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BROADER AUDIENCE TRANSPARENCY INDEX FOR CENTRAL BANKS

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Transparency is one of the key quantitative indicators of the quality of central bank communication. The more information a central bank releases about its policy, the more transparent its communication is considered to be. Globally, there are several popular indices to assess the transparency of communication. However, all of them fail to assess the transparency of central banks for the population. This paper is set to fill in this gap, which is especially important given the pivot of monetary authorities towards expanding communication with the general public. The BATI (Broader Audience Transparency Index) assesses 20 central banks in developed and developing countries in terms of the key functions of their public communication (information, education, accountability, and signalling).

In total, the index has 40 criteria, of which three are punitive. They downgrade central bank assessments for redundant style, bureaucratic syntax, and contradictory signals, which may endanger dialogue with the public. When drafting the BATI criteria we incorporated the results of other researchers across various areas, i.e. monetary policy, government information policy in a general sense, marketing, brand management, and cognitive psychology. The BATI is based on indicators the value of which has been established in empirical studies or thoroughly founded in theoretical academic papers.

When evaluating the index criteria, we employed both the standard method of expert assessment of communication with the help of lists (traditionally used to create transparency indices) and NLP and LLM methods for handling non-structured data. Specifically, 23 out of the 40 criteria of the index were defined using expert assessment, four – LLM models, and 13 – machine text analysis.

The Bank of Canada, the Bank of England and the European Central Bank received the highest BATI scores among central banks for communication with the general public. The Bank of Russia is ranked fourth with 17.31 points out of 37. It belongs to the group of central banks that use advanced practices in communication with the public but have certain gaps in some communication functions. At the same time, the Bank of Russia has the highest score in audience education (tied with the US Federal Reserve System and the Reserve Bank of Australia). In general, the BATI index value is significantly higher in developed economies than in developing countries. This is consistent with the findings of studies on central bank transparency for professional audiences. The Bank of Russia is an exception among developing countries. It is closer to central banks in developed economies on almost all criteria of transparency for broader audience.

The main academic novelty of this paper is the attempt to bridge the gap in terms of the absent instrument for assessing central bank efforts to enhance transparency for the general public. Our proposed BATI index assesses the extent of central bank efforts within each of the main communication functions and can help monetary authorities choose the options how to further develop their information policies. Moreover, our newly created instruments for automated handling of non-structured data also make a contribution to the literature.

JEL classification: E52, E58, E71

Keywords: monetary policy, communication, transparency, text analysis, LLM

Contents

Introduction

Transparency is one of the key measures of central bank communication. The more information a central bank releases about its policy, the more transparent its communication is considered. Quite often, modern central banks state their commitment to the policy supporting transparency and devote a separate block within their strategies to this topic.

There exist several transparency indices, which are traditionally used to assess the openness of monetary authorities. First of all, these are Eijffinger and Geraats 2006; Dincer and Eichengreen 2014, 2019, 2022; Al-Mashat et al 2018. These indices help track the massive increase in the transparency of monetary authorities observed over the last two decades.

At the same time, we believe that there remains a considerable gap in the area of transparency of monetary authorities. These indices are not meant to measure central bank's

transparency in their communication with society. As such, they thoroughly assess regulators in terms of disclosing their forecasting and policy analysis systems (FPAS), but fail to measure the clarity of this information to the general public. It is hardly possible to imagine that an ordinary person can develop trust in a central bank after turning to its website and reading a detailed algorithm for calculating fan charts on the uncertainty of the forecast of real sector variables. In all probability, such material will not enhance the transparency of this central bank for the reader.

It is not enough to say that communication with the general public is important for monetary authorities; it has come to the fore in recent years. Blinder et al. (2008): 'Virtually, all the research to date has focused on central bank communication with the financial markets. It may be time to pay some attention to communication with the general public. Admittedly, studying communication with the general public will pose new challenges to researches. In the end, it is the general public that gives central banks their democratic legitimacy, and hence their independence.'

This paper seeks to contribute to closing this gap by setting forth a Broader Audience Transparency Index (BATI) for central banks. Therefore, **the aim of this paper** is to develop a technique to quantify central bank efforts to enhance communication transparency for a broader audience.

The index we create assesses the communications of 20 central banks in developed and developing countries over 2023. The list of central banks includes: the Bank of Israel, the Bank of Canada, the Bank of England, the Bank of Japan, the Central Bank of the Russian Federation, the Czech National Bank, the ECB, the National Bank of Poland, the Bank of Norway, the Reserve Bank of New Zealand, the Reserve Bank of Australia, the Bank of Sweden (Swedish Riksbank), the South African Reserve Bank, the US Federal Reserve System, the Bank of Korea, the Bank of Thailand, the Central Bank of Brazil, the Central Bank of Armenia, the Bank of Jamaica, and the National Bank of Kazakhstan. We have so far been unable to include a broader range of banks due to the non-availability of communications in English for a number of banks (Argentina, Chile), the minimum amount of communication with the public (the Philippines), or the absence of the inflation targeting (IT) regime (China). Besides, we have not evaluated transparency for past periods (prior to 2023) as some important components of the index (primarily those capturing the user-friendliness of central bank websites) cannot technically be extended leftwards on the time scale.

When elaborating the BATI architecture, we took into consideration several sections of the academic literature, which address the issue of what exactly makes public communication transparent. First of all, the list of findings includes those obtained from papers on central bank

communication. However, we deemed it possible to also include findings from related disciplines, for example from the field of state information policy in general, especially that of governments. They are largely associated with the transparency of authorities and the ways to ensure it. We believe that these findings can be equally useful for monetary authorities. Moreover, the issue of building central bank communication with the broader audience can be also viewed as the issue of corporate branding, where monetary authorities provide price stability services and seek to shape positive attitudes of customers towards their brand. This makes a great number of marketing research papers relevant to central banks.

The BATI consists of four sub-indices built according to the functions of central bank communication with the public, i.e. information, education, acc0ountability, and signalling.

Informing the public about decisions taken is a key communication task. Creating awareness to account for policy decisions is viewed as one of the three basic functions of central bank communication policy in Haldane et al (2020). This function can also be seen in the published strategies of several central banks. For example, the Swedish Riksbank describes it as making it possible for the general public, the Riksdag (Swedish Parliament), and the mass media to understand, examine and evaluate the work done by the Riksbank; the Reserve Bank of India declares the objective to disseminate information with minimum time delays.

Education is another key communication function. As established by many researchers, financial literacy plays one of key roles in building household inflation expectations. Agents with better knowledge about economics and in the field of financial literacy tend to have lower inflation expectations.

Ensuring accountability is the third function. It becomes especially important for independent central banks maintaining IT regimes where they are to report to the public on policies pursued, either directly or via legislative authorities.

Finally, the signalling function of communication is the fourth block. In recent decades, the role of this function has been constantly increasing. In response to the growing global uncertainty, regulators started to use new communication instruments designed to provide economic agents with clearer signals, primarily forward guidance.

When evaluating the index criteria, we employed both the standard method of expert assessment of communication with the help of lists (traditionally used to create transparency indices) and NLP and LLM methods for handling non-structured data. Specifically, 23 out of the 40 criteria were defined using expert assessment, and four – LLM models.

This paper contributes to the literature in the following way:

1) It closes the gap caused by the lack of an instrument to evaluate the transparency of communication with the general public. The academic community and monetary authorities have long been aware of the importance of public communication, but until now, there has been no method to quantify central bank efforts to enhance the transparency of such communication.

2) Our paper introduces several new automated instruments based on NLP models to assess communication.

3) It provides the results of the machine analysis of a dataset of 100 best English-language speeches made in the 20th century (compiled by researchers from the University of Wisconsin-Madison and Texas A&M University, the list reflects the opinions of 137 leading American scholars in the field of public speeches) and extracts quantitative benchmarks of successful verbal communication from it.

The BATI index assesses the extent of efforts central banks make in each of the main communication functions, and provides guidance for monetary authorities as to the areas of further development of their information policies.

This paper is structured as follows. Chapter 1, Literature Review, sums up relevant research that became the starting point for this paper. Chapter 2 describes the composition of the index, justifies each of the indicators, and provides calculation methods. In Chapter 3, we checked the results for robustness to language change by recalculating NLP and LLM criteria in Russian instead of English for three central banks. Chapter 4 lists the results obtained. Chapter 5 makes the conclusion and outlines further research areas.

1. Literature Review

1.1. Advantages and limitations of transparency

Many central banks have become more transparent in recent years. The thoroughly detailed indices (Eijffinger and Geraats 2006; Dincer and Eichengreen 2014, 2019, 2022; Al-Mashat et al 2018) evidence considerable increase in the transparency of monetary authorities over the past two decades. At the same time, there are two outstanding issues: 1) whether there exists an optimal level of central bank transparency and where it is (still a highly debated question in the academic community); 2) whether higher transparency leads to the higher quality of monetary policy and public welfare.

Several academic papers give answers to the first issue both in terms of theoretical justification and in terms of its empirical confirmation. The issue of whether transparency is of critical value for the efficient implementation of monetary policy has been a matter of discussion in academic research for over two recent decades. On the one side, there is a big group of researchers who postulate and substantiate the key value of transparency for central bank policies (these are primarily Geraats (2001), Eijffinger and Geraats (2006), Dincer and Eichengreen (2014, 2019, 2022)). The advocates of transparency note that its high level minimises inflation volatility, increases the predictability of central bank decisions, and helps central banks be more flexible in their reaction to economic shocks. On the other side, many authors warn against the costs of transparency and identify obvious negative effects of excessive or untimely instances of information disclosure by central banks. Let us have a closer look at these papers.

First, it is worth mentioning that probably not all central banks need the highest possible level of transparency. Jensen (2002) and Van der Cruijsen et al (2010) conclude that high transparency is primarily needed in countries with low confidence in central banks and long periods of unstable inflation. Relatively sound central banks do not need it as much.

The most frequently mentioned negative effects of high transparency include miscommunication, and excessive noise and details in the information space (Jensen (2002), Mishkin (2004)). In the course of a debate on public trust in institutions in 2017, Andrew Haldane, chief economist of the Bank of England, argued that the central bank could limit transparency in rough times not to further worsen the situation. He said that high transparency during crisis would be the equivalent of ‘shouting fire in crowded theatre’ and would cause an ‘even greater haemorrhaging in confidence’ and greater damage for households from the fallout of the crisis. He concluded that for that reason the Bank of England was not fully open and fully transparent during the 2008 financial crisis.

Morris and Shin (2002) introduce an additional argument against excessive transparency. In a situation of a highly transparent central bank, its narrative may strengthen the coordination motive of agents in response to monetary authorities’ communications. As agents are making decisions, they may be influenced by (a) the coordination motive when interacting with other agents; (b) the motive of reaction to economic fundamentals. Central bank transparency can considerably shift agents’ preferences to motive (a) which can impair the quality of their decision-making process.

Let us now turn to papers addressing the issue of whether higher transparency leads to an increase in the quality of monetary policy and public welfare. Far less numerous, such papers are chiefly focused on financial variables acting as response variables.

Demertzis and Hallett (2007) found out that central bank transparency has no influence on the level of inflation and of the output gap. However, the dispersion of inflation and of the

output gap can be associated with the variance of transparency. In turn, Papadamou et al (2014), based on data received from 40 central banks over 1998–2005, conclude that higher transparency makes it possible to reduce the volatility of financial markets. Horváth and Vaško (2016) note that excessive transparency is not conducive to better financial stability. Furthermore, higher transparency is not needed in certain periods. Ehrmann and Fratzscher (2009b) demonstrated that the introduction of the quiet week before the publication of the US Fed's decision made it possible to avoid market volatility and speculation. That is, such self-imposed restraints on communication may yield positive results and even become necessary.

We view the interrelation between central bank transparency and public welfare as one of the key issues in this debate. Relying on game theory and J.M. Keynes's beauty contest concept, Morris and Shin (2002) proved that the openness of authorities could reduce welfare. They conclude that communication is a double-edged sword for authorities. It is effective in inspiring people to act in certain ways (with respect to central banks, to save or spend), but the problem is that it may become too effective. Agents tend to overreact to public information; therefore, any mistake or misinterpretation can do much damage to society. This leads to a major challenge for central banks: they need to provide information in such a way that it does not mispresent the situation in the real sector and does not prevent agents from making independent decisions.

This sparked off an intense debate, including Economist entitled 'It's not always good to talk'. It put forth the argument, as the main criticism of monetary authorities, that excessive openness make markets lazy. As a result, traders give the opinions of loquacious central bankers undue weight, and skimp on their own independent assessments of the economy. If the central bank is wrong, economic agents are likely to make wrong decisions. With both economic expertise and debate losing in quality, society as large stands to lose.

Angelotes and Pavan (2005), Cornard and Heinemann (2004), Hellwig (2004), Blinder and Wyplosz (2005), and also Svensson (2006) criticise this approach, stating that public welfare is by far greater given the openness of authorities. Svensson (2006) complements the basic model of Morris and Shin (2002) and proves that an increase in reasonable parameters of openness is accompanied by the growth of public welfare. Moreover, a public and private information balance brings about greater growth in welfare than in case of the dominance of private information. That means that public disclosures are essential for welfare growth.

