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Content-based Metric on Monetary Policy Uncertainty by Using Large Language Models[1]

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Abstract

Policy uncertainty has the potential to reduce policy effectiveness. Existing studies have measured policy uncertainty by tracking the frequency of specific keywords in newspaper articles. However, this keyword-based approach fails to account for the context of the articles and differentiate the types of uncertainty that such contexts indicate. This study introduces a new method of measuring different types of policy uncertainty in news content which utilizes large language models (LLMs). Specifically, we differentiate policy uncertainty into forward-looking and backward-looking uncertainty, or in other words, uncertainty regarding future policy direction and uncertainty about the effectiveness of the current policy. We fine-tune the LLMs to identify each type of uncertainty expressed in newspaper articles based on their context, even in the absence of specific keywords indicating uncertainty. By applying this method, we measure Japan's monetary policy uncertainty (MPU) from 2015 to 2016. To reflect the unprecedented monetary policy conditions during this period when the unconventional policies were taken, we further classify MPU by layers of policy changes: changes in specific market operations and changes in the broader policy framework. The experimental results show that our approach successfully captures the dynamics of MPU, particularly for forward-looking uncertainty, which is not fully captured by the existing approach. Forward- and backward-looking uncertainty indices exhibit distinct movements depending on the conditions under which changes in the policy framework occur. This suggests that perceived uncertainty regarding monetary policy would be state-dependent, varying with the prevailing social environment.

Keywords: Bank of Japan; Central Bank Communication; Generative Pre-trained Transformer; Large Language Model; Monetary Policy; Policy Uncertainty; Text Data
JEL classification: E52, E58, C88

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1 Introduction

Policy uncertainty is a potential source for reducing policy effectiveness, especially in areas where communication between policymakers and private economic agents plays a key role.[1] on the monetary side. Gorodnichenko et al. (2023) emphasizes the importance of non-verbal communication by central banks. Based on this recognition, policymakers and academics have developed and utilized various indicators to measure policy uncertainty. Among these, the most common method is the keyword-based approach proposed by Baker et al. (2016), which creates an uncertainty index based on the proportion of newspaper articles containing frequently used words related to policy uncertainty.[2] uncertainty, risk, volatility, and tension. Examples include Baker et al. (2019), Caldara et al. (2020), Husted et al. (2020), Ahir et al. (2022), Caldara and Iacoviello (2022), Lastauskas and Nguyen (2023), Hong et al. (2024), and Rogers et al. (2024). However, this approach fails to capture the context of articles and distinguish the types of uncertainty indicated by such contexts. For instance, the keyword-approach measure cannot distinguish whether the uncertainty is about policy *that has been made* or about policy *that is likely to be taken in the future*.

To fill this gap, this study proposes a content-based uncertainty index by utilizing Large Language Models (LLMs). Specifically, we fine-tune pre-trained language models to differentiate policy uncertainties into forward-looking and backward-looking uncertainties. The former refers to uncertainty regarding future policy directions, and the latter pertains to uncertainty regarding the effectiveness of the current policy. Our framework identifies each type of uncertainty expressed in newspaper articles judging from their context, even if they do not contain specific keywords representing uncertainty.

We conduct an experiment applying the proposed method to measure Japanese monetary policy uncertainty (MPU) from 2015 to 2016. This period is considered to be one of heightened uncertainty, especially within the context of recent Japanese monetary policy. Although the Bank of Japan has continued its quantitative easing since 2001 and quantitative and qualitative monetary easing since 2013, the targeted inflation rate was not achieved. It is not hard to imagine that the long-term deflation lasting nearly two decades from the late 1990s led people to feel uncertainty about the effectiveness of monetary policy as well as uncertainty on the future policies. This justifies the significance of measuring Japanese MPU of this period by distinguishing between forward-looking uncertainty and backward-looking uncertainty.

In addition, the BOJ not only expanded the monetary easing level but also introduced two new policy frameworks in this period, which were the negative interest rates policy and the yield curve control policy. Unlike conventional monetary policy, which focuses on changes in policy interest rates, these unconventional policies require distinguishing between decision-making of policy framework and that of specific market operations under such frameworks. To reflect the unprecedented monetary policy conditions during this period, we further classify MPU by the layers of policy changes: market operation uncertainty and policy frameworks uncertainty.

The experimental results show that our content-based approach successfully captures the

[1] See, for example, Woodford (2005) and Ferreira de Mendonça and Simão Filho (2007) for discussion

[2] This method is widely used to measure

dynamics of the MPU, which vary significantly depending on the type of uncertainty examined. The four uncertainty indices reveal several significant spikes around the introduction of new policy frameworks. However, the intensity of the spikes varied across indices and even within the same index. This suggests that forward-looking and backward-looking uncertainty can exhibit distinct responses depending on the conditions under which policy framework changes occur. These findings indicate that perceived uncertainty regarding monetary policy is state-dependent, varying with the prevailing social environment.

In recent years, some studies have used LLMs to evaluate the content of monetary policy announcement by policymakers. For example, Smales (2023) asked LLMs to evaluate policy stance based on an announcement by the Federal Reserve Bank of Australia regarding its monetary policy decisions and created a variable that takes values between -1 and 1. Alonso-Robisco and Carbó (2023) used ChatGPT to evaluate central bank statements on digital currency in order to measure the central bank's stance on it. That paper demonstrates that ChatGPT was also found to be reliable and close to the results of the experts.[3]

Among these studies, Audrino et al. (2024) is the closest to the present study. Similar to this paper, that paper provides a method for measuring uncertainty by using LLMs. While their work aims to classify general uncertainty by the domain of sources of uncertainty, such as economic policy, financial markets, geopolitical risks, and monetary policy, this paper focuses on classifying the types of MPU based on the context in the newspaper article. It is also novel in that the present study fine-tunes LLMs by reflecting the views of experts to capture the nuances of MPU as reliably as possible.

This paper is organized as follows. In the next section, we explain how to construct our content-based MPU. We apply our method to create Japanese MPU indices for 2015-16 and show their dynamics and comparisons with keyword-based MPU index in Section 3. Section 4 concludes the paper.

2 Measuring monetary policy uncertainty by uncertainty type

In this section, we start by classifying types of "uncertainty" in monetary policies. Then, we explain how to construct our content-based MPU, which is obtained by utilizing a large language model.

2.1 Four types of MPU

This paper classifies the uncertainty in monetary policies into four types. The four types of uncertainty consist of two perspectives on monetary policy. The first perspective considers whether the monetary policy a newspaper article mentions is about policy direction that can

[3]Hansen and Kazinnik (2023) asked LLMs to evaluate policy stance from FOMC public statements. They divided policy stances into five categories and asked LLMs to evaluate which category they fell into, and compared the results with human evaluations. Lopez-Lira and Tang (2023) use ChatGPT to evaluate news headlines. Martineau et al. (2023) uses a BERT-based model trained on the Szeged Uncertainty Corpus (Szarvas et al., 2012) to detect the types of general uncertainty cues at the token level. They compute a newspaper article's score for MPU by counting the number of individual words with uncertainty cues. In contrast, our metric extracts whole sentences—rather than individual words—that express MPU (not general uncertainty) using LLMs fine-tuned by experts in monetary policy.

be considered in the future or effectiveness of policies already decided. We term the former *forward-looking uncertainty* (FL) and the latter *backward-looking uncertainty* (BL). To make the above difference clearer, here we show examples. Let us consider an article reporting pressure on the Bank of Japan (BOJ) for additional easing due to the lower inflation rate than the bank targets. The article tells some possibilities that the BOJ will change the current policy course for additional easing in the next meeting. Then, this article brings forward-looking uncertainty but not backward-looking uncertainty. As another example, let us consider an article reporting a rise in interest rates during the BOJ's large-scale government bond purchases, which is supposed to lower the rates. This article expresses a concern for the effectiveness of the BOJ's policy, which was taken in the past, and does not mention the BOJ's future actions.

The second perspective addresses layers of policy changes: changes in specific market operations and changes in the broader policy framework. We call the uncertainty in the former changes *market operation uncertainty* and that in the latter changes *policy framework uncertainty*. The former contains the level of the short-term policy rate, size of asset purchase programs, and target level of the long-term interest rate. The latter contains the introduction of inflation targeting, negative interest rates, and yield curve control. This difference is important because there is uncertainty in changing market operations despite no uncertainty in the policy framework. For example, an article saying that the BOJ will purchase more Japanese Government Bonds to promote monetary easing would give people a sense of uncertainty about future market operations but not about changes in the policy framework itself such as QQE.

