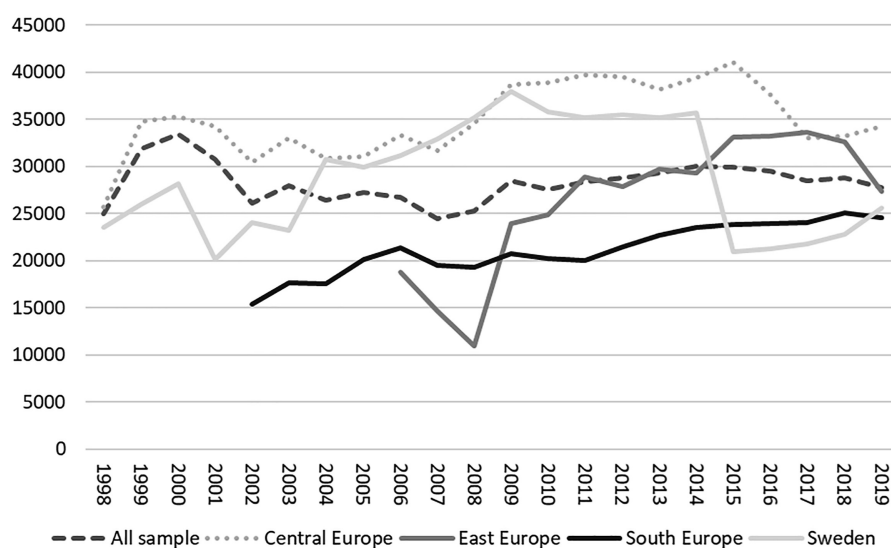
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Appendix



Note(s): The number of words in the figure does not exclude stopword list

Source(s): Own elaboration

Figure A1.
Average number of words in inflation reports

Corresponding author

Łukasz Kurowski can be contacted at: lkurow@sgh.waw.pl

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