Two decades after the publication of Morris and Shin (2002), one can assume that their concerns about the excessive public reaction to central bank communications have not been confirmed. Modern people exist in an oversaturated information environment where their media consumption has changed dramatically due in part to the viral spread of social networks and messengers. Today, central banks face completely different problems. They no longer fear that their voice will be drowned by private sector signals. They rather fear that their voice will be lost altogether (Kumar, Afrouzi, Coibion, and Gorodnichenko 2015, Binder 2016, D'Acunto, Hoang, Weber 2020, McMahon and Naylor 2023, Dräger 2023).

Of modern research, let us additionally mention the paper by Casiraghi, Perez (2022), who note that analysts' error in forecasting policy rates decreases with growth in central bank transparency. Their calculations suggest that moving from a level of transparency equivalent to that of the Reserve Bank of India – which in 2010 (before the adoption of inflation targeting) was near the bottom of the rating scale – to that of Sweden, at the top of the rating scale, reduces inflation volatility by 3 pp and inflation by 11 pp, all else being equal.

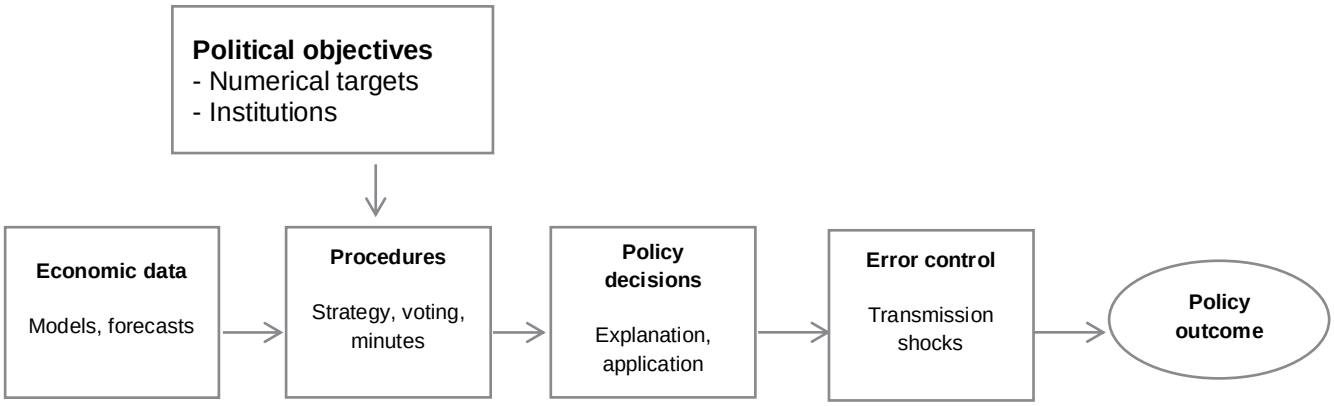
To conclude this section, let us also note that the problems and costs of openness were a matter of concern for not only monetary authorities and researchers. This topic is thoroughly discussed in the literature on public administration. Summarising works on this topic, Meijer et

al (2018) call to search for the 'golden mean' between openness and its risks. Each change of transparency may yield catastrophic effects if it is in shortage or excess.

1.2. Existing transparency indices

In what follows, we discuss approaches to the quantification of central bank transparency. The majority of the above-mentioned papers on measuring transparency effects use the index of Dincer and Eichengreen (2014, 2019, and 2022). It is based on the paper by Eijffinger and Geraats (2006), who identified five sub-types of central bank transparency (political, economic, procedural, operational and related to disclosing decisions). These indices are based on the following rationale: if agents understand how data on the economy transform into monetary policy decisions at all stages, then the central bank's policy is transparent and surprises are unlikely. All the components of this chain and their interrelations are shown in Chart 1.

Chart 1. Concept of transparency index according to Eijffinger and Geraats (2006)



Source: Eijffinger and Geraats (2006).

Table 1. Comparison of different central bank transparency indices

No.	Paper	General description of index	Main transparency indicators	Number of banks reviewed, years
1	Bini-Smaghi and Gros, 2001	The indicator is based on four components: the precision of the objective, the strategy to reach it, published data and forecasts, communication strategy (diversity in the way information is disclosed irrespective of whether it is informative or not).	1 Objective: 1.1. Ultimate goal; 1.2. Quantification. 2. Strategy: 2.1. Announcement of strategy; 2.2. Announcement of intermediate target; 2.3. Announcement of indicators. 3. Publication of data/forecasts: 3.1. Macro model used; 3.2. Data on targets; 3.3. Inflation forecast. 4. Communication strategy: 4.1. Parliamentary hearings; 4.2. Frequency of reports; 4.3. Press conferences; 4.4. Publication of press releases; 4.5. Statement of future moves; 4.6. Publication of minutes; 4.7. Publication of individual votes.	6 banks
2	Fracasso, Genberg, and Wyplosz, 2003	The index is built on the analysis of inflation reports by 20 inflation targeting (IT) central banks and is designed to characterise this document. It assesses the quantity, quality and accessibility of information presented in the reports, the clarity of assumptions about key macroeconomic variables, the description of monetary policy decision-making, and the summary. The paper also presents an overall rating for each inflation report based on its credibility,	1. Quality of information (time to read entire report, discussion of past decisions, discussion of current challenges, presentation of the strategy, disagreements within the committee, arguments for future decisions); 2. Clarity of assumptions made at time of decision (exchange rate, domestic demand (private and public), foreign demand, foreign financial conditions, financial markets); 3. Quantity of information provided (on inflation, detailed prices, growth, risks, policy discussion in committee); 4. How demanding is it to find information (who decides, when are decisions taken, what are the objectives of policy, what information is used as input, how is the information processed);	20 banks, 2002

		expertise, completeness, style of presentation and informative value.	5. Presentation of the policy-making process (the section devoted to presenting how policy decisions are made – length (pages), time to read (minutes), provides efficient summary, conveys rationale of policy decisions, deals with objections, general convincing); 6. Inflation forecast (forecast shown, fan chart shown, horizon of forecast, forecast errors compared to others, data on past errors, GDP growth forecast, unemployment forecast, other forecasts); 7. Presentation of the underpinnings of inflation forecasts (explicit model, informal arguments, assumptions underlying interest rate and exchange rate forecasts); 8. Size and readability of executive summaries (length, time to read, understandable by economists and non-economists); 9. Quality of executive summaries (effective summary, conveys rationale of policy decisions, deals with objections, generally convincing); 10. Overall assessment (convincing, banks' expertise, completeness of report, writing style, information provided, whether information is intimidating for economists and non-economists).	
3	Eijffinger and Geraats 2006	The Eijffinger and Geraats index analyses actual information disclosure by central banks. The index is based on a theory-consistent framework and distinguishes various aspects of transparency depending on the role that information plays in the monetary decision-making process. The authors believe that this makes their index better suited to test theoretical predictions, to compare central banks, and to analyse transparency dynamics. The index is based on assessments of political, economic, procedural, policy and operational transparency. The maximum score is 15.	1. Political transparency: 1.1. Formal objectives; 1.2. Quantitative targets; 1.3. Institutional arrangements. 2. Economic transparency: 2.1. Economic data; 2.2. Policy models; 2.3. Central bank forecasts. 3. Procedural transparency: 3.1. Explicit strategy; 3.2. Minutes; 3.3. Voting records. 4. Transparency of policy decisions: 4.1. Prompt announcement; 4.2. Policy explanation; 4.3. Policy inclination. 5. Operational transparency: 5.1. Control errors;	9 banks, 1998–2002

			5.2. Transmission disturbances; 5.3. Evaluation policy outcome.	
4	Dincer and Eichengreen 2014, 2019, 2022	The Dincer and Eichengreen index is based on the assessments of political, economic, procedural, and policy and operational transparency. Political transparency, or openness about policy objectives, involves a formal statement of objectives, including a prioritisation in the case of multiple goals, quantification of objectives, and explicit institutional arrangements. Economic transparency refers to the economic information used in the formulation of monetary policy. This encompasses the economic data to which policymakers refer, the models that they use to constructs forecasts and evaluate the impact of their monetary policy decisions, and internal forecasts. Procedural transparency refers to the manner in which monetary policy decisions are made. This is assessed based on whether or not the central bank provides an explicit monetary policy rule or strategy, and an account of monetary policy deliberations and how the decision was reached. Policy transparency (transparency of decisions) captures to what extent the central bank discloses its decisions and provides the associated explanation and rationale, and whether or not it provides forward guidance. Operational transparency refers to the information the central bank provides about problems of monetary policy	1. Political transparency: 1.1. Formal Primary Objective(s) with Prioritization; 1.2. Quantified Main Monetary Policy Objective(s); 1.3. Explicit Instrument Independence. 2. Economic transparency: 2.1. Macroeconomic Policy Model(s); 2.2. Numeric Macroeconomic Forecasts; 2.3. Quarterly Medium-Term Inflation and Output Forecasts. 3. Procedural transparency: 3.1. Explicit Monetary Policy Strategy; 3.2. Minutes (within Eight Weeks); 3.3. Comprehensive, Timely Minutes; 3.4. Voting Balance/Records (within Three/Eight Weeks); 3.5. Prompt Individual Voting Records. 4. Transparency of policy decisions: 4.1. Prompt Announcement of Policy Adjustments; 4.2. Explanation of Policy Adjustments; 4.3. Always Explanation of Policy Decision; 4.4 Qualitative Forward Guidance; 4.5 Quantitative Forward Guidance. 5. Operational transparency: 5.1. Monetary Transmission Disturbances; 5.2. Evaluation Monetary Policy Outcomes.	112 banks, 1998–2019

		implementation. Typically, this takes the form of a discussion of control errors in achieving operating targets, unanticipated macroeconomic disturbances that affect the transmission of monetary policy, and evaluation of the results of decisions made. The maximum score is 15.		
5	Al-Mashat et al., 2018	The Al-Mashat et al. (CBT-IT) index is designed for IT central banks. The aim of the CBT-IT index is to establish transparency benchmarks reflecting best practices at the most advanced IFT countries (Full-Fledged Inflation-Forecast Targeting), for further transparency improvements. The index covers three broad aspects of central bank activities, consistent with the theoretical underpinnings of the IT strategy. These include transparency about objectives (four questions), about the forecasting and policy analysis system (FPAS) (nine questions), and about decision-making process (seven questions). The maximum score is 20.	1. Transparency about objectives: 1.1. Is there a formal statement of the objectives of monetary policy emphasizing the dual mandate (or multiple objectives), and that inflation is the primary objective? Is it easily accessible on the central bank's website? 1.2. Is the inflation target defined clearly? 1.3. Might financial stability objectives override the primacy of the inflation (price stability) objective? If the central bank does not have a financial stability responsibility, it should be explicit that it uses the policy interest rate tool to affect financial conditions to the extent that it affects the output gap and hence achieving the inflation target; 1.4. Does the central bank use a loss function evaluation to show how well it has been doing in managing the short-run output-inflation tradeoff? 2. Transparency about the Forecasting and Policy Analysis System (FPAS): 2.1. Are the basic economic data relevant for the conduct of monetary policy publicly available in a downloadable format from the central bank's website (could also include links to other statistical agencies)? For example, data reported in the monetary policy reports should be made available on the website; 2.2. Is the core quarterly projection model (model used for policy-making) publicly available and documentation updated within the last 5 years? 2.3. How transparent is the central bank about the reaction functions (or loss functions) that are used to compute the interest rate paths (or paths for other instruments when the policy rate is constrained by the ELB) in their regular projection exercises? Do the monetary policy reports include a reference to the core model documentation that has the reaction function or the loss function?	One bank, 1998–2017

			2.4. For what variables does the central bank publish a consistent endogenous instrument (e.g., policy rate) quarterly macroeconomic projection over a horizon of at least two years? 2.5. Does the central bank regularly publish forecast densities (fan charts) to communicate forecast uncertainty? 2.6. Is the underlying methodology constructing the forecast densities (fan charts) clear and easily accessible? 2.7. Does the central bank regularly publish an assessment of forecast revisions (decomposition of forecast changes vis-à-vis the previous forecast)? 2.8. Does the central bank publish alternative scenarios in their monetary policy reports to illustrate key risk(s) in the baseline forecast? 2.9. Do the monetary policy reports include historical data and forecasts for financial variables? Financial variables include long-term government bond yields, consumer lending rates, mortgage rates, equity prices, property prices, credit aggregates, corporate risky spreads (e.g., BAA-AAA bond yields), and credit standards (e.g., loan officer surveys). All data should be available in downloadable format. 3. Transparency about Policy Process: 3.1. Does the central bank publish a press statement immediately following the policy decisions? 3.2. Is the policy decision explained at a press conference immediately after it is announced? Are the presentations available in English? 3.3. Does the central bank present its regular forecast updates with the Q&A session to journalists, analysts, and market participants? Are the presentations available in English? 3.4. Is there a public account of the policy deliberations (“minutes”) published in less than one month after the meeting? 3.5. Is the role of staff and policymakers in the baseline forecast process communicated clearly? 3.6. Is the forecasting performance of the central bank reviewed at least once a year in the monetary policy reports or in a separate document? 3.7. When was the last time the central bank or the government held or invited an external evaluation of the policy framework and the FPAS, and made the results publicly available?	

The central bank transparency indices reviewed in Table 1 made a considerable contribution both to the academic literature and to the development of central bank communication process. However, we still observe certain gaps in the topic of monetary authority transparency:

1.) Current transparency indices are chiefly focused on the professional audience and, consequently, leave out the objective of central bank communication policy to interact more effectively with the public. This was in part defined as a transparency problem by Mishkin (2004).