This results in a classification of four types of uncertainties as in Table 1: the forward-looking uncertainty related to market operation (Type FL1), the forward-looking uncertainty related to policy framework (Type FL2), the backward-looking uncertainty related to market operation (Type BL1), and the backward-looking uncertainty related to policy framework (Type BL2). These types of uncertainty are distinguished by context and are difficult to identify by currently used keywords.[4] In addition, some newspaper articles talk about uncertainty in monetary policy without containing keywords for uncertainty. Therefore, we classify each newspaper article as to which type of uncertainty by using large language models. Once we have finished the classification, we can calculate the ratio of articles containing uncertainty to all articles, which creates our content-based metric of MPU.

2.2 Fine-tuned models for detecting four uncertainty types

We utilize large language models to detect different types of MPU based on the contents of newspaper articles. Specifically, the models identify sentences expressing the four types of uncertainty considering the context of an article. It then: 1) summarizes the parts of the article related to monetary policy, 2) determines whether uncertainty is present and provides the reasoning, and 3) if uncertainty is detected, extracts the relevant sentences. Figures 1 to 4 present the instruction prompts for each uncertainty type in Japanese, and Figures 5 to 8 are their English translation. Figure 9 displays a sample response for Type FL1 uncertainty.

[4]See Arbatli Saxegaard et al. (2022) for a list of currently used keywords.

To train the models, we fine-tune pre-trained language models separately for each of the four uncertainty types by using four sets of training data, which share the same set of articles but with different label responses for different types.

The most difficult and labor-intensive task in the fine-tuning is preparing a sufficient amount of high-quality training datasets, supported by expertise, for each of the four types of uncertainty. Especially, limited training data can lead to instability of learning outcomes and even overfitting. To ensure a sufficient amount of data, we employed a data augmentation technique. Specifically, we have pre-trained language models shorten and paraphrase the original set of articles, while also manually altering or removing information as needed, thereby creating pseudo-articles and labels. To ensure expertise, we have all training data undergo a double-check by experts, including economists and professionals with experience in coordinating monetary policy decisions with central banks as part of government policy staff.

2.3 Creating the content-based MPU index by type

There are two approaches to calculate the MPU index: an index based on *article counts* and an index based on *word* counts. The former index is based on the number of articles that mention MPU. This is the approach by which the traditional uncertainty index is calculated (Baker et al., 2016; Husted et al., 2020). The latter index essentially represents the ratio of the number of words in sentences mentioning the MPU in an article to the total number of words in the article as used in Martineau et al. (2023). We count the number of letters instead of words because Japanese sentences consist of letters.

The details of the construction of our MPU indices are as follows. We take several steps to calculate the index. As an example, we explain how to construct an index based on letter counts. First, we count the number of letters of sentences that discuss MPU and then scale the raw count for each newspaper and day by the total character count in the same paper and day. Second, we standardized each paper's scaled count to unit standard deviation and then averaged the two newspapers by day to get the daily index. Finally, we adjusted the index to a mean of 100 for the period from 2015 to 2016. We calculate an index based on article counts in the same manner as the one based on letter counts.

3 Case of Japanese monetary policy change: 2015-2016

3.1 Brief history of Japanese monetary policy in 2015-2016

In April 2013, the Bank of Japan (BOJ) introduced a quantitative and qualitative monetary easing (QQE) to achieve its price stability target of a 2% year-on-year increase in the consumer price index as quickly as possible, within a target timeframe of approximately two years. This involved changing the primary operational target for financial market from the uncollateralized overnight call rate to the monetary base. Initially, the BOJ aimed to conduct money market operations so that the monetary base will increase at an annual pace of about 60-70 trillion yen. The BOJ also began purchasing assets, including long-term government bonds.

However, the CPI inflation rate hovered around 1 percent in the third quarter of 2014 despite massive monetary easing. The BOJ raised the target level of monetary base to ap-

proximately 80 trillion yen annually in October 2014. While the BOJ maintained a positive stance on achieving the target inflation rate and denied additional easing, the market remained skeptical of inflation and speculated about further easing measures.

The BOJ decided to introduce a negative interest rate policy in January 2016. The BOJ maintained the previous financial market operation and asset purchase policies but applied an interest rate of minus 0.1 percent to part of the current accounts held by financial institutions at the BOJ. In September of the same year, the bank additionally introduced a new framework for strengthening monetary easing called quantitative and qualitative monetary easing with yield curve control, providing guidelines for manipulating short- and long-term interest rates.

The difficulty in achieving the initial 2% inflation target within the projected two years led to calls for a review of the Quantitative and Qualitative Monetary Easing policy in 2015 (Nikkei, 2015a). By the end of 2014, the Bank of Japan's asset holdings under this policy had reached about 60% of Japan's GDP, prompting discussions on exit strategies for normalizing monetary policy (Nikkei, 2015b). Based on this recognition, several newspaper articles have noted the difficulty of continuing monetary easing by purchasing Japanese Government Bonds. In July 2016 the bank announced that it would conduct a "Comprehensive Assessment" of the effectiveness of the QQE policy in September 2016.

From 2015 to 2016, Japan's monetary policy was largely recognized as maintaining its ongoing easing stance. However, there were several aspects perceived as uncertain regarding the effectiveness of the existing policies and future policy directions. Thus, this period is one of the most promising and meaningful sample periods for measuring MPU by different uncertainty types.

3.2 Data

This paper employs newspaper articles published by The Mainichi Newspapers Co., Ltd. (2016, 2017) and The Yomiuri Shimbun (2016, 2017). These newspapers are distributed nationwide in Japan. The former has the largest circulation, and the latter has the third largest circulation. The total share of their circulation was 29.2% in 2015 and 29.1% in 2016.

To analyze the uncertainty of monetary policy, we select articles containing either "日本銀行" ("the Bank of Japan") or "日銀" ("the BOJ"). Additionally, we excluded articles published in the regional sections so that we could choose articles that would be seen across all regions without duplication as much as possible. As a result, during the sample period from January 1, 2015, to December 31, 2016, our dataset includes 1,305 articles (1,116,458 characters) from Mainichi Shimbun, and 1,357 articles (1,201,998 characters) from Yomiuri Shimbun. Table 2 presents the descriptive statistics for the number of articles and letter counts in each newspaper.

The authors select 200 newspaper articles from the population set for making the training set for fine-tuning a pre-trained language model. The 200 articles are chosen predominantly from periods covering the BOJ's important decisions and other significant events. From the original 200 articles, we generate 200 more pseudo-articles, resulting in four training sets of 400 articles with different labels for different types of uncertainty. For fine-tuning, we use OpenAI's GPT-4o mini as the base model and perform hyperparameter optimization using

cross-validation.

3.3 Movements of our new index

Our daily Japanese Monetary Policy Uncertainty Index is shown in Figure 10. The daily MPU index is represented by blue bars (left axis), and its 7-day moving average is shown by red lines (right axis). For each type of uncertainty, indices based on article count and letter count are closely related: the correlation coefficients are 0.84 for Type FL1, 0.88 for Type FL2, 0.85 for Type BL1, and 0.91 for Type BL2.[5] Therefore, without the loss of generality, we could explain the dynamics of the content-based MPU by focusing on the index based on letter count as in Figure 10.

The metric demonstrates that the uncertainty captured from newspaper articles mainly comes from Types FL1 and BL2. In terms of the number of articles, our fine-tuned models identify 368 articles (13.8% of the total 2659 articles analyzed) as Type FL1 uncertainty and 706 (26.6%) as Type BL2 uncertainty, while only 147 (5.5%) and 17 (0.6%) are Types FL2 and BL1, respectively. This paper is the first to capture uncertainty in monetary policies consists of two components: forward-looking uncertainty on market operation (Type FL1) and backward-looking uncertainty on policy effectiveness of the current monetary policy framework (Type BL2) independently by using LLMs.[6]

This study investigates the dynamics of Types FL1 and BL2 more closely. Figure 11 shows the daily Japanese MPU on Type FL1 uncertainty (forward-looking uncertainty on market operation) based on letter counts. The index started increasing from the beginning of 2016 when the bank of Japan introduced "Quantitative and Qualitative Monetary Easing with Negative Interest Rates." The mean for 2015 is 41.6 and that for 2016 is 158.2. The index indicates that uncertainty about whether the Japanese central bank would change its guidelines for market operation in 2016 is about 3.8 times higher than in 2015. The seven-day moving average (red line) shows that the uncertainty index has increased since the beginning of 2016, with sharp increases in July and September: the former is when BOJ announced that it would conduct a comprehensive assessment of the developments in economic activity and prices and the latter is when the bank introduced the YCC policy.