2.) Existing transparency indices are not associated with indicators of public trust, which is the basis of central bank independence.

3.) These indices suggest that a central bank striving for transparency should consistently comply with the criteria of indices and publish as much information for analysts as possible. This approach may not be similarly effective for individuals who view the abundance of information as 'a lot of noise' because of the high costs of processing it (Reis (2013) said that there is no compelling evidence that high transparency leads to an increase in public welfare). The issue of the potential usefulness of central bank information for households (e.g. if such information can raise the quality of households' economic decisions) has not been examined by the academic literature.

The aim of this paper is to contribute to closing this gap by building the central bank's Broader Audience Transparency Index.

As we initiate the study of central bank transparency for the population, we cannot possibly disregard the question of why monetary authorities should communicate with non-professionals. The most comprehensive explanation of the importance of communicating with the broader audience can be found in Haldane and McMahon (2018).

To sum up these findings, let us mention that in the 1990s and early 2000s central banks began to transition to IT policies. This regime is radically different from the management of money supply or the gold standard. Under this regime, banks wanted to manage the expectations and sentiment of economic agents who make decisions to spend or save. The balance of this sentiment in a market economy influences inflation in terms of demand. There are two ways to steer households' behaviour: through interest rates and communication. The trend towards increased communication with the broader audience intensified in the aftermath of the 2008–2009 global financial crisis when central banks reached the limit of stimulating the economy using conventional instruments (e.g. interest rates). In these settings, the role of communication came to the fore as it allowed managing the entire curve of expected central bank decisions. Finally, as described by Dincer and Eichengreen (2014), expanded central bank communication is part of a broader trend where the state in general becomes more accountable and responsible to society for the policy it conducts.

Freedman and Laxton (2009) state that, as any other public policy, monetary policy benefits from higher public support and understanding. Considered a sample scenario, which requires policy tightening in order to avoid the overheating of the economy. Such a situation could raise much criticism if the public did not understand the underlying reasons. Over a mid-term horizon, de jure or de facto independence of a central bank considerably depends on its acceptance by the public.

1.3. Types of published information

Information available to a central bank as a state institution can be tentatively divided into three groups:

1) information of public interest;

2) technical details for a professional audience;

3) classified information.

First, let us single out the third category, i.e. information that shall not be disclosed at all. Stiglitz (2002) speaks about the following types of such information: personal data of individuals, various types of professional secrets (medical, lawyer's, banking), and also information the disclosure of which may threaten the safety of individuals in the case of military conflicts.

At the next stage, we need to identify information of interest for broad public. Following the 'quiet revolution' in communication, many central banks have concluded that it is necessary to disclose any information. In her well-known speech 'How to open up a central bank – and why stay open', Cecilia Skingsley, First Deputy Governor of the Riskbank, noted that while in the past, central banks used to ask 'Do we communicate this', they now ask 'Why wouldn't we communicate this?' In turn, Haldane, Macaulay and McMahon (2020) go further and ask, 'How should we communicate this to engage a broader cross-section of society?' To put it differently, central banks should not just disclose all available information, but should do it in a language that is comprehensible for average individuals without a higher education in economics. This approach corresponds to the marketing principle of company branding – 'be uncomfortably transparent'.

However, several academic papers bring into question the appropriateness of this approach for central banks. It is possible that not all information published today by central banks is needed by the public, and not all of it helps build trust in central banks.

Reis (2013) asks the following question: is there any strong argument for a central bank not to reveal everything it knows? He sums up sceptical theoretical findings on this topic made by several researchers. For example, Reis (2011), Eusepi and Preston (2010), and Gaballo (2013) suggest that central bank announcements may foster confusion rather than better understanding. This happens when a central bank publishes excessive statistical information that is not directly related to its mandate and decisions. In theory, the accuracy of perception of the economic situation by economic agents becomes worse in such situations, which in turn worsens the quality of monetary policy. Moreover, signals from central banks may affect agents' attention to information from the real sector, which also reduces the effectiveness of monetary authorities and may even lead to overreaction to public information (Morris and Shin 2002, 2005; Amador and Weill 2010). Reis (2013) concludes that while the literature has developed enough theoretical arguments for these effects, they have not been convincingly confirmed in reality.

However, recent papers confirm the existence of this relationship in practice. Brouwer and De Haan (2021) demonstrate that communication about ECB instruments does not influence the average level of public trust in monetary authorities. Huang and Simon (2021) prove that less technical language of communications does not always lead to a better understanding of central bank measures and is needed only for non-economists.

1.4. Key conclusions for successful communication with broader audience

This section sums up the main conclusions and research outcomes that were found in the course of examination of the topic of communication with the broader audience. In the first place, the list includes conclusions obtained from the literature on central bank communication. However, we thought it possible to add conclusions from related disciplines, namely, from the sphere of state information policy in a broad sense, especially government information policy. They are largely associated with the transparency of authorities and the ways to ensure it. We believe that these findings can be equally useful for monetary authorities. Moreover, the issue of building central bank communication with the broader audience can be also viewed as the issue of corporate branding, where monetary authorities provide price stability services and seek to shape positive attitudes of customers towards their brand. This makes a great number of marketing research papers relevant to central banks.

1) The more informed agents are, the higher trust in monetary authorities they have (Binder 2017; Haldane and McMahon 2018; Lamla and Vinogradov 2019).

2) Plain language improves both trust in central banks and the quality of their communications with general public (Blinder 2008; Ittner, Schubert 2008; Bholat, Broughton, Ter Meer, and Walczak 2019; Mochhoury 2023).

3) While it is acceptable to have information open to interpretation and debate for professional audience, information meant for broader audiences should be as complete, consistent, accurate, and unambiguous as possible (Issing 2005, Dale et al. 2011).

4) The layered content of communication performs well to attract the attention of the audience (Haldane and McMahon 2018).

5) Excessive technical information about instruments does not help improve public trust (Brouwer and De Haan 2021).

6) Communication in the form of explanation and dialogue (question-answer) is well received by a broader audience (Ehrmann and Fratzscher, 2009).

7) Video statements by bank management increase public interest in monetary policy decisions; the content of information meant for a broad audience should be personalised, i.e. public information should be easily recognisable (Swanson and Mancini, 1996; Binder 2015).

8) Successful communication should take into account current patterns of information consumption of the population and be included in new media (Edwards, 2003; Romer 2013).

9) The more the format of central bank announcements resembles news in the media, the higher the chance that the media takes an interest in them (Munday, Brookes 2021). This means that monetary authorities' texts should be written in simple language and short sentences, should have summaries at the beginning of each release and be supported with figures.

10) The content should have a human face and be close to everyday life of ordinary people (relatable content) (Bholat, Broughton, Ter Meer, and Walczak 2019). The authors recommend using 'prices' instead of 'inflation', providing relatable examples on the effect of certain events on the cost of purchases, and also presenting a regional breakdown of key statistics. Mochhoury 2023 also informs about the importance of using the pronoun 'we' instead of the official names of organisations.

11) The amount of materials for the broader audience should be smaller than for professionals (Mochhoury 2023).

12) Speakers inspire more credibility when they are authentic, i.e. give examples from their own lives, speak honestly and openly, and are not afraid to admit their mistakes. Informal communication (Su, Ahmad and Wood 2020), including live interviews, public speeches, statements, conferences, are of particular importance.

13) Trust grows when an organisation, in addition to social media presence, actively responds to its audience and helps build a community (Jothi, Neelamalar and Prasad 2011). Games, quizzes and updates raise the interest of the audience.

14) It is necessary to create a considerable number of instruments to receive feedback (Illes, Mathews 2015).

15) Apart from the complexity of published texts, it is necessary to control the complexity of content (conceptual complexity) (McMahon and Naylor 2023).

2. Composition of the Broader Audience Transparency Index

The Broader Audience Transparency Index (hereinafter, the BATI), which we construct for central banks, consists of four sub-indices built on the basis of communication functions of central banks:

A. Informing

A1. Indicators of the adaptability of materials for the broader audience

A2. Indicators of the development of information dissemination channels

B. Educating (ensures equal access to information for everybody compared to access for professionals)

C. Ensuring central bank accountability to the public

D. Signalling

When calculating all textual characteristics, we use English-language versions of materials and where absent – LLM-enabled translations into English.

In the following sub-sections, we examine sub-indices, substantiate each criterion, and provide calculation methods.

A. Informing the public

Informing the public about decisions is a key communication objective.

Informing by way of explanation is viewed as one of the three basic functions of central bank communication policy in Haldane et al (2020). This function is also reflected in published strategies of central banks. For example, the Swedish Riksbank describes it as making it possible for the general public, the Riksdag (Swedish Parliament), and the mass media to understand, examine and evaluate the Riksbank's efforts; the Reserve Bank of India declares the objective of disseminating information with minimum time delays.

We examine two blocks of measures as indicators characterising central bank efforts to inform the public: adjustment of materials for the broader audience (press releases on interest rate policy, central bank statements, and governor interviews) and the maturity of information dissemination channels. The first group of criteria covers cognitive accessibility of texts and speeches to average non-economists, and the perception of their style. The second group is responsible for the potential physical access of readers or viewers to this information. It is assumed that the more channels a central bank employs to disseminate information, the wider its outreach. All this contributes to enhancing the efficiency of informing the public about decisions.

1. Adjustment of materials for the broader audience

1.1. Adjustment of press releases on interest rate decisions

1.1.1. Automated Readability Index

The problem of clarity of central bank language has been a key issue in the academic literature in recent years and a central focus of monetary authorities. Central bank language

is unclear to roughly 95% of the population (Haldane 2018), which is a serious barrier to attracting public attention to central bank communications. Simpler language plays an important role in engaging a broad audience (Ferrara and Angino, 2022).

The accessibility of communication for the broad audience is most commonly assessed with the Flesch index (Flesch, 1948). Its slightly improved version is the automated readability index (Kincaid et al, 1975); another modification is the Automated Readability Index (ARI). These indices assess text complexity based on just two simple characteristics: the average length of words in syllables or characters and the average length of sentences in words. For our research, we choose the ARI.

The method for calculating the index (scores for English) is as follows:

$$ARI = 0{,}5\frac{\sum words}{\sum sent} + 4{,}71\ \frac{\sum char}{\sum words} - 21{,}34 \qquad (1)$$

ARI is the Automated Readability Index

∑words is the sum of words in the text

∑sent is the sum of sentences in the text

∑char is the sum of characters in the text

After evaluating the data of all the materials over a year, they were averaged, and the final score for the criterion was assigned as follows:

1, if ARI < 12 (one needs less than 10 years of study to understand the text – a level accessible to most of the population);

0.5, if 12 < ARI < 14 (one needs from 10 to 12 years of study to understand the text);

0, if ARI > 14 (one needs more than 12 years of study to understand the text).

The py-readability-metrics package for Python was used for the technical processing of texts.

1.1.2. Availability of explainers for the broader audience

One of the ways to enhance the readability of central bank texts is multi-layered communication that is currently used by the Bank of Russia, the Bank of England, the Reserve Bank of Australia, the Reserve Bank of New Zealand, and others. This involves the creation of several versions of every monetary policy document of public importance: a short, often visualised, version for a wide audience and a longer version for professionals, which provides full technical details.

There are several illustrative examples of successful multi-layered communication. For example, in 2017, the Bank of England issued its Inflation Report (currently, the Monetary Policy Report) in a new format, unveiling a short version of the report in simple language for non-economists. As a result, activity on the Bank of England's website within 24 hours of the publication nearly doubled, as compared to previous reports. In a survey by Bank of England regional agents about the new report, 70% of respondents said that the new version of the report helped them better understand the content. Later on, Haldane and McMahon, 2018

carried out a special analysis of the new format on two groups – the broad audience and economics students. The results confirm that the adapted version of the report is easier to understand even for specialist students, which means that this format improves the value of material for any audience. The research also finds that straightforward and simpler communication with non-specialists boosts the chances of closing the gap between expectations and central bank forecasts.

The indicator was scored as follows:

1: On its website and/or in social media, a central bank publishes explainers on monetary policy decisions for the broader audience (videos, infographics, visualised cards, and short versions of press releases written in simpler language).

0: No materials are published.

1.1.3. The extent to which material is summarised

This criterion is based on Munday and Brookes (2021). They proposed comparing the language of central bank communications and media language. Consistent with their approach, the closer the language of monetary authorities is to media language, the higher their chances of being heard. Munday and Brookes (2021) examine several dozens of textual features at various levels (lexis, discourse, syntax, etc.) and identify those influencing the media's decision to report or not to report such news.

The model is as follows:

$$\frac{1-\mathrm{k_t}}{\mathrm{k_t}} = \beta_0 + \beta_1^{\mathrm{T}}\left(\theta_{\mathrm{B},t}^{\mathrm{T}}\,\theta_{\mathrm{B},t}\right) + \beta_2^{\mathrm{T}}\theta_{\mathrm{B},t} + \beta_3^{\mathrm{T}}\left(z_t \otimes \theta_{\mathrm{B},t}\right) + \beta_4^{\mathrm{T}} z_t + \beta_5^{\mathrm{T}}(z_t \otimes z_t) \quad (2),$$ where

k is the share of newspapers directly reporting (quoting) a central bank message for period t;

θ_B is central bank text features;

z is the state of the economy.

351 variables are identified as θ_B using analytical methods including by means of cognitive psychology and linguistics. They are divided into groups: 13 dummy variables for material types and topic labels (49 features) and linguistic / news features (289).

After the regression analysis of the model, the following 28 variables are found to be significant. Among them, there are four 'absolute' variables – the text features which influence quotation in the media irrespective of the economic situation.

Three of them have a positive effect:

- The proportion of personal pronouns, squared;
- The extent to which the first sentence is a 'headline', squared;
- The number of instances when amounts in units of currency are mentioned, squared.

And one has a negative effect;

- The average number of 'verb + particle' structures (e.g. pick. . . up, slow . . . down), squared.

Taking into consideration this empirical evidence, we also apply several criteria from this paper, first, the extent to which the first sentence is a 'headline'.

To derive it, we compare two word embeddings obtained using word2vec, namely the first paragraph of a text and the remainder.

Computations are technically implemented using the spaCy package for Python.

To benchmark the obtained results, we use the mean value of the obtained index (SIM) and a corpus of English-language news (where texts should be summarised almost perfectly by default, as journalists follow strict editorial rules for news releases). We use the Global News Dataset from Saksham, 2023 as the corpus of texts. From the total list of media institutions, we select the following: International Business Times, BBC News, Forbes, Reuters, Bloomberg, The Washington Post, Associated Press, Chicago Tribune, NBC News, and CNN. This truncated corpus comprises 6357 news articles, where the mean value SIM = 0.46407, the 0.75th quantile = 0.64085, and the 0.25th quantile = 0.30434.

As the distribution identified in the news corpus is close to normal [0; 1], we leave the score equal to the SIM value. Accordingly, the closer the SIM value is to 1, the higher is the extent to which the first sentence of a release summaries the text.

1.1.4. Conceptual Complexity Index

To assess the conceptual complexity of central bank texts, McMahon and Naylor (2023) used an ad hoc jargon dictionary of 350 words. It is assumed that the more frequently central banks use these jargon words, the higher the conceptual complexity of texts.

The authors propose several methods for calculating conceptual complexity. For the purposes of this paper, we apply Simple Measure: Proportion of Jargon (PoJ), calculated according to the formula:

$$PoJ_d = \frac{\sum_{j=1}^{J} w_j}{\sum_{i=1}^{N} w_i} \equiv \frac{W_j}{W_i} \quad (3), \text{ where}$$

POJ_d is a simple measure of conceptual complexity of text d;

w_i is the i^{th} word;

w_j is the j^{th} jargon word;

Wi is the number of words in a piece of text;

Wj is the number of jargon words in a piece of text.

We exclude from the list of jargon terms those used repeatedly (in all probability, the authors include them to reflect related concepts in different topics), the words ‘coronavirus’ and ‘covid’ which are no longer specialised terms, and also the names of UK agencies that are not relevant for the countries under review.

We take the mean PoJ measure for the above-mentioned truncated Global News Dataset corpus as the benchmark for which a bank is scored 1. For these texts, the mean PoJ equalled 0.00757, the 0.75th quantile = 0.00943, and the 0.25th quantile = 0.00266.

The indicator was scored as follows:

1, if PoJ < 0.00266;

0.75, if 0.00266 < PoJ < 0.00757;

0.5, if 0.00757 < PoJ < 0.00943;

0, if PoJ > 0.00943.

1.1.5. Penalty for verb-particle structures

This criterion is also taken from the above-mentioned Munday and Brookes (2021). The average number of 'verb + particle' structures in the text (e.g. pick. . . up, slow . . . down) is used as an indicator:

$PRT = \frac{\sum part\_verb}{\sum sent}$ (4), where

PRT is the amount of penalty for particle-verb structures;

∑part_verb is the total of all 'verb + particle' structures in the text;

∑sent is the number of sentences in the text.

We use the above-mentioned news dataset as the best practice for this indicator, since the paper by Munday and Brookes (2021) is based on the idea that central bank texts that are close to media style are better quoted.

For these texts, the mean PRT equals 0.11078, 0.75th quantile = 0.14440, and 0.25th quantile = 0.05556.

The indicator was scored as follows:

0, if PRT= 0;

-0.25, if PRT < 0.05556;

-0.5, if 0.05556 < PRT < 0.11078;

-0.75, if 0.11078 < PRT < 0.14440;

-1, if PRT> 0.14440.

1.1.6. Penalty for wordiness

Monetary policy press releases issued by central banks are in essence news articles in which they disclose their decisions and the reasoning behind them.

That makes press releases comparable with other information products, primarily those published by media. Accordingly, modern journalism rules can be also applied to central bank news. One of such rules is the search for the optimal message length, expressed as the number of words. It is directly linked with the amount of time during which an average online user is able to maintain concentration. As of the first quarter of 2024, this global indicator averaged around 30 seconds (according to regular Chartbeat surveys). This corresponds to merely 119 words (Brysbaert, 2019). Meanwhile, the standards of major English-language media outlets are softer and tend to allow 500-word texts. For example, Menéndez Alarcón, 2012 reports that the average length of articles is 622 words in the New York Times and 516 words in the Washington Post. According to the standards of the Associated Press, the optimal length of a news article is 300-500 words.

Speaking about the upper limit, beyond which the new text becomes difficult to comprehend, Chartbeat researchers have also established that audience engagement stops to increase for texts of 2,000+ words. They also note that the majority of news articles have less than 500 words.

These data helped construct the following criteria, with scores assigned as follows:

0, if LEN (news length expressed as the number of words) < 500;

-0.25, if 500 < LEN < 1000;

-0.5, if 1000 < LEN < 2000;

-1, if LEN> 2000.

All the results were averaged for the year.

1.1.7. Frequency of mentions of households

Pfeifer and Marohl, 2023 developed CentralBankRoBERTa, a pre-trained neural network that labels central bank communications according to their messages addressed to target audiences. This instrument can help estimate the respective shares of text volume devoted to households, financial markets, firms, etc.

When constructing this criterion, we presumed that the more individuals read about themselves in central bank communications (i.e. about households: in what way things happening to them influenced the decision, and what consequences it will have for them), the more involved they are in this communication.

$HH = \frac{\sum households}{\sum sent}$ (5), where

HH is the household mention index;

∑households is the total of sentences devoted to households and calculated with the help of CentralBankRoBERTa;

∑sent is the number of all sentences in the text.

In total, Pfeifer and Marohl, 2023 identified five categories of audiences: households, firms, the financial sector, the government, and the central bank. In line with the above, an ideally balanced communication assumes that at least 20% of text is dedicated to households. As we assess central bank transparency for the broader audience, and as its importance has been growing in recent years, we will consider that the ideal benchmark is 20-40% of text dedicated to households.

Eventually, we obtain the following criterion, scored as follows:

1, if over 30-40% of a text is dedicated to households;

0.75, if 20-30% or over 40% of text is dedicated to households;

0.5, if 10-20% of text;

0.25, if 5-10% of text;

0, if less than 5% of text.

1.2. Adjustment of statements on interest rate decisions

1.2.1. Automated Readability Index

The calculation method is similar to that described in paragraph 1.1.1.

1.2.2. Conceptual Complexity Index

The calculation method is similar to that described in paragraph 1.1.4.

1.2.3. Index of Emotionally Charged Words

Audience engagement is one of the three key objectives of central bank communication (Haldane et al, 2020). It is broadly achieved by using specific language, which has been the focus of considerable attention of researchers in recent years. Specifically, when developing this group of criteria we rely on the findings by Swanson and Mancini (1996) and Binder (2015) that public information should be recognisable; the findings by Bholat, Broughton, Ter Meer, and Walczak (2019) on the importance of a 'relatable' communication style, those by Mochhoury (2023) on the importance of personal pronouns, and also by Su, Ahmad and Wood (2020) on authentic communication style and informal communication.

Let us pay special attention what came to be known as relatable/human touch content. Bholat et al (2019) conducted an online survey among 4,521 UK citizens, in which respondents were asked to rate one of the formats of Bank of England communication and answer a question on the level of trust in monetary authorities. The key findings of the study are that simpler text with pictures does not deliver tangible improvements in trust, while the use of relatable content does. This type of content includes: 1) the use of 'you' instead of 'consumers' and 'we' instead of 'central bank'; 2) the use of familiar words instead of technical terms, such as 'prices' instead of 'inflation'; 3) examples from everyday life, such as the costs of regular purchases, holiday spending, etc.; 4) personalisation, i.e. interactive charts of regional economic indicators.

Going further, Su, Ahmad and Wood (2020) supplement this list with the importance of the speaker's 'authenticity', when they sound like a 'normal' person and not an official, speak honestly and directly, and are not afraid to give personal experience examples and apologise for mistakes.

The use of more emotional language to capture the audience's attention is also described in journalism studies, with a detailed description offered by Wahl-Jorgensen, 2020.

Before constructing the text emotion index (EI), we conduct a routine text pre-processing procedure. All words are brought down to their root forms (lemmatisation), and all punctuation marks and service parts of speech are removed. Economic terms (according to the McMahon and Naylor (2023) jargon dictionary) are a priori emotionally neutral, and were therefore removed from the index to reduce its noise. All these pre-processing steps are enabled by the stanza package for Python. Then, high-frequency words are also removed. The expanded logarithmic version of the wordfreq library dictionary serves as an English-language frequency dictionary, where the frequency of words takes values from 1 (most rare words) to 8 (most frequent words). For example, 'inflation' has a frequency of 4.14, 'GDP' – 4.0, 'bank' – 5.16, and 'disinflation' – 1.65. All words with the frequency above 6 were removed.

Next, the emotionality of each word was assessed using the Harvard IV-4 dictionary. The derived series was converted to a modulus and averaged. The final index takes values from 0 (direct speech totally devoid of emotionally charged words) to 1 (direct speech, where almost every word is highly emotional).

$EI=(\sum |sent|)/n$ (6), where

EI is Index showing the use of emotionally charged words;

sent is sentiment of a word according to the Harvard IV-4 dictionary;

n is the number of assessed words in the text.

The benchmark was constructed on the basis of EI features for the corpus of best English-language speeches: the 0.25th quantile = 0.25068, the 0.75th quantile = 0.31677.

Scores were assigned according to the following rule:

1, if $0.25068 < EI < 0.31677$;

0, if otherwise.

1.2.4. Personal Pronoun Index

The use of personal pronouns in speech is an indispensable condition for a special style of communication, which creates the above-described relatable content.

We took the dataset of 100 best English-language speeches of the 20th century to construct the benchmark showing the use of personal pronouns in public speeches. Compiled by researchers from the University of Wisconsin-Madison and Texas A&M University, this list reflects the opinions of 137 leading American scholars in the field of public speeches. The final measure was 0.06637, the average of the share of personal pronouns in 100 best speeches. The 1st and 3rd quartiles were 0.04646 and 0.08215 respectively.

After that, the value of the PRP index was calculated:

$PRP = \frac{\sum pers\_pron}{\sum words}$ (7), where

PRP is the index of the use of personal pronouns;

∑pers_pron is the total of all personal pronouns in the processes text;

∑words is the sum of all words in the text.

The final value of the criteria was calculated and scores were assigned as follows:

1, if 0.06637 < PRP < 0.08215;

-0.5, if 0.04646 < PRP < 0.06637 OR PRP > 0.08215;

0, if PRP< 0.04646.

1.2.5. Frequency of mentions of households

The calculation method is similar to that described in paragraph 1.1.7.

1.3. Adjustment of governor interviews

1.3.1. Automated Readability Index

The calculation method is similar to that described in paragraph 1.1.1.

1.3.2. Conceptual Complexity Index

The calculation method is similar to that described in paragraph 1.1.4.

1.3.3. Index of Emotionally Charged Words

The calculation method is similar to that described in paragraph 1.2.3.

1.3.4. Storytelling Index

Storytelling is a method of communicating information either in the form of stand-alone narratives (literary work, theatre play, theatre performance, etc.) or in the form of a story as an illustration included in another narrative. The latter is usually understood as storytelling in

marketing (Fog, Budtz, and Yakaboylu, 2005) and pedagogy (Green, 2004). We understand storytelling in the latter sense in this paper as well.

ChatGPT 4, a large language model, is used to identify instances of storytelling in interviews. The prompt is formulated as follows: 'Highlight all of the individual elements of storytelling in the following text'.

Our calculation excludes interviews consisting of less than 1,000 words. Those were typically brief news compilations of key quotes from journalists' conversations with governors, without any elements of storytelling.

The criterion is calculated on the basis of the following approach, which took into account the use of storytelling in the dataset of 20-century best speeches, with scores assigned as follows:

1, if there are 20 to 40 storytelling elements per 1,000 words;

0.75, if there are 10 to 20 elements;

0.5, if there are 5 to 10 elements;

0.25, if the number of elements > 0;

0 in all other cases.

1.3.5. Humour Index

As in the above criterion, the assessment is made with the help of ChatGPT 4, a large language model. The prompt is formulated as follows: 'Try to spot all the instances of the use of humour in this text (there may not be any).'

The final criterion is obtained on the basis of the following approach, which takes into account the use of storytelling in the dataset of 20-century best speeches, with scores assigned as follows:

1, if there are 0.5 to 2 instances of the use of humour per 1,000 words in the interviews of the heads of banks;

0.5, if there are 0 to 0.5 instances, and also over 2 instances of the use of humour per 1,000 words in the interviews of the heads of banks;

0 in all other cases.