Figure 12 shows the daily Japanese MPU on Type BL2 uncertainty (backward-looking uncertainty on policy framework) based on letter counts. The uncertainty of Type BL2, similar to that of Type FL1, has also increased significantly since 2016. However, compared to Type FL1, the seven-day moving average of Type BL2 uncertainty is not significant in July 2016, but the index stands out more noticeably at the two points in January and September 2016 when the Bank of Japan introduced the new policy frameworks.

These differences indicate that each policy event provoked different aspects of uncertainty depending on the situation at that time. As explained in Section 3, the Bank announced that it would conduct a comprehensive assessment of the developments in economic activity

[5] We remove three articles for which the fine-tuned model return poor responses. Then, our MPU index is based on 2659 articles. This remove does not bring any differences in the interpretation of our MPU index.

[6] Our fine-tuned model captures a few Type FL2 and BL1 uncertainty during this period. It is consistent with our training set where there are fewer articles classified as Type FL2 and BL1 uncertainty rather than Type FL1 and BL2.

and prices under "QQE" and "QQE with a Negative Interest Rate" in the Monetary Policy Meeting held on July 28-29, 2016. Conducting a comprehensive assessment means analyzing the effects of monetary policies taken at that time, which implies there might be some room for policy changes. In addition, a comprehensive assessment has not been conducted in the past. Thus, it is quite natural to think that policy changes may be made at the next MPM so that Type FL1 uncertainty would increase.

Also, it is reasonable to expect an increase in uncertainty about the effectiveness of the current monetary policy in January 2016 when BOJ introduced "Quantitative and Qualitative Monetary Easing with Negative Interest Rates." This timing is consistent with the Bank's target timing for achieving the 2% inflation rate that it has been explaining since April 2013. With the difficulty of achieving this goal, it is evident that people were questioning the effectiveness of the new policy.

In this way, our indices reveal that forward-looking and backward-looking uncertainties can exhibit different responses depending on the conditions under which changes in the policy framework occur. This suggests that the perceived uncertainty regarding monetary policy is state-dependent, varying with the prevailing social environment at each given time.

3.4 Comparison with the existing keyword-based MPU

In this section, we compare our MPU index aggregated to monthly format with the monthly keyword-based index of MPU by Arbatli Saxegaard et al. (2022), which is constructed by using the same way as Baker et al. (2016), to determine the nature of our index.

While Arbatli Saxegaard et al. (2022) creates the keyword-based monthly index by using Japan's four major newspapers (Yomiuri, Asahi, Mainichi and Nikkei), only two newspapers are available for our study. This limitation, however, does not bring large differences. Figure 13 compares the MPU based on the four major newspapers with the MPU regenerated with the two newspapers, Mainichi and Yomiuri, by employing the same method as Arbatli Saxegaard et al. (2022). The figure confirms that both indices behave in almost the same manner. Additionally, the correlation coefficient is so high at 0.98 that the MPU created using only two newspapers can represent the existing MPU.

Figure 14 shows our monthly MPU index on each type of uncertainty based on article count and letter count. The correlation coefficients between article-counted MPU and letter-counted MPU are quite high: 0.97 for Type FL1, 0.94 for Type FL2, 0.98 for Type BL1, and 0.99 for Type BL2. As we have seen in the daily MPU index, the forward-looking uncertainty (Type FL1 and FL2) increases from January 2016 to its highest value at September 2016. For the backward-looking uncertainty (Types BL1 and BL2), the MPU has increased significantly twice in January and September 2016.

Now we compare our newly developed content-based index of MPU with the keyword-based index of MPU created from two newspapers. As the first investigation, instead of looking at each type of MPU, we create an aggregate index created by counting articles that the fine-tuned model identifies uncertainty in any of the types. Figure 15 shows a comparison of our aggregated content-based MPU index with the keyword-based MPU index. As shown in the figure, the dynamics of indices are similar, with a high correlation coefficient of 0.88. This

result implies that the keyword-based index captures a broad sense of uncertainty, encompassing both the effectiveness of monetary policy implementations and the future direction of monetary policy.

The largest difference between the two MPU indices occurs in September 2016, where the content-based index represents greater uncertainty than the keyword-based MPU index. To understand this difference, we further investigate the content-based MPU index by uncertainty type. Figures 16 and 17 compare the keyword-based MPU index and the content-based MPU index (article count) for Types FL1 and BL2 uncertainties, respectively. These figures suggest that the difference in September 2016 primarily originates from Type FL1 uncertainty.

To understand why Type FL1 uncertainty was larger than the keyword-based MPU index in September 2016, we return to the newspaper articles published in this period to see what they reported. We find that many articles are not included in the keyword-based MPU index due to the absence of keywords in the "uncertainty" term set, but their contents could still be interpreted as indicating uncertainty.[7] During this period, there was growing awareness of the deadlock in monetary policy, and various issues were discussed. For example, even though the BOJ kept its stance on continuing QQE, some newspapers introduced market participants' fear that it might be impossible to purchase JGB further under the circumstances at the time. Also, there was discussion of restricting the level of monetary easing by facing an announcement of conducting the comprehensive assessment, which made market participants uncertain about what monetary policy would be taken. In fact, a variety of concrete monetary easing measures were discussed, including further JGB purchases, an expansion of the negative interest rate range, and the purchase of foreign bonds. In this context, even without keywords in the "uncertainty" term set, many newspaper articles could be seen as indicating uncertainty regarding future monetary policy based on their contents, which can be said to have increased Type FL1 uncertainty.

3.5 Comparison with some measures for uncertainty

How do our newly constructed indices relate to some indicators of uncertainty? To see this, Tables 3 and 4 show a correlation coefficient between the content-based MPU index and some volatility indices, an index of monetary policy uncertainty for the US, and an index of political uncertainty in Japan.[8]

The content-based MPU indices are positively correlated with stock market implied volatility, foreign exchange rate implied volatility, and interest rate volatility, which is consistent with the expected sign. Correlation coefficients range 0.2 to 0.5. Exceptions include an index for Type BL1. It does not have a relationship with interest rate implied volatility. In contrast, the content-based MPU indices are poorly correlated with CBOE volatility index and

[7] See Appendix A for more details on the differences in articles identified by the content-based and keyword-based approaches for measuring MPU.

[8] Stock market volatility is the Nikkei stock average volatility index over one month calculated from Nikkei 225 futures and options; Exchange rate volatility is the option-implied volatility over the next month for the USD-Japanese yen exchange rate; Interest rate volatility is the option-implied volatility over the next month based on Japanese government bond with 10-year tenor; CBOE volatility index is the option-implied volatility over the coming 30 days for the S&P 500; US MPU index is a newspaper-based index of monetary policy for the US by Baker et al. (2016); The political uncertainty index reflects the relative approval rating of the ruling and opposition parties in Japan.

a newspaper-based index of monetary policy uncertainty for the US, implying that our newly constructed indices have informative content related to uncertainties over the BOJ's monetary policy. The content-based MPU indices are negatively correlated with an index of political uncertainty in Japan with correlation coefficients of 0.2 to 0.4. We can read from this result that the central bank is perceived to be less likely to change monetary policy when political uncertainty grows and thus uncertainty surrounding monetary policy decisions does not soar correspondingly. In sum, these results lend support for the view that our newly constructed MPU indices quantify uncertainties over the BOJ's monetary policy.

3.6 Model performance

To evaluate the model performance, we provide some metrics such as accuracy, precision, recall and F1-score. We randomly select 135 newspaper articles, representing approximately 5% of the population, to classify the type of uncertainty each article fits by using human intelligence, and examine the model's outputs by comparing them with human results. We compare the performance of our model with that of two other models: a model with fine-tuning but without data augmentation and the base model without fine-tuning. Table 5 shows the comparison of performance of the models. The proposed model achieves the highest accuracy and F1-score for all uncertainty types. In particular, for accuracy, our model achieves scores exceeding 0.9 for all types. However, since our data is highly imbalanced, we prioritize evaluating the F1 score as follows. For Type BL1, our model achieves only 0.33, whereas in the other models, the number of articles identified as positive by the model was zero, making the score undefined. This is likely because very few articles, in our highly imbalanced dataset, correspond to Type BL1 uncertainty. For Type FL2 as well, although to a lesser degree, there are similar issues, and the performance across all models, including ours, is not high. In contrast, for Types FL1 and BL2, our model achieves high scores above 80. In particular, compared to the model without data augmentation, our model performs scores that are approximately 20 points higher for Type FL1 and over 10 points higher for Type BL2, demonstrating the effectiveness of data augmentation through the generation of pseudo-articles. On the other hand, for the base model without fine-tuning, there were no articles classified as positive by the model for both types, making the score undefined. Overall, these results demonstrate the importance of expertise-based fine-tuning and data augmentation through pseudo-articles.