Instances when journalists joked were removed from the calculation.

2. Development of information dissemination channels

Today, media are not only a source of information, but also play an important role in shaping a society's views, values and cultural identity (Sutrisno, 2023). In this paper, media are divided into five types:

1) Print media (traditional newspapers, magazines, and journals that provide news, analyses, and other information products);

2) Radio and television;

3) Digital media (this fastest growing segment includes websites, online news platforms, blogs, podcasts, streaming videos, etc.);

4) Social media (this is a subcategory of digital media that allows users to interact, share content, and communicate with each other);

5) Interactive media (this includes video games, simulators, and other interactive applications enabling more active user experience).

It was inevitable that the revolution in media consumption also affected central banks. The process of information dissemination channels has been extremely fast. This is what Andy Haldane, former chief economist of the Bank of England said about this process: "With the arrival of the Monetary Policy Committee (MPC) in 1997, the number of published speeches trebled. And with the advent of the FPC and PRC, Bank publications have kept going through the gears. In 2020, the Bank issued 62 speeches, 56 working papers, over 100 consultation documents, 74 blogs and around 100 statistical releases – in total, around 500 publications. That is around four million words – a genuine revolution in transparency practices.'

It is worth reminding that until late 1980s, the US Fed did not even inform about its decisions. Issing (2005), in his classical paper on how central banks communicate, said that regulators' websites were their main communication channel. He also mentioned television, radio, and print media.

Modern central banks strive to employ all types of the above-listed media. They also use direct communication channels, namely live meetings with various audiences, e.g. conference calls with investors or outreach meetings with businesses and regional visits. For example, since 2017, the Bank of Russia has been holding meetings with businesses and regional experts after each key rate decision. This practice existed at the Bank of England before the pandemic. The Bank of Norway continues to use this practice today.

Considering the existing literature on media communications and the practices of central banks, we identify the following communication channels that can be used by monetary authorities:

1) websites;

2) television and radio;

3) traditional printed media – newspapers, journals, and magazines, as well as digital information and analytical media (news portals, news agencies, online magazines, etc.);

4) blogs, podcasts, streaming videos;

5) video games and mobile applications;

6) social media;

7) direct communication channels – targeted meetings with selected audiences (regional trips, round tables, open lectures, etc.).

When compiling the criteria of openness of central bank communication channels to the broader audience, we assumed that the broader audience would hardly read highly specialised financial, economic and business media on a regular basis. We believe that central bank rhetoric in such media is meant for market professionals. For this reason, we do not take into account such channels of information dissemination, as we consider them 'invisible' for ordinary citizens.

The openness criteria are intended to assess how actively the central bank uses all theoretically available channels to communicate with the broader audience.

2.1. Holding press conferences on decisions made

Press conferences are identified by Issing (2005) as one of the key communication products, and 20 years later, they retain their relevance. During press conferences, the public (acting through the media and bloggers) are able to ask the central bank management about their decisions. That is why we believe that a regular press conference is a key element of the monetary policy communication network.

When assigning scores, we were guided by the following approach:

1, if the central bank management holds press conferences after each key rate decision, and if these events are attended by journalists from socio-political publications and bloggers;

0.75, if the central bank management holds press conferences after each key rate decision, and if these events are attended by journalists from only business publications and/or analysts/authors of professional blogs on economics;

0.5, if press conferences are not held after each decision;

0, if no press conferences are held.

2.2. Number of social media used

In recent years, central banks have started to actively use social media both to increase their audience reach and to receive feedback. Several academic papers have been devoted to this topic, e.g. Ehrmann and Wabitsch, 2021, who analyse message traffic in social media and prove that central bank communication on these platforms can be successful in reaching the non-expert community. Masciandaro et al, 2024 report that only 2.5% of central bank micro-messages on popular social media are retweeted, and that readers take the greatest interest in messages about the issue of new banknotes and coins.

In this paper, we use several indicators for social media.

This block discusses the indicator of the number of social networks used. Based on the conclusions of Erdoğmuş and Cicek, 2012 and McCaughey et al, 2014 that an increase in the use of networks boosts brand loyalty, we formulate the indicator and assign scores as follows:

1, if a central bank uses more than five social networks;

0.8, if it uses four social networks;

0.6, if it uses three social networks;

0.4, if it uses two social networks;

0.2, if it uses one social network;

0, if no social media are used.

2.3. Level of interaction in social media

In this block, we assess the level of central bank interaction in social media. Hayes et al (2020) revealed that a company's use of paralinguistic cues (emojis) in social media improves communication. From other social media marketing (SMM) papers, we also know that these networks require active interaction with customers to build trust relationships (Tsimonis and Dimitriadis, 2014), as well as a strong sense of humour (Taecharungroj and Nueangjamnong, 2014).

The indicator was constructed using the following approach, with scores assigned as follows:

1, if the central bank uses memes, emojis, and responds to messages from its subscribers;

0.75, if it uses two of the above mentioned formats;

0.5, if it uses only one of them;

0 in all other cases.

2.4. Share of interviews to non-business media during the year

This criterion draws on the idea that a central bank, which is focused on the general public, will seek to give interviews not only to traditional business media, but also to social, political, entertainment media and popular bloggers.

Scoring criteria are as follows:

1, if 82-100% of interviews are given to non-business media;

0.75 score: 51-81%;

0.5 score: <50%;

0.25, if the governor gave interviews only to business media;

0, if the governor did not give any interviews.

2.5. Number of governor interviews per year

This criterion is based on the assumption that the more interviews a central bank governor gives per year, the better their chances of being heard by the public.

Scoring criteria are as follows:

1, if more than ten interviews per year;

0.8, if up to eight interviews per year;

0.6, if up to six interviews per year;

0.4, if up to four interviews per year;

0.2, if up to two interviews per year;

0, if no interviews.

2.6. Regular outreach meetings with the public, including regional visits, round tables, free discussions, and open speeches

Regular direct communications with various audiences are an integral part of central bank communication tools described by Issing (2005). Unlike communications with the public through media, such communication has an important advantage as it helps avoid intermediaries and enables a direct dialogue.

Scoring criteria are as follows:

1, if a central bank holds more than five direct meetings with audiences per year;

0.5, if up to four meetings are held per year;

0, no meetings are held.

B. Audience education

This section presents indicators designed to assess central bank efforts to deliver on one of the key functions of their information policy (Haldane et al, 2020), i.e. educating a broader audience to enhance their financial literacy. According to the model proposed in this paper, a higher level of understanding of central bank measures reduces welfare losses during economic shocks and increases the effectiveness of communication (the function described in our Block A).

According to the findings of many research papers (van der Cruijsen et al. 2015, Rumler and Valderrama 2020, Bholat et al. 2019), financial literacy plays one of the key roles in forming households' inflation expectations. Agents with higher level of economic knowledge and financial literacy have lower inflation expectations (Rumler and Valderrama, 2020). In their laboratory experiment, Burke and Manz, 2014 found that an increase in financial literacy reduces households' inflation forecast error. Based on randomised controlled trials of German households, Dräger and Nghiem, 2023 established that the provision of information as part of financial literacy measures increased the likelihood that an individual would be prepared to answer questions about inflation and make an inflation forecast.

Nowadays, central banks are doing their best to enhance the financial literacy of the population. Specifically, the Bank of Russia, the Bank of Israel, the Reserve Bank of New Zealand, and the Bank of Canada have financial literacy portals or sections of their websites and conduct offline events to promote financial literacy (e.g. at their museums). In addition to the fincult.info financial literacy portal itself, the Bank of Russia also developing the project's accounts in social media. Using these resources, central banks explain in simple and visual formats how the modern economy works, what role the central bank plays in it, and how individuals can protect themselves against fraudsters, for example.

Based on the below-listed criteria, 1 point is assigned, if the respective instrument was available during the reporting year, and 0 points if absent:

1. The website has a section of questions and answers (FAQ) on monetary policy;
2. The website offers a link to another site dedicated to financial literacy or to a special section of this website;
3. Release of explanatory videos with the management or staff of the central bank on decision-making principles, objectives, tools, and processes.
4. Publication of a personal inflation calculator;
5. Participation of the central bank in educational programmes for schoolchildren;
6. Publication by the central bank of videos, texts, open lectures for university students;
7. Availability of a mobile or video game explaining monetary policy.

The Bank of Russia is the leader among all central banks reviewed in this block.

C. Ensuring accountability

In addition to informing the public and improving financial literacy, communication has another highly important function – ensuring the central bank's accountability to the public. It becomes especially important for independent central banks following IT regimes where they are to report to the public on policies pursued, either directly or via legislative authorities.

'The central bank must regularly demonstrate that it is appropriately pursuing its mandated goals. Demonstrating its fidelity to its mandate in turn requires that the central bank be transparent about its economic outlook and policy strategy', said Ben Bernanke, former US Fed's Chairman in his speech in May 2010.

In our research paper, we establish that central bank's efforts to ensure its accountability to the public are seen in its disclosure of objectives and values, ethical principles, publication of the Strategy, and how it is accountable to the public for not achieving the target. For example, the Bank of Russia includes a decomposition of inflation deviation from the target in the Monetary Policy Guidelines.

The importance of announcing general values has been shown in the literature on marketing, cognitive psychology, and communications.

According to Havas' 2019 global Meaningful Brands study, it is important for 77% of shoppers that brands share their life values. Openly declared shared goals help companies become closer to their audiences. Shared goals and values are of special importance for younger generations like millennials and Gen-Z (2023 Nielsen Annual Marketing Report). When dealing with difficult audiences who are prejudiced or negative, Anne Janser's book 'Writing to Be Understood: What Works and Why' recommends appealing to shared values in writing as a universal method. The broader audience a central bank deals with is often difficult.

In the literature, much attention is paid to the relationship between a company's mission and its financial performance or other indicators of its success in the market. Bart et al (2001) and Dermol and Širca (2018) found such a link; however, it is indirect rather than direct and works through raising staff efficiency.

We have not managed to find papers that link the disclosure of a central bank's mission (or other parameters of its value platform) and its performance (primarily, effectiveness in ensuring price stability). At the same time, many central banks currently announce their missions and speak in detail about their objectives (see From Vision to Objectives of the Bank of Israel, ECB Values of the European Central Bank, etc.).

What is a company's mission statement? Falsey (1989) defines a mission statement as the answer to questions about what a company is and what it does. David (1993) and Achua and Lussier (2016) additionally say that a company's mission statement should specify what differentiates it from its peers and competitors. Sufi and Lyons (2003) point out that a mission is a reason for the company's existence, its declaration of intentions and the disclosure of the methods by which it plans to achieve its objectives.

What does a mission consist of? Campbell and Yeung (1991) singled out the four components: purpose, strategy, behaviour standards and values. David (1989) identified nine key components of the mission: 1) customers, 2) products or services, 3) markets, 4) technology, 5) concern for survival, growth, and profitability, 6) philosophy, 7) self-concept, 8) concern for public image, and 9) concern for employees. Based on a case study of real companies from the US and Canada, Bart (1997b) investigated 25 items that the firms included in their mission statements.

Since a central bank is a non-profit organisation and the profit motive cannot be included in its mission statement, only two big blocks remain in the lists of marketing strategy research papers; these are: 1) objectives and 2) values. The objective is part of any central bank's strategy and is incorporated in all existing transparency indices of monetary authorities. Keeping this in mind, we also primarily include the objective in our index, but changed the format of this parameter to consider the specificity of the broader audience and the findings obtained from market research studies. The important aspect of our index is not the disclosure

of the objective by itself, but the explanation of its social significance, of the objective as the creation of a public good by the central bank.

As for the disclosure of values, their importance in the process of mission disclosure is described by David, 1989; Want, 1986; Campbell and Yeung, 1991; Ireland and Hitt, 1992; Klemm et al., 1991). A detailed disclosure of its value system is provided, for example, by the Central Bank of Ireland. It identifies three objectives: integrity and care for people; preparedness to innovate, to listen and to learn; and teamwork.

Finally, the last issue in this block is social responsibility and charity, and the establishment of ethics committees. According to a number of research papers (Chun et al, 2013; Hategan and Curea-Pitorac, 2017; Liao 2020), these practices can also improve a company's performance (through its market capitalisation or financial performance). Some central banks speak about their efforts in charity programmes and commitment to ethical standards. For example, Bank of England staff choose three charities of the year: one that aligns with the inclusion agenda, one with a regional focus, and one large internationally recognised charity. The ECB has had the Ethics Committee since 2014, its Rules of Procedure are published, and all bank staff are obliged to follow them. These Rules of Procedure apply to bank secrecy, conflict of interest, working with national banks, rules for gifts, the need for friendly relations with colleagues, etc.

Based on the below-listed criteria, 1 point is assigned, if the respective instrument was available during the reporting year, and 0 points if absent:

1. Publication of a socially significant Mission Statement;
2. Publications of central bank values;
3. Responsibility for achieving the objective;[1]
4. Participation in charity and social assistance programmes;
5. Disclosure of information about the ethics committee;
6. A spokesperson position;
7. Publication of the results of the quality audit of communication for the last five years, including within the context of Monetary Policy Reviews;
8. Publication of a communication strategy.

D. Transparency of the signalling system

The signalling function of central bank communication is the last but not least block in our transparency index. By contrast, the role of this function has grown steadily over recent decades (more specifically, since the GFC[2]). In response to growing global uncertainty, regulators started to use new communication instruments designed to provide economic agents with clearer signals, primarily forward guidance.

Many papers have been devoted to this topic, primarily Haldane, 2019 on the coordinating role of central bank communication, Casiraghi and Perez, 2022, explaining that

[1] A special approach was applied to this criterion, with scores assigned as follows: 1: The deviation of inflation from the target over the past year did not exceed 1 pp for countries whose inflation target <= 2% and 2 pp for others.
0.5: The above-mentioned condition was not met, but the central bank published an open letter to the president or parliament explaining why the target was not met. 0: The central bank allowed for inflation to deviate from the target over the past year and did not officially report on it in a special document.
[2] Global Financial Crisis.

'while there can be merit in allowing for divergent perspectives across officials, central bank communications should not deliver contradictory or confusing messages and should be associated with the institution', and also a review of central bank signalling by Svensson, 2014. There are also important conclusions by Bennani et al, 2020 that policymaker signals from the ECB help better understand future monetary policy. Moreover, we take into consideration several articles that justify the importance of non-contradictory information from central banks, since information that is too detailed and full of contradictory judgements can be confusing, especially to the general public (Jensen (2002), Mishkin (2004)).

We use the following criteria to assess the transparency of the signalling system and assigned scores as follows:

1. Press releases contain a signal of future decisions

- 0, if there is no signal or if there is a non-directional data dependent signal (for example, South African Reserve Bank press release, dated 26 January 2023: *'In this uncertain environment, monetary policy decisions will continue to be data dependent and sensitive to the balance of risks to the outlook'*; US Fed press release, dated 3 May 2023: *'The Committee would be prepared to adjust the stance of monetary policy as appropriate if risks emerge that could impede the attainment of the Committee's goals.'*);
- 1, if the signal is given (e.g. Bank of Norway press release, dated 21 September 2023: '*Whether additional tightening will be needed depends on economic developments. There will likely be one additional policy rate hike, most probably in December*'; Bank of Russia press release, dated 15 September 2023*: 'The Bank of Russia will consider the necessity of further key rate increase at its upcoming meetings.*').

2. Press releases provide the timing of inflation returning to target

- 0, if there is no such information – return to target is either not mentioned or its timing is not specified (e.g. Bank of Korea press release, dated 19 October 2023: *'Accordingly, it is judged that the timing of consumer price inflation converging on the target level is more likely to be delayed than previously expected'*; National Bank of Poland press release, dated 6 July 2023: '*The Council assesses that the strong monetary policy tightening undertaken by NBP is leading to a decline in inflation in Poland towards the NBP inflation target. At the same time, given the strength and persistence of the earlier shocks, which remain beyond the impact of domestic monetary policy, the return of inflation to the NBP inflation target will be gradual'*).
- 1, if this information is given (e.g. Czech National Bank press release, dated 2 February 2023: *'The forecast also expects inflation to get close to the inflation target in the first half of next year.'*; Reserve Bank of Australia press release, dated 1 August 2023: '*The central forecast is for CPI inflation to continue to decline, to be around 3¼ per cent by the end of 2024 and to be back within the 2–3 per cent target range in late 2025.'*).

3. The Harry Truman index for press releases

Using the D3 criterion, we determine the potential degree of noise in the central bank's signal embedded in its monetary policy announcements.

There exists abundant literature suggesting contradiction detection algorithms (e.g. De Marneffe et al, 2008; Li et al, 2017; Gärtner and Göhlich, 2024). They are based on formal logic principles and compare text embeddings or large language models. However, all these methods are designed to find an apparent contradiction between two texts or between two individual sentences. As central bank texts contain contradictions of a slightly different nature, we are unable to use these methods.

Additionally, we use Chat GPT to detect inherent contradictions in texts, but the results do not seem convincing. For example, the model quite often detects in texts 'contradictions' of the following nature:

1) 'The 12-month inflation continues to decrease in Armenia's partner countries, yet the overall inflation environment remains elevated due to sustained high demand and the pressures from the labour market.'

2) 'Tight international financial conditions are contributing to lower prices in commodity markets. As a result, the inflationary effects of the global economy on the Armenian economy continue weakening.'

The model gives the following comment: 'The text says that inflation goes down in Armenia's partner countries, claiming at the same time that tight international financial conditions lead to lower prices in commodity markets. This statement contradicts the other statement that the overall inflationary environment remains elevated.'

We do not see any contradiction here, since the robust domestic demand in Armenia does not correspond to the trend towards cooling demand in its trading partners.

The idea underlying the final D3 criterion was inspired by the famous quotation from Harry Truman, the 33rd US President: 'Give me a one-handed Economist. All my economists say 'on ONE hand...', then 'but on the other...' In our opinion, it accurately conveys the confusion an ordinary person experiences when talking with an economist. It is especially true if this person needs to make a decision here and now (this is exactly the reason why households listen to central bank signals: they urgently need to make everyday decisions about the timing of loans or large purchases). Instead of unambiguous information, readers very often receive contradictory signals: e.g., 'the economy slows down... but, on the other hand, its growth pace remains high,' 'inflationary pressures are high, though it is declining globally,' 'declining growth' or 'negative growth.'

We use the D3 indicator to estimate the degree of 'two-handedness' and 'one-handedness' of central bank materials. The more often they have similar structures, the greater the penalty for the text. This reflects the potential confusion felt by a non-economist when reading such texts.

$IHT = \frac{\sum adv}{\sum sent}$ (8), where

IHT is the Harry Truman index;

∑adv is the sum of all instances when unigrams, bigrams and trigrams appear in texts, helping to express opposite points of view, arguments, or circumstances:

Despite
Even so
In contrast
By contrast
In spite of
Whereas
Conversely

However
But
On the other hand
Conversely
Nevertheless
Alternatively
Nonetheless
Notwithstanding
Despite
Even so
In contrast
In spite of
Whereas
On the flip side
Though
Although
Instead
Regardless
Except
Otherwise
Rather
Admittedly
At the same time

∑sent is the number of sentences in the text.

For the benchmark, the IHT is calculated from the news dataset described above. For these texts, the mean IHT equals 0.10469, 0.75th quantile = 0.15789, and 0.25th quantile = 0.03448.

As a result, the penalty criterion is as follows:

0, if IHT < 0.03448;

-0.25, if 0.03448 < IHT < 0.10469;

-0.5, if 0.10469 < IHT < 0.15789;

-1, if IHT> 0.15789.

3. Robustness test

To test the results for robustness we changed the language from English into Russian and re-valued the NLP and LLM criteria for three central banks: the Bank of Russia, the National Bank of Kazakhstan, and the Central Bank of Armenia. Since the highest scores of the BATI are assigned to English-speaking countries, we assume that the scores of other central banks might be underestimated because of the translation into English. In other words, English-speaking central banks might have a linguistic advantage over non-English-speaking ones. Unlike communication with the professional community (people who closely monitor central banks' decisions, investors, analysts), communication with the public is predominantly conducted in the native language, which confirms the need for an additional test for the robustness of results to language change.

As a result, the following criteria were re-assessed:

- 111 – Automated readability index (press-release)
- 113 – The extent to which material is summarised (press-release)
- 114 – Conceptual Complexity Index (press-release)
- 115 – Penalty for verb-particle structures (press-release)
- 116 – Penalty for wordiness (press-release)
- 117 – Frequency of mentions of households (press-release)
- 121 – Automated Readability Index (central bank statement)
- 123 – Index of Emotionally Charged Words (central bank statement)
- 124 – Personal Pronoun Index (central bank statement)
- 125 – Frequency of mentions of households (central bank statement)
- 131 – Automated readability index (interview)
- 132 – Conceptual Complexity Index (interview)
- 133 – Index of Emotionally Charged Words (interview)
- 134 – Storytelling Index (interview)
- 135 – Humour Index (interview)
- D3 – Harry Truman Index for press releases

These changes primarily affect Part A, which assesses the informing function. Besides, one of the three criteria in Part D was also reassessed. Parts B and C, which assess central bank efforts to communicate their functions of the accountability to the public and improving financial literacy, are very resistant to language change, for they assess the availability of materials rather than their content. When testing these criteria, we reviewed various versions of websites, including in local languages.

To assess criteria with the automated readability index (111, 121) we took the formula adapted for Russian from Evstigneeva and Sidorovskiy, 2021 and used the following scale of compatibility of two indices:

Table 2. ARI compatibility scale for English and Russian[3]

ARI ENG	ARI RUS	Education level	Difficulty of reading	Age	BATI score
1	10	Kindergarten	Extremely easy	5–6 yrs. old	1
2	10	Frist grade	Extremely easy	6–7 yrs. old	
3	10	Second grade	Very easy	7–8 yrs. old	
4	10	Third grade	Very easy	8–9 yrs. old	
5	10	Fourth grade	Easy	9–10 yrs. old	
6	9	Fifth grade	Fairly easy	10–11 yrs. old	
7	9	Sixth grade	Fairly easy	11–12 yrs. old	
8	8	Seventh grade	Average difficulty	12–13 yrs. old	
9	7	Eighth grade	Average difficulty	13–14 yrs. old	
10	6	Ninth grade	Slightly difficult	14–15 yrs. old	
11	5	Tenth grade	Somewhat difficult	15–16 yrs. old	
12	4	Eleventh grade	Fairly difficult	16–17 yrs. old	0.5
13	3	Twelfth grade	Difficult	17–18 yrs. old	
14	2	College student	Very difficult	18-22 yrs. old	0
15	2	College student	Very difficult	22-23 yrs. old	
16	1	College graduate	Extremely difficult	24–25 yrs. old	

For the criteria measuring the extent to which material is summarised (Criterion 113), the difference was the use of the Russian language model of the spaCy package (ru_core_news_lg instead of en_core_web_lg). Apart from this, the function and the scoring criterion remained the same.

The calculation method of the Conceptual Complexity Index (Criteria 114, 132) had to be changed largely. First, it was necessary to lemmatise the text because of grammatical cases used in Russian. Second, some jargon words had several translation variants; therefore, all of them were added to the list (e.g. two variants of the Russian for 'monetary policy': монетарная политика, денежно-кредитная политика). Third, English-language news could not serve as the basis for comparison, so we used the dataset of Russian-language news described in Evstigneeva and Karpov, 2023. According to the results of calculation, the share of economic jargon words in both Russian- and English-language central bank texts by far exceeds the share of such words in business news (0.75th quantile).

Instead of the penalty for particle-verb structures (115) we applied the penalty for split predicates, the closest phenomenon in Russian. This is a widespread feature of the bureaucratic style, when a verbal predicate is replaced by a noun with the same root plus a semi-notional verb. For example, 'происходит рост производительности труда' instead of 'растет производительность труда', 'принял решение' instead of 'решил', 'происходит ослабление' instead of 'ослабляется'. The Russian-language news dataset again served as a benchmark.

The penalty criterion for wordiness (116) remained unchanged. Though texts in Russian are usually longer than their English equivalents, we decided to disregard this difference, which ranges within 10%. We made this decision, as we could not find any academic research on the estimation of the optimal size of a news item in Russian.

When calculating the criterion of the frequency of mentions of households (117, 125), given the absence of the Russian version of CentralBankRoBERTa, we expertly marked the

[3] The source for English is https://readabilityformulas.com/the-automated-readability-index-ari/, the source for Russian is Evstigneeva and Sidorovskiy, 2021.

texts of three selected central banks, guided by the principles of the original article. For the rest, the calculation method was unchanged.

For the index of emotionally charged words (123, 133), we used a methodology which is very similar to the one described in paragraph 1.2.3, but instead of Harvard-IV we applied КартаСловСен, a sentiment dictionary for Russian from Kulagin, 2021, and instead of wordfreq, a frequency dictionary for English, – a frequency dictionary for Russian (to remove terms which can create excessive noise for data) from Lyashevskaya and Sharov, 2009 (this dictionary draws on the Russian national corpus). As a result, it is revealed that Russian texts are a priori more 'emotional'. Let us compare: the average value of the emotion index for Bank of Russia statements was 0.23614 for original Russian-language texts against 0.13627 for their translations into English. To estimate the benchmark, we used a corpus of 100 op-eds in Russian business newspapers RBC, Vedomosti and Kommersant, since we did not have a corpus of the best speeches in Russian. We believe that in terms of emotionality the genre of op-eds is highly comparable to the texts of speeches.

The method to calculate the share of personal pronouns (124) was unchanged except for the use of Russian personal pronouns and the dataset of op-eds to estimate the benchmark.

To calculate the use of storytelling and humour (134 and 135), we took the same LLM, the only difference being that it was applied to Russian-language documents. The scoring criteria remained unchanged.

To calculate the Harry Truman index, we took Russian translations from the corresponding list in D3. The news dataset was used as a benchmark.

The derived indices for Russian and English are compared in Table 3. According to the results, the majority of indices did not change with language change (13 out of 16). That said, those that changed (the automated readability index for press releases, the extent to which material is summarised for press releases, and the penalty for particle-verb structures for press releases) were downgraded: the switch to Russian made the scoring of communication for all three central banks worse than it was for English. The Bank of Russia would lose 0.18 points, the Central Bank of Armenia – 0.79 points, and the National Bank of Kazakhstan – 0.23 points. Given the overall scores for these banks standing at 17.31, 9.26 and 6.74 respectively, the results seem robust to language change.