4 Concluding remarks

This paper utilizes a fine-tuned large language model to create a policy uncertainty index based on newspaper article content. The main contribution of this study lies in its development of a method that distinguishes between the forward-looking uncertainty regarding what policies may be adopted in the future and the backward-looking uncertainty concerning the effectiveness of current policies. Previous keyword-based methods have not provided indices that differentiate between these types of uncertainties. Additionally, in the context of monetary policy, there is uncertainty not only about market operations but also regarding broader policy frameworks. Our method can capture the dynamics of each type of policy uncertainty.

The proposed methodology will facilitate further studies. For example, beyond monetary policy, it is possible to develop indices that distinguish between forward-looking and backward-looking uncertainties in areas such as trade and fiscal policies. Moreover, this approach offers the potential for further analyses of the relationship between economic variables and policy uncertainty. For instance, expectations about future policies play a significant role in forecasting financial variables such as stock prices and interest rates. Creating type-specific uncertainty indices can help identify the extent to which different types of uncertainty affect markets, thereby improving predictive accuracy.

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	Market Operations	Policy framework
Forward-looking (Decision)	Type FL1	Type FL2
Backward-looking (Effectiveness)	Type BL1	Type BL2

Table 1: Classification of monetary policy uncertainty

		Mean	S.D.	Min	Max	Sum
Mainichi	Articles per Month	54.38	24.46	22	125	1,305
	Letters per Article	855.52	817.30	31	9,076	1,116,458
Yomiuri	Articles per Month	56.54	34.01	21	160	1,357
	Letters per Article	885.78	967.04	20	8,896	1,201,998

Table 2: Summary statistics on newspaper articles

Uncertainty measure	Type FL1	Type FL2	Type BL1	Type BL2	Frequency
Stock market volatility	0.38	0.21	0.20	0.46	Weekly
Exchange rate volatility	0.46	0.33	0.15	0.40	Weekly
Interest rate volatility	0.27	0.18	-0.02	0.30	Weekly
CBOE volatility index	0.04	-0.04	0.12	0.19	Weekly
US MPU index	0.22	0.22	-0.01	0.10	Monthly
Political uncertainty index	-0.24	-0.23	-0.33	-0.37	Monthly

Table 3: Correlations with content-based MPU (article count) and other measures of uncertainty

Uncertainty measure	Type FL1	Type FL2	Type BL1	Type BL2	Frequency
Stock market volatility	0.29	0.11	0.20	0.45	Weekly
Exchange rate volatility	0.43	0.24	0.13	0.38	Weekly
Interest rate volatility	0.25	0.14	-0.03	0.25	Weekly
CBOE volatility index	-0.04	-0.09	0.12	0.20	Weekly
US MPU index	0.18	0.07	-0.02	0.05	Monthly
Political uncertainty index	-0.17	-0.17	-0.25	-0.33	Monthly

Table 4: Correlations with content-based MPU (letter count) and other measures of uncertainty

MPU type	Model	Metrics			
		Accuracy	Precision	Recall	F1-score
Type FL1	Fine-tuned model with data augmentation	**0.96**	0.74	0.93	**0.82**
	Fine-tuned model without data augmentation	0.91	0.59	0.67	0.63
	Base model	0.88	0.00	0.00	n.a.[2]
Type FL2	Fine-tuned model with data augmentation	**0.96**	0.50	0.50	**0.50**
	Fine-tuned model without data augmentation	0.94	0.33	0.33	0.33
	Base model	**0.96**	1.00	0.17	0.29
Type BL1	Fine-tuned model with data augmentation	**0.97**	1.00	0.20	**0.33**
	Fine-tuned model without data augmentation	0.96	0.00	0.00	n.a.[2]
	Base model	0.96	n.a.[1]	0.00	n.a.[1]
Type BL2	Fine-tuned model with data augmentation	**0.90**	0.74	0.94	**0.83**
	Fine-tuned model without data augmentation	0.82	0.59	0.88	0.71
	Base model	0.76	n.a.[1]	0.00	n.a.[1]

Table 5: Model performance

[1] Since the number of instances identified as positive by the model, which forms the denominator of precision, was zero, precision could not be defined, and consequently, the F1 score, which is the harmonic mean of precision and recall, could not be defined either.

[2] Since both precision and recall are zero, the F1 score, which is their harmonic mean, cannot be defined either.

以下の記事の中で、執筆者または記事中の人物や機関が、日本銀行が今後どのような金融市場調節方針を決定するかについて不透明さがあることを認識しているととれることが書かれている場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 該当する箇所を含む文章を要約する
2. 該当する箇所が選ばれた理由を記述する
3. 該当する箇所を含む一文を一切省かずに書き出す

一方、執筆者または記事中の人物や機関が、日本銀行が今後どのような金融市場調節方針を決定するかについて不透明さがあることを認識しているととれることが書かれていない場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 記事全体または一部の文章を要約する
2. 記事全体または一部の文章が該当しない理由を記述する
3. 不透明さがあることを示す文章はないことを明記する

金融市場調節方針に含まれる主要なものは、以下のとおりです。
a. マネタリーベースの増減ペース
b. 国債の買い入れ額、保有残高、買い入れる国債の平均残存期間など
c. 国債以外の資産、例えば ETF（上場投資信託）、J-REIT（不動産投資信託）、CP（コマーシャル・ペーパー）、社債などの買い入れ額、保有残高、買い入れ対象資産など
d. 短期の政策金利の水準、日本銀行当座預金のうち政策金利残高に適用される金利の水準
e. 長期金利（10 年物国債金利）の誘導目標水準

以下に列挙されている大きな金融政策枠組みは、金融市場調節方針に含まれません。
ア. 量的・質的金融緩和
イ. 物価安定目標
ウ. マイナス金利政策
エ. 長短金利操作（イールドカーブ・コントロール）

追加緩和または追加の金融緩和と書かれている場合、それは規模やペースを増やしたり金利水準を引き下げたりするといった金融市場調節方針の変更を意味します。ただし、文脈から上記ア-エの大きな金融政策枠組みの追加導入についての記述であることが明らかな場合を除きます。

Figure 1: The prompt for inquiring Type FL1 uncertainty

以下の記事の中で、執筆者または記事中の人物や機関が、日本銀行が今後どのような金融政策枠組みを決定するかについて不透明さがあることを認識しているととれることが書かれている場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 該当する箇所を含む文章を要約する
2. 該当する箇所が選ばれた理由を記述する
3. 該当する箇所を含む一文を一切省かずに書き出す

一方、執筆者または記事中の人物や機関が、日本銀行が今後どのような金融政策枠組みを決定するかについて不透明さがあることを認識しているととれることが書かれていない場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 記事全体または一部の文章を要約する
2. 記事全体または一部の文章が該当しない理由を記述する
3. 不透明さがあることを示す文章はないことを明記する

金融政策枠組みに含まれる主要なものは、以下のとおりです。
a. 量的・質的金融緩和
b. 物価安定目標
c. マイナス金利政策
d. 長短金利操作（イールドカーブ・コントロール）

以下に列挙されている個別の金融市場調節方針は、金融政策枠組みに含まれません。
ア. マネタリーベースの増減ペース
イ. 国債の買い入れ額、保有残高、買い入れる国債の平均残存期間など
ウ. 国債以外の資産、例えば ETF（上場投資信託）、J-REIT（不動産投資信託）、CP（コマーシャル・ペーパー）、社債などの買い入れ額、保有残高、買い入れ対象資産など
エ. 短期の政策金利の水準、日本銀行当座預金のうち政策金利残高に適用される金利の水準
オ. 長期金利（10 年物国債金利）の誘導目標水準

追加緩和または追加の金融緩和と書かれている場合、それは規模やペースを増やしたり金利水準を引き下げたりするといった金融市場調節方針の変更を意味します。ただし、文脈から上記 a-d の大きな金融政策枠組みの追加導入についての記述であることが明らかな場合を除きます。

Figure 2: The prompt for inquiring Type FL2 uncertainty

以下の記事の中で、執筆者または記事中の人物や機関が、日本銀行が記事掲載時点で採用または採用を決定している金融市場調節方針がもたらす効果に不透明さがあることを認識しているととれることが書かれている場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 該当する箇所を含む文章を要約する
2. 該当する箇所が選ばれた理由を記述する
3. 該当する箇所を含む一文を一切省かずに書き出す

一方、執筆者または記事中の人物や機関が、日本銀行が記事掲載時点で採用または採用を決定している金融市場調節方針がもたらす効果に不透明さがあることを認識しているととれることが書かれていない場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 記事全体または一部の文章を要約する
2. 記事全体または一部の文章が該当しない理由を記述する
3. 不透明さがあることを示す文章はないことを明記する

金融市場調節方針に含まれる主要なものは、以下のとおりです。
a. マネタリーベースの増減ペース
b. 国債の買い入れ額、保有残高、買い入れる国債の平均残存期間など
c. 国債以外の資産、例えば ETF（上場投資信託）、J-REIT（不動産投資信託）、CP（コマーシャル・ペーパー）、社債などの買い入れ額、保有残高、買い入れ対象資産など
d. 短期の政策金利の水準、日本銀行当座預金のうち政策金利残高に適用される金利の水準¥ne. 長期金利（10 年物国債金利）の誘導目標水準

以下に列挙されている大きな金融政策枠組みは、金融市場調節方針に含まれません。
ア. 量的・質的金融緩和
イ. 物価安定目標
ウ. マイナス金利政策
エ. 長短金利操作（イールドカーブ・コントロール）

追加緩和または追加の金融緩和と書かれている場合、それは規模やペースを増やしたり金利水準を引き下げたりするといった金融市場調節方針の変更を意味します。ただし、文脈から上記ア-エの大きな金融政策枠組みの追加導入についての記述であることが明らかな場合を除きます。

Figure 3: The prompt for inquiring Type BL1 uncertainty

以下の記事の中で、執筆者または記事中の人物や機関が、日本銀行が記事掲載時点で採用または採用を決定している金融政策枠組みがもたらす効果に不透明さがあることを認識しているととれることが書かれている場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 該当する箇所を含む文章を要約する
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3. 該当する箇所を含む一文を一切省かずに書き出す

一方、執筆者または記事中の人物や機関が、日本銀行が記事掲載時点で採用または採用を決定している金融政策枠組みがもたらす効果に不透明さがあることを認識しているととれることが書かれていない場合、次の 3 つのことをおこなってください。あとで示す出力フォーマットに従って、作業記録を作ってください。
1. 記事全体または一部の文章を要約する
2. 記事全体または一部の文章が該当しない理由を記述する
3. 不透明さがあることを示す文章はないことを明記する

金融政策枠組みに含まれる主要なものは、以下のとおりです。
a. 量的・質的金融緩和
b. 物価安定目標
c. マイナス金利政策
d. 長短金利操作（イールドカーブ・コントロール）

以下に列挙されている個別の金融市場調節方針は、金融政策枠組みに含まれません。
ア. マネタリーベースの増減ペース
イ. 国債の買い入れ額、保有残高、買い入れる国債の平均残存期間など
ウ. 国債以外の資産、例えば ETF（上場投資信託）、J-REIT（不動産投資信託）、CP（コマーシャル・ペーパー）、社債などの買い入れ額、保有残高、買い入れ対象資産など
エ. 短期の政策金利の水準、日本銀行当座預金のうち政策金利残高に適用される金利の水準
オ. 長期金利（10 年物国債金利）の誘導目標水準

追加緩和または追加の金融緩和と書かれている場合、それは規模やペースを増やしたり金利水準を引き下げたりするといった金融市場調節方針の変更を意味します。ただし、文脈から上記 a-d の大きな金融政策枠組みの追加導入についての記述であることが明らかな場合を除きます。

Figure 4: The prompt for inquiring Type BL2 uncertainty

If the article indicates that the author or the individuals or organizations mentioned in it acknowledge uncertainty regarding the future directions of the Bank of Japan on its guideline for money market operations, please perform the following three tasks and record your work in the specified output format provided later:
1. Summarize the relevant portion of the article.
2. Describe the reason for selecting the portion as relevant.
3. Provide the verbatim text containing the relevant portion without omitting any part of the sentence.

Conversely, if the author or the individuals or organizations mentioned in the article do not acknowledge uncertainty regarding the future directions of the Bank of Japan on its guideline for money market operations, please perform the following three tasks and record your work in the specified output format provided later:
1. Summarize the article as a whole or a specific portion of the article.
2. Explain why the portion or the article as a whole is not relevant.
3. Clearly state that there is no mention of uncertainty regarding the Bank of Japan's future decisions.

The key aspects included in guideline for money market operations are as follows:
a. The pace of change in the monetary base.
b. The amount of Japanese government bonds purchased, the balance of government bond holdings, or the average remaining maturity of purchased bonds.
c. The amount and balance of assets other than government bonds, such as ETFs (Exchange-Traded Funds), J-REITs (Japanese Real Estate Investment Trusts), CP (Commercial Papers), and corporate bonds, as well as the types of assets purchased.
d. The level of short-term policy interest rates or the interest rate applied to policy-rate balances in current accounts held at the Bank of Japan.
e. The target level for long-term interest rates (e.g., the 10-year government bond yield).

The following major monetary policy frameworks are *not* included in guideline for money market operations:
A. Quantitative and Qualitative Monetary Easing.
B. Price Stability Target.
C. Negative Interest Rate Policy.
D. Yield Curve Control.

When the text mentions "additional easing" or "further monetary easing," this is understood as referring to changes in guideline for money market operations, such as increasing the scale or pace of monetary easing or lowering interest rate levels, unless the context explicitly indicates a reference to the introduction of one of the major monetary policy frameworks listed above (A-D).

Figure 5: The prompt for inquiring Type FL1 uncertainty (English translation of Figure 1)

If the article indicates that the author or the individuals or organizations mentioned in it acknowledge uncertainty regarding the future decisions of the Bank of Japan on its monetary policy frameworks, please perform the following three tasks and record your work using the output format provided later:
1. Summarize the portion of the article that includes the relevant statement.
2. Explain why this portion was selected as relevant.
3. Provide the verbatim text of the relevant sentence(s) without any omissions.

Conversely, if the article does not indicate that the author or the individuals or organizations mentioned in it acknowledge uncertainty regarding the future decisions of the Bank of Japan on its monetary policy frameworks, please perform the following three tasks and record your work using the output format provided later:
1. Summarize the entire article or a specific portion of it.
2. Explain why the article or the portion of it is not relevant.
3. Clearly state that there is no mention of uncertainty regarding the Bank of Japan's future decisions.

The key elements included in monetary policy frameworks are as follows:
a. Quantitative and Qualitative Monetary Easing.
b. Price Stability Target.
c. Negative Interest Rate Policy.
d. Yield Curve Control.

The following specific monetary policy operations are *not* included in monetary policy frameworks:
1. The pace of changes in the monetary base.
2. The amount of Japanese government bonds purchased, the balance of bond holdings, or the average remaining maturity of purchased bonds.
3. The amount and balance of assets other than government bonds, such as ETFs (Exchange-Traded Funds), J-REITs (Japanese Real Estate Investment Trusts), CP (Commercial Papers), and corporate bonds, as well as the types of assets purchased.
4. The level of short-term policy interest rates or the interest rate applied to policy-rate balances in current accounts held at the Bank of Japan.
5. The target level for long-term interest rates (e.g., the 10-year government bond yield).

When "additional easing" or "further monetary easing" is mentioned, it is understood as referring to changes in guideline for money market operations, such as increasing the scale or pace of easing or lowering interest rates, unless the context explicitly indicates reference to the introduction of one of the major monetary policy frameworks (a-d).

Figure 6: The prompt for inquiring Type FL2 uncertainty (English translation of Figure 2)

If the article indicates that the author or the individuals or organizations mentioned in it acknowledge uncertainty about the effects of the guidelines for money market operations adopted or decided upon by the Bank of Japan as of the publication date, please perform the following three tasks and record your work using the output format provided later:
1. Summarize the portion of the article that includes the relevant statement.
2. Explain why this portion was selected as relevant.
3. Provide the verbatim text of the relevant sentence(s) without any omissions.

Conversely, if the article does not indicate that the author or the individuals or organizations mentioned in it acknowledge uncertainty about the effects of the guidelines for money market operations adopted or decided upon by the Bank of Japan as of the publication date, please perform the following three tasks and record your work using the output format provided later:
1. Summarize the entire article or a specific portion of it.
2. Explain why the article or the portion of it is not relevant.
3. Clearly state that there is no mention of uncertainty regarding the effects of the guidelines for money market operations.

The key elements included in guidelines for money market operations are as follows:
a. The pace of changes in the monetary base.
b. The amount of Japanese government bonds purchased, the balance of bond holdings, or the average remaining maturity of purchased bonds.
c. The amount and balance of assets other than government bonds, such as ETFs (Exchange-Traded Funds), J-REITs (Japanese Real Estate Investment Trusts), CP (Commercial Papers), and corporate bonds, as well as the types of assets purchased.
d. The level of short-term policy interest rates or the interest rate applied to policy-rate balances in current accounts held at the Bank of Japan.
e. The target level for long-term interest rates (e.g., the 10-year government bond yield).