The assumption that the quality of local language communications is considerably higher than their translated into English versions was not confirmed by the analysis.

Table 3. Check of robustness of NLP and LLM indicator results to change from English to Russian

Central bank	111		113		114		115		116		117		121		123	
	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS
Bank of Russia.	0.5	0.5	0.8574	0.6735	0	0	-0.5	-0.5	-0.5	-0.5	0.5	0.5	1	1	0	0
Central Bank of Armenia	0.5	0	0.8867	0.5947	0	0	-0.25	-0.5	0	0	0.5	0.5	NA	NA	NA	NA
National Bank of Kazakhstan	0.5	0.5	0.8940	0.6644	0	0	-0.5	-0.5	-0.25	-0.25	0.5	0.5	NA	NA	NA	NA

Central bank	124		125		131		132		133		134		135		D3	
	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS	ENG	RUS
Bank of Russia.	0	0	0.5	0.5	1	1	0	0	0	0	0.5	0.5	0	0	-0.25	-0.25
Central Bank of Armenia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
National Bank of Kazakhstan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4. Results

This section presents the results of assessment of central bank communication with the broader audience (information, education, accountability, and signalling).

Central banks earning the highest BATI scores were the Bank of Canada (20.33 out of 37), the Bank of England (20.28 out of 37), and the ECB (18.53 out of 37). The full picture is shown in Chart 1.

All the banks under review can be roughly divided into four groups: 1) BATI > 20 (there are only two: the Bank of Canada and the Bank of England). Accordingly, these central banks have the most advanced communication with the general public; 2) BATI >15 (the European Central Bank, the Bank of Russia, the Reserve Bank of New Zealand, and the US Fed). These central banks are marked by advanced public communication practices, but have a number of gaps in some communication functions (e.g., the Bank of Russia has the lowest score for the functions of communication of accountability, and the US Fed – for the signalling function); 3) BATI > 10 (the Bank of Japan, the Bank of Israel, the Swedish Riksbank, the Bank of Jamaica, the Central Bank of Brazil, the Reserve Bank of Australia, and the Czech National Bank). These banks have gained success in developing certain communication functions; 4) BATI < 10; these are all the remaining banks which are at the stage of developing communication as a policy instrument.

The decomposition of data by communication function is as follows:

- The Bank of Canada, the Bank of England, and the ECB top the rating in terms of adjustment of communication for the population. While the first two banks have high scores due to the quality of texts (clarity, brevity, and content focus on households), the ECB is ranked high thanks to the wide network for disseminating its information, reaching a large number of EU individuals.
- The Bank of Russia, the US Fed, and the Reserve Bank of Australia have the best scores for the education of the public.
- The ECB and the South African Reserve Bank have the highest scores for the accountability function. Compared to other banks, they pay more attention to the communication of shared values.
- The Bank of England, the Bank of Russia, and the Central Bank of Brazil have the best results in implementing the signalling function. These central banks seek to provide directional signals, avoid ambiguity and usually indicate the timing of reaching their inflation targets. In this group, there were also banks with a negative score of the sub-index due to potentially high risks of noise in their communications.

We also presented results for central banks operating in developed and developing countries. According to Chart 2, the BATI value is on average higher in developed countries. This is in line with the conclusions of previous researchers (primarily, Dincer and Eichengreen 2019) that central bank transparency (for professionals) is notably higher in developed countries. The Bank of Russia (represented by the only turquoise line in the upper part of Chart 2) is an obvious exception in our rating, for it is closer to central banks of developed countries in terms of almost all transparency criteria for the broader audience.

Let us have a separate look at the adjustment degree of key monetary policy materials for the population (press releases, statements, and interviews). As shown in Chart 3, the Reserve Bank of New Zealand boasts the best format of the press release for the public, by far surpassing other central banks. This is the only bank giving an ‘easier’ version of its monetary policy decision (explainer) to the public. There are only 311 words in the press release on average; there are no complicated syntactic structures in the text. It means that the

bank does its best to speak the language understandable by the population. The Bank of Russia also publishes information on monetary policy decisions that is written in simple language and adapted for the general public. These materials are published on a separate website of the Bank of Russia's educational resource on financial literacy (fincult.info).

The Bank of Canada has the most adjusted statements. They have the advantage of being written in very simple language (only 11 on the ARI scale), using personal pronouns (it is the only bank with its executives' speeches very close to the world's top English speeches according to this criterion) and active storytelling about issues important for households.

Finally, the best interviews are given by Andrew Bailey, Governor of the Bank of England. They have almost ideal indicators of humour and emotions, as well as very simple language, which is accessible for the general public (and the highest readability score in the rating).

We also compared the BATI values with those of the transparency index for professionals. To do this, we took the methodology from Al-Mashat (2018) and updated data for 20 central banks as of 2023. Our findings are presented in Chart 4, which compares the percentage of fulfilled criteria for both indices in 2023.

Group 1: central banks with high transparency both for professionals and the broader audience (% of fulfilled criteria: BATI > 50% and Al-Mashat > 50%). According to the 2023 data, none of the banks made it to this group.

Group 2: central banks whose focus is more skewed towards the broader audience (% of fulfilled BATI criteria > 50%). The group includes the Bank of Canada, the Bank of England, and the ECB.

Group 3: central banks that fulfilled > 50% of the Al-Mashat criteria (the Bank of Russia, the Czech National Bank, the National Bank of Poland, the Bank of Norway, the Swedish Riskbank, and the Reserve Bank of New Zealand).

Group 4: central banks where the total percentage of fulfilled transparency criteria (BATI + Al-Mashat) exceeds the median of the remaining data (after deducting Groups 2 and 3), or 60.03%. This group includes the Bank of Israel, the Bank of Japan, the US Fed, and the Bank of Thailand.

Group 5: all remaining central banks (the Bank of Korea, the Bank of Jamaica, the Reserve Bank of Australia, the Central Bank of Brazil, the National Bank of Kazakhstan, and the Central Bank of Armenia).

Chart 1. Decomposition of transparency index for the broader audience

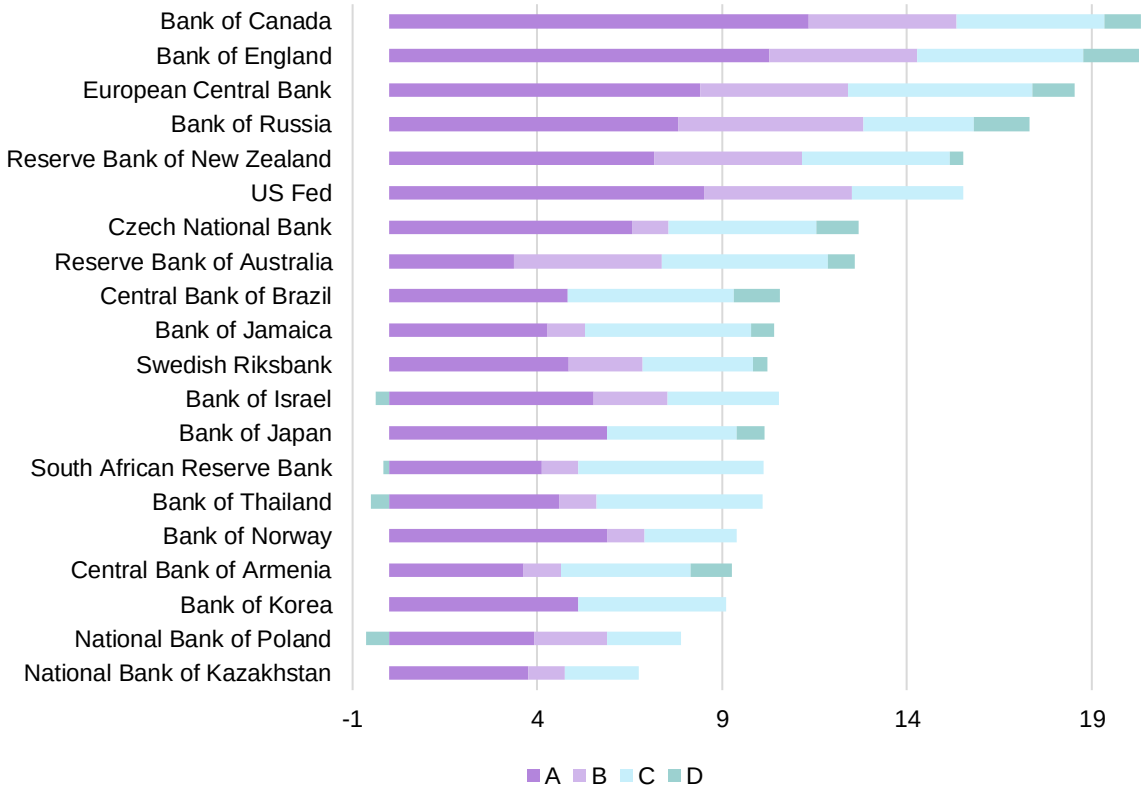


Chart 2. Comparison of transparency assessments for developed and developing countries

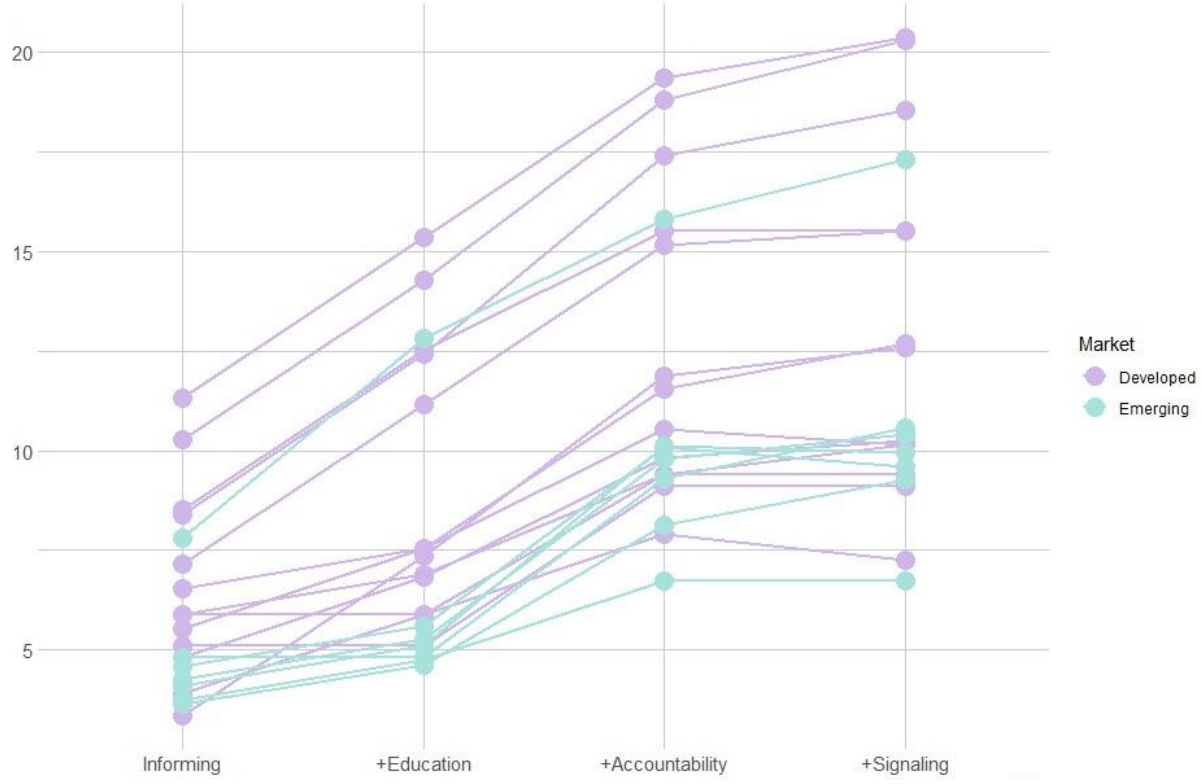


Chart 3. Adjustment of key monetary policy materials (press releases / decision announcements, central bank statements, and interviews) for the broader audience