The following major monetary policy frameworks are *not* included in guidelines for money market operations:
1. Quantitative and Qualitative Monetary Easing.
2. Price Stability Target.
3. Negative Interest Rate Policy.
4. Yield Curve Control.

When "additional easing" or "further monetary easing" is mentioned, it is understood as referring to changes in guidelines for money market operations, such as increasing the scale or pace of easing or lowering interest rates, unless the context explicitly indicates reference to the introduction of one of the major monetary policy frameworks (1-4).

Figure 7: The prompt for inquiring Type BL1 uncertainty (English translation of Figure 3)

If the article indicates that the author or the individuals or organizations mentioned in it acknowledge uncertainty about the effects of the monetary policy framework adopted or decided upon by the Bank of Japan as of the publication date, please perform the following three tasks and record your work using the output format provided later:
1. Summarize the portion of the article that includes the relevant statement.
2. Explain why this portion was selected as relevant.
3. Provide the verbatim text of the relevant sentence(s) without any omissions.

Conversely, if the article does not indicate that the author or the individuals or organizations mentioned in it acknowledge uncertainty about the effects of the monetary policy framework adopted or decided upon by the Bank of Japan as of the publication date, please perform the following three tasks and record your work using the output format provided later:
1. Summarize the entire article or a specific portion of it.
2. Explain why the article or the portion of it is not relevant.
3. Clearly state that there is no mention of uncertainty regarding the effects of the monetary policy framework.

The key elements included in the monetary policy framework are as follows:
a. Quantitative and Qualitative Monetary Easing
b. Price Stability Target
c. Negative Interest Rate Policy
d. Yield Curve Control

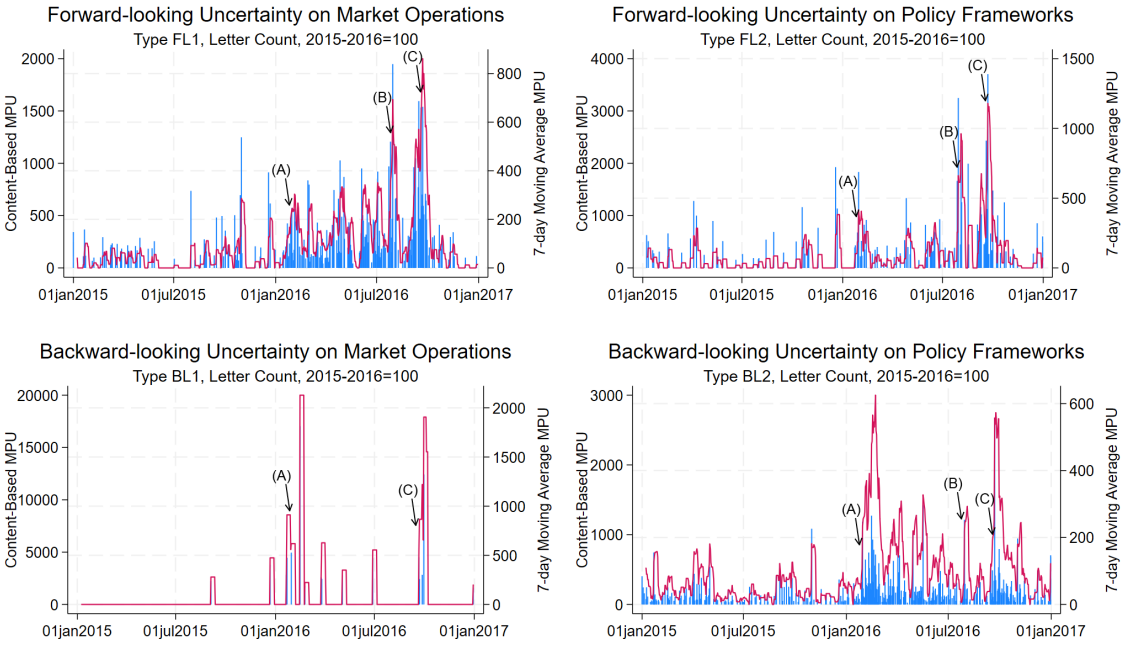
The following specific monetary policy operations are *not* included in the monetary policy framework:
1. The pace of changes in the monetary base
2. The amount of Japanese government bonds purchased, the balance of bond holdings, or the average remaining maturity of purchased bonds
3. The amount and balance of assets other than government bonds, such as ETFs (Exchange-Traded Funds), J-REITs (Japanese Real Estate Investment Trusts), CP (Commercial Papers), and corporate bonds, as well as the types of assets purchased
4. The level of short-term policy interest rates or the interest rate applied to policy-rate balances in current accounts held at the Bank of Japan
5. The target level for long-term interest rates (e.g., the 10-year government bond yield)

When "additional easing" or "further monetary easing" is mentioned, it is understood as referring to changes in guidelines for money market operations, such as increasing the scale or pace of easing or lowering interest rates, unless the context explicitly indicates reference to the introduction of one of the major monetary policy frameworks (a-d).

Figure 8: The prompt for inquiring Type BL2 uncertainty (English translation of Figure 4)

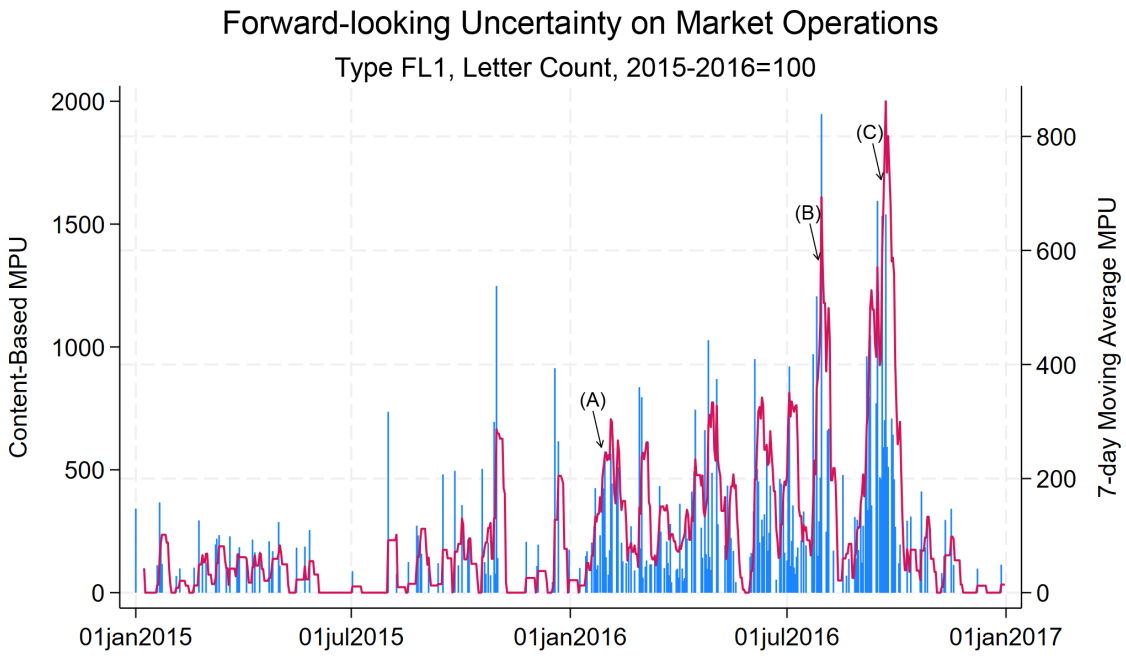
Article	Response
債券市場では、金利が上昇しています。新発 10 年物国債の流通利回りは一時的に年マイナス 0.010%まで上昇し、約 8 か月半ぶりの高水準となりました。 日本銀行は 10〜11 日に金融政策決定会合を開き、これまでの政策の効果を検証する予定です。市場では、日銀の国債購入が限界に達しているとの見方が広がっており、今後の買い入れペースの減少を懸念する投資家が国債を売る動きを強めています。	1. 執筆者は、日本銀行が次回の金融政策決定会合で、これまでの金融政策の効果を検証すると記述。 —これは日銀が今後どのような金融市場調節方針を決定するかについての記述ではないので該当しない。 2. 執筆者は、市場関係者の間で、日銀の国債購入は限界にきているとの見方が出ており、今後日銀の国債買い入れペースが落ちることを警戒する声があることを記述。 —これは、執筆者が日銀が今後どのような金融市場調節方針を決定するかについて不透明さがあることを認識しているととれる。 したがって、該当する文章は以下の通り。 #市場では、日銀の国債購入が限界に達しているとの見方が広がっており、今後の買い入れペースの減少を懸念する投資家が国債を売る動きを強めています。
In the bond market, interest rates are rising. The secondary yield on newly issued 10-year JGBs temporarily rose to minus 0.010% per annum, the highest level in about eight and a half months. The Bank of Japan is scheduled to hold a monetary policy meeting on October 10-11 to review the effects of its policies to date. There is a growing view in the market that the BOJ's JGB purchases have reached their limit, and investors concerned about a reduction in the pace of future purchases are increasingly selling JGBs.	1. The author states that the BOJ will review the effects of its monetary policy to date at its next monetary policy meeting. -This is not applicable because it is not a description of what the BOJ will decide regarding guidelines for market operations from this time. 2. The author states that some market participants believe that the BOJ's JGB purchases have reached their limit and are wary that the pace of BOJ JGB purchases will slow down. -This can be interpreted as indicating that the author is aware that there is uncertainty about what the BOJ will decide regarding guidelines for market operations from this time. Thus, the relevant sentence is as follows. # There is a growing view in the market that the BOJ's JGB purchases have reached their limit, and investors concerned about a reduction in the pace of future purchases are increasingly selling JGBs.

Figure 9: A sample of response for identifying Type FL1 uncertainty (news article is pseudo)



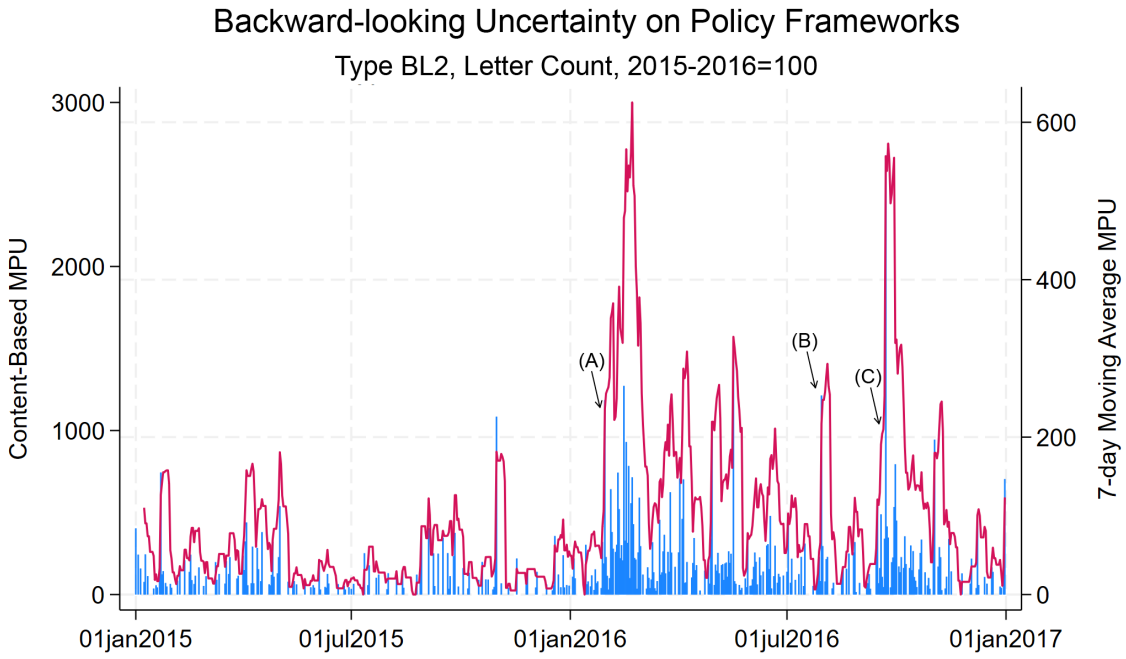
[Note] The daily index is represented by blue bars (left axis), and its 7-day moving average is shown by red lines (right axis). The arrows indicate (A) Introduction of the Negative Interest-rate Policy (Jan. 29, 2016), (B) Annoucement for the "Comprehensive Assessment" (Jul. 29, 2016), and (C) Publication of the "Comprehensive Annoucement" and introduction of the Yield Curve Control (Sep. 21, 2016).

Figure 10: Daily Japanese MPU based on letter count



[Note] The daily index is represented by blue bars (left axis), and its 7-day moving average is shown by red lines (right axis). The arrows indicate (A) Introduction of the Negative Interest-rate Policy (Jan. 29, 2016), (B) Annoucement for the "Comprehensive Assessment" (Jul. 29, 2016), and (C) Publication of the "Comprehensive Annoucement" and introduction of the Yield Curve Control (Sep. 21, 2016).

Figure 11: Daily Type FL1 Japanese MPU (letter count)



[Note] The daily index is represented by blue bars (left axis), and its 7-day moving average is shown by red lines (right axis). The arrows indicate (A) Introduction of the Negative Interest-rate Policy (Jan. 29, 2016), (B) Annoucement for the "Comprehensive Assessment" (Jul. 29, 2016), and (C) Publication of the "Comprehensive Annoucement" and introduction of the Yield Curve Control (Sep. 21, 2016).

Figure 12: Daily Type BL2 Japanese MPU (letter count)

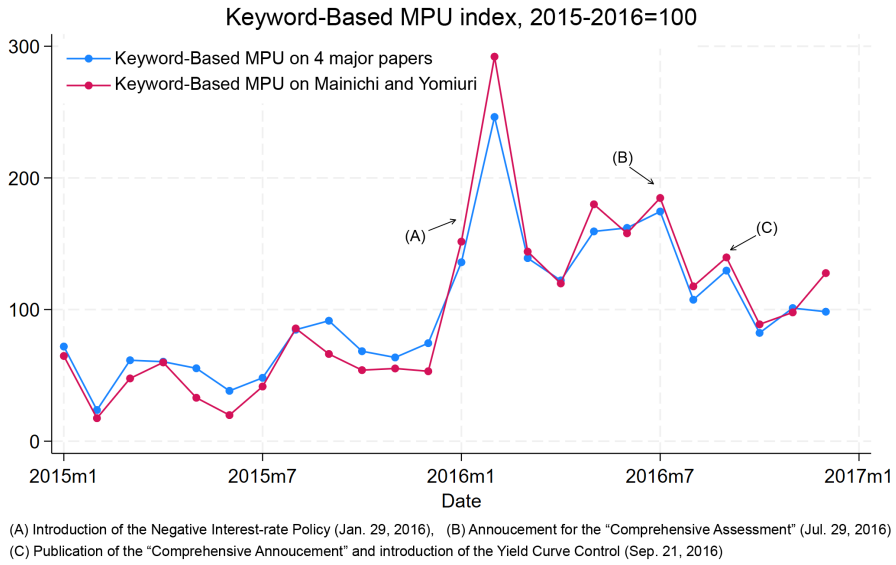


Figure 13: Comparison between MPU based on Mainichi and Yomiuri Shimbun and that based on four major newspapers

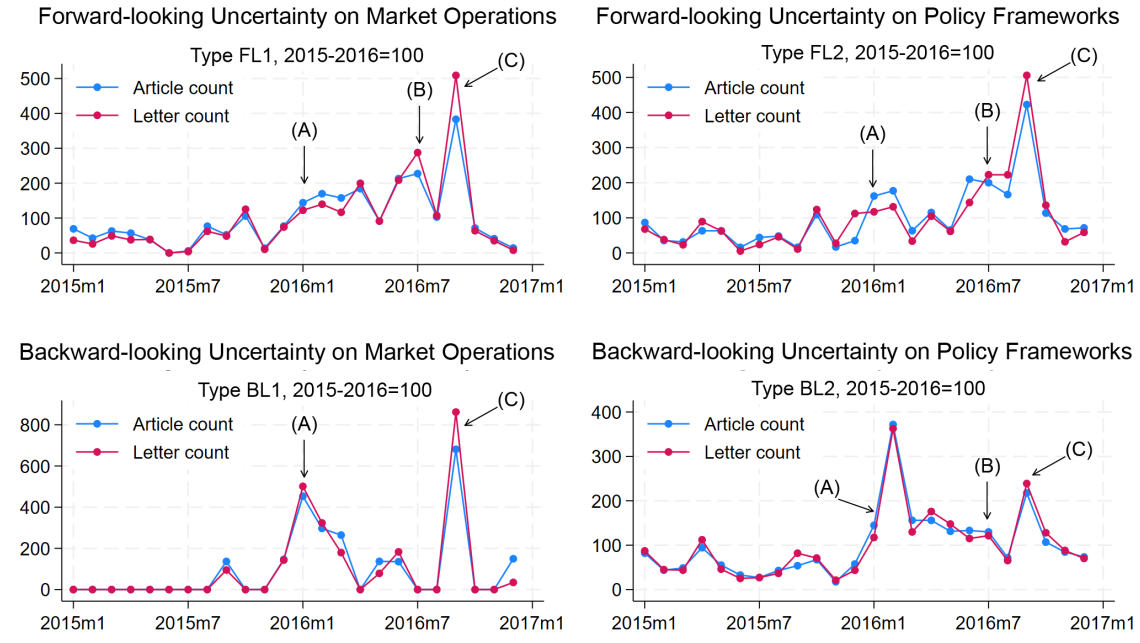
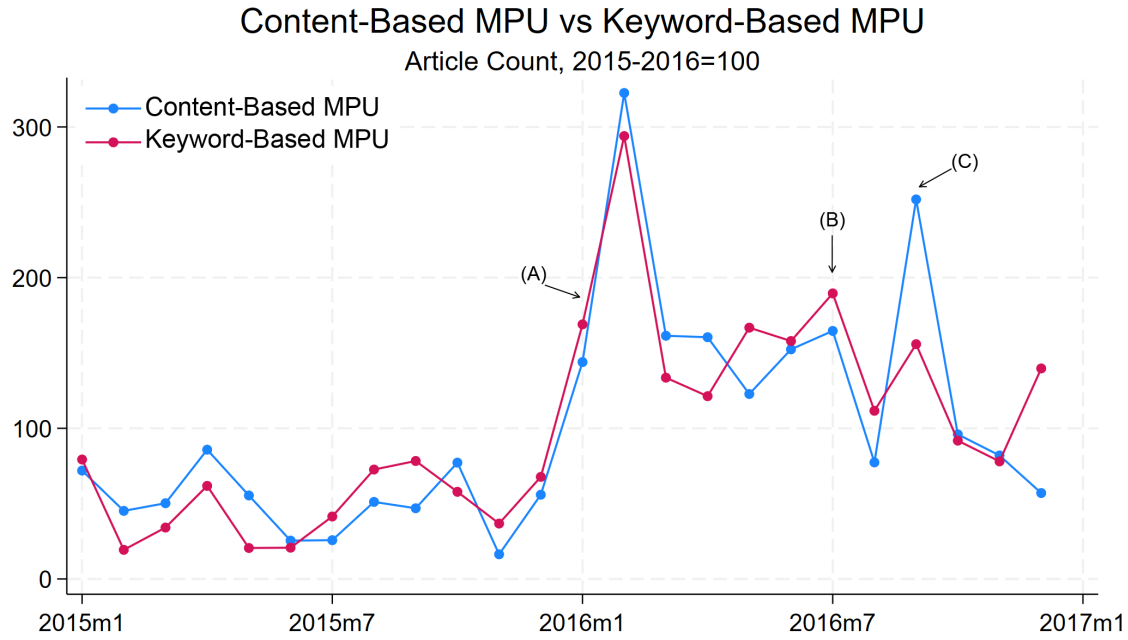
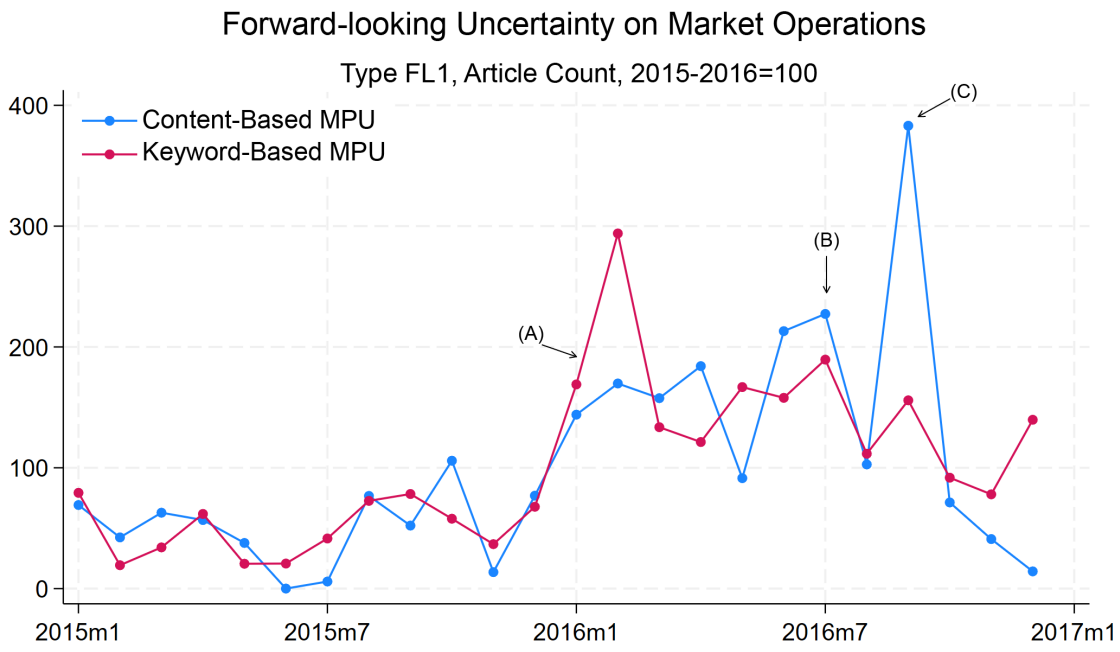


Figure 14: Content-based Japanese MPU: Monthly



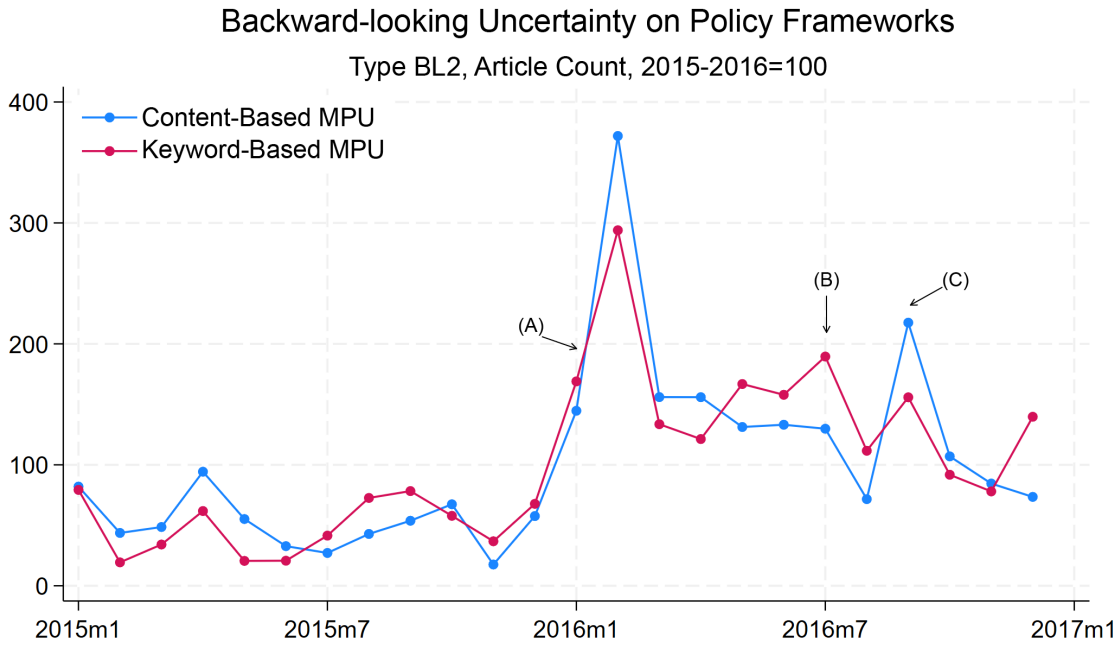
(A) Introduction of the Negative Interest-rate Policy (Jan. 29, 2016), (B) Annoucement for the "Comprehensive Assessment" (Jul. 29, 2016)
(C) Publication of the "Comprehensive Annoucement" and introduction of the Yield Curve Control (Sep. 21, 2016)

Figure 15: Keyword-Based MPU vs Content-Based MPU (article count)



(A) Introduction of the Negative Interest-rate Policy (Jan. 29, 2016), (B) Annoucement for the "Comprehensive Assessment" (Jul. 29, 2016)
(C) Publication of the "Comprehensive Annoucement" and introduction of the Yield Curve Control (Sep. 21, 2016)

Figure 16: Monthly Type FL1 Japanese MPU (article count)



(A) Introduction of the Negative Interest-rate Policy (Jan. 29, 2016), (B) Annoucement for the "Comprehensive Assessment" (Jul. 29