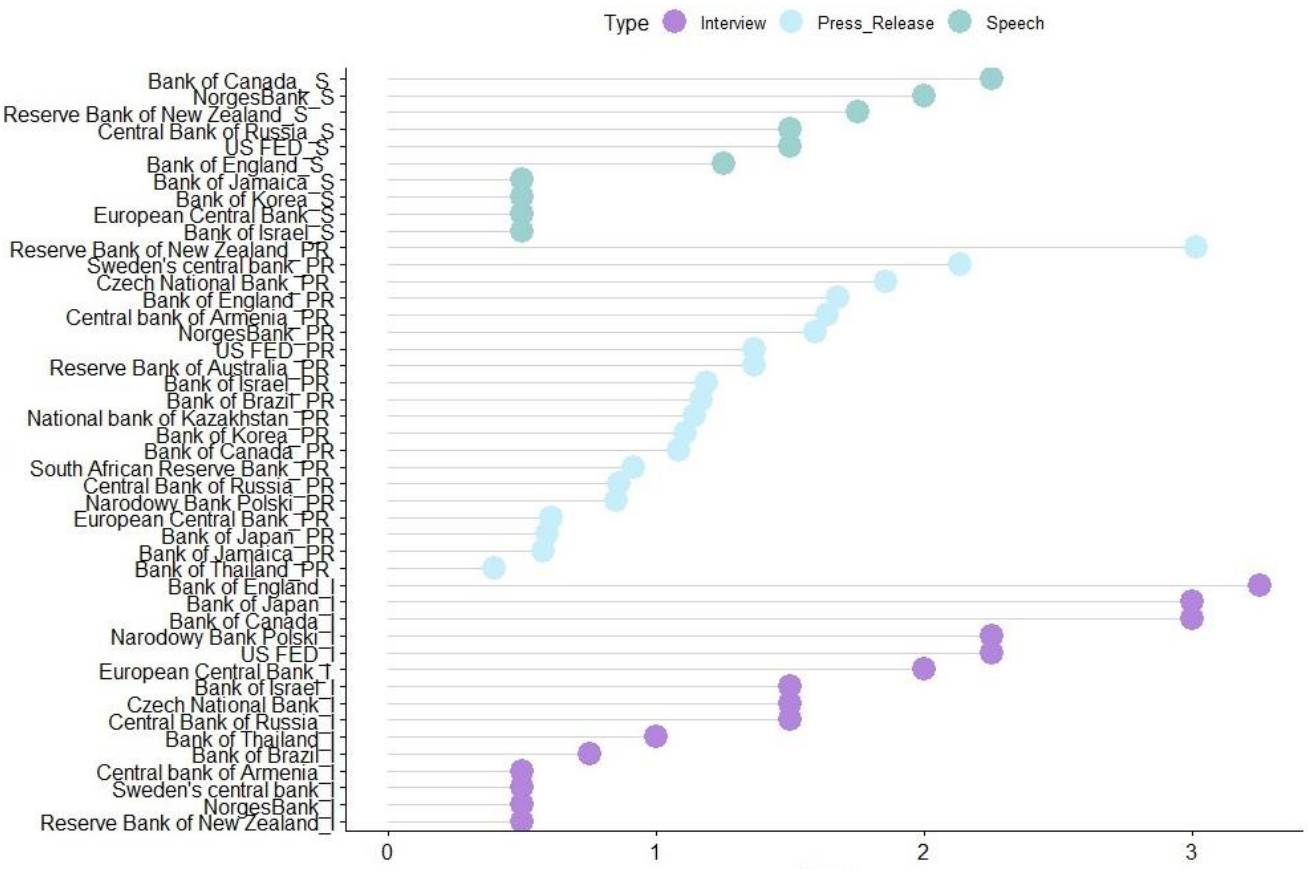
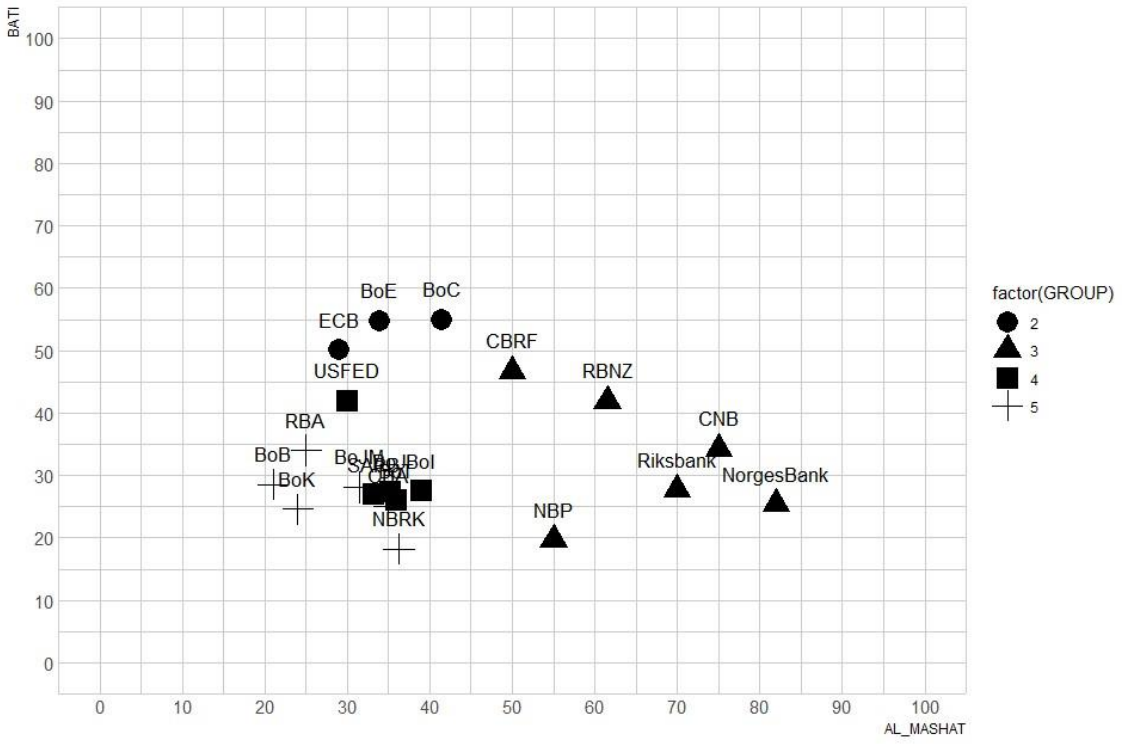


Chart 4. Central bank transparency for broader (Y axis) and professional (X axis) audiences



5. Conclusion

The aim of this paper was to develop a method to quantify central bank efforts in enhancing communication transparency for the broader audience. We created the BATI index and made calculations on its basis for 20 central banks from developed and developing countries for 2023. The list of central banks includes: the Bank of Israel, the Bank of Canada, the Bank of England, the Bank of Japan, the Central Bank of the Russian Federation, the Czech National Bank, the ECB, the National Bank of Poland, the Bank of Norway, the Reserve Bank of New Zealand, the Reserve Bank of Australia, the Bank of Sweden (Swedish Riksbank), the South African Reserve Bank, the US Federal Reserve System, the Bank of Korea, the Bank of Thailand, the Central Bank of Brazil, the Central Bank of Armenia, the Bank of Jamaica, and the National Bank of Kazakhstan.

When drafting the BATI criteria we incorporated the results of other researchers across various areas, i.e. monetary policy, government information policy in a general sense, marketing, brand management, and cognitive psychology. The BATI is based on indicators the value of which has been established in empirical studies or thoroughly argued in theoretical academic papers.

The BATI consists of four sub-indices built according to the functions of central bank communication with the public, i.e. information, education, accountability, and signalling. 37 points are assigned in total if all the criteria are met. Besides, the index has indicators, which penalise communication for redundant style, bureaucratic syntax, and contradictory signals, which may all endanger dialogue with the public.

When evaluating the index criteria, we employed both the standard method of expert assessment of communication with the help of lists, traditionally used to create transparency indices (see Dincer and Eichengreen 2014, 2019, 2022; Al-Mashat et al 2018) and NLP and LLM methods for handling non-structured data. Specifically, 23 out of 40 criteria of the index were defined using expert assessment, four – LLM models (use of humour and storytelling in communication, and focus on households), and the remaining 13 – machine text analysis. The last group includes frequently employed criteria, such as assessment of text readability and length, and indices that were specially created for this study to assess the emotionality of statements and identify complicated syntactic structures and the extent to which texts are summarised, among other objectives. Furthermore, we took into consideration the findings of previous researches, first of all, Munday and Brookes (2021) about the features of central bank texts used to attract the media's attention, as well as McMahon and Naylor (2023) about jargon words that can make monetary authorities' texts unclear to the broader audience.

To be able to make a better assessment of the signalling function of communications, we elaborated the Harry Truman index, which was inspired by the famous quotation of the 33rd US President about 'one-handed economists,'[4] which fairly accurately, in our opinion, describes the confusion an average person experiences when talking with an economist. Instead of unambiguous information, readers very often receive contradictory signals: e.g., 'the economy slows down... but, on the other hand, its growth pace remains high,' 'inflationary pressures are high, though generally declining globally,' 'declining growth' or 'negative growth.' With the help of a special index, we assessed the potential confusion of a non-economist reading such texts.

Since communication with the broader audience implies, among other things, verbal communication in a format close to traditional political speeches, we conducted an automated analysis of 100 best English-language speeches of the 20th century. Compiled by researchers from the University of Wisconsin-Madison and Texas A&M University, the list reflects the

[4] 'Give me a one-handed Economist. All my economists say 'on ONE hand...,' then 'but on the other...'

opinions of 137 leading American scholars in the field of public speeches. The analysis of this dataset helped create benchmarks of the optimal use of personal pronouns and emotionally charged words in public speeches. Based on this work, we built new indices: The personal pronoun index in central bank statements and the index of emotionally charged words in interviews. They make it possible to assess how close central bankers' speeches are to the best samples of speeches.

The main academic novelty of this paper is the attempt to bridge the gap in terms of the absent instrument for assessing central bank efforts to enhance transparency for the broader audience. The BATI index we propose assesses the extent of central bank efforts within each of the main communication functions, and can help monetary authorities choose the options of developing their information policies in the future. Moreover, our newly created instruments for automated handling of non-structured data also contribute to the literature.

Drawing on the assessment of communication of 20 central banks following IT regimes, we have identified the following:

1) Central banks earning the highest BATI scores were the Bank of Canada (20.33 out of 37), the Bank of England (20.28 out of 37), and the ECB (18.53 out of 37). All the banks under review can be roughly divided into four groups:

   1) BATI > 20 (the Bank of Canada and the Bank of England);

   2) BATI >15 (the European Central Bank, the Bank of Russia, the Reserve Bank of New Zealand, and the US Fed);

   3) BATI > 10 (the Bank of Japan, the Bank of Israel, the Swedish Riksbank, the Bank of Jamaica, the Central Bank of Brazil, the Reserve Bank of Australia, and the Czech National Bank).

   4) BATI < 10; these are all the remaining banks which are at the stage of developing communication as a policy instrument.

2) The Bank of Canada, the Bank of England, and the ECB top the rating in terms of adjustment of communication for the population. While the first two banks have high scores due to the quality of texts (clarity, brevity, and content focus on households), the ECB is ranked high thanks to the wide network for disseminating its information, reaching a large number of EU individuals. The Bank of Russia, the US Fed, and the Reserve Bank of Australia have the best scores for the education of the public. The ECB and the South African Reserve Bank have the highest scores for the accountability function. Compared to other banks, they pay more attention to the communication of shared values. The Bank of England, the Bank of Russia, and the Central Bank of Brazil have the best results in implementing the signalling function. These central banks seek to provide directional signals, avoid ambiguity and almost always indicate the timing of reaching their inflation targets. In this group, there were also banks with a negative score of the sub-index due to potentially high risks of noise in their communications.

3) Similar to the Dincer and Eichengreen index, our index is sustainably higher in developed countries. The only exception is the Bank of Russia, whose fulfilment of almost all the transparency criteria for the broader audience is closer to the central banks of developed countries.

4) We separately considered the adjustment of key monetary policy materials for the population (press releases, statements, and interviews). The Reserve Bank of New Zealand has the best format of press release for the public, by far surpassing all other central banks. The Bank of Canada has the most adjusted statements. The best interviews are given by Andrew Bailey, Governor of the Bank of England.

5) We also compared the BATI values with those of the transparency index for professionals (Al-Mashat, 2018). Based on the results of the analysis, we divided all central banks into four groups by combination of approaches to communication with the public and professionals. We also found that there were no central banks capable of fulfilling more than 50% criteria for both indices simultaneously. Overall, central banks with long IT experience and communication development tend to focus only on one audience. For example, the Bank of Canada, the Bank of England, and the ECB have by far more fulfilled criteria for the index aimed at the broader audience than at professionals. On the other hand, the Czech National Bank, the National Bank of Poland, the Bank of Norway among others are demonstrating higher transparency when communicating with markets.

To test the results for robustness we changed the language from English into Russian and re-valued the NLP and LLM criteria for three central banks: the Bank of Russia, the National Bank of Kazakhstan, and the Central Bank of Armenia. Since the highest scores of the BATI are assigned to English-speaking countries, we assume that the scores of other central banks might be underestimated because of the translation into English. In other words, English-speaking central banks might have a linguistic advantage over non-English-speaking ones. Unlike communication with the professional community (people who closely monitor central banks' decisions, investors, analysts), communication with the public is predominantly conducted in the native language, which confirms the need for an additional test for the robustness of results to language change.

According to the robustness test, the bigger portion of indicators (13 out of 16) did not change with language change. Moreover, the three indicators that changed were revised downwards, i.e. the switch to Russian made the assessment of communication of all the central banks worse than it was for English. The Bank of Russia would lose 0.18 points, the Central Bank of Armenia – 0.79 points, and the National Bank of Kazakhstan – 0.23 points. Given the overall scores for these banks standing at 17.31, 9.26 and 6.74 respectively, the results seem fairly robust to language change The assumption that the quality of local language communications is considerably higher than their translated into English versions was not confirmed by the analysis.

This paper did not aim to make conclusions as to the efficiency of these practices and whether the fulfilment of individual functions of communication with the broader audience makes it possible to anchor households' inflation expectations and raise public confidence in the policy. However, this paper offers an instrument to enable such studies in the future. Additionally, we believe that an important area for further research will be the expansion of the list of central banks and of the timeframe under study (the paper analyses only one point of time in 2023). This will make it possible to obtain a more comprehensive idea of transparency dynamics and general trends.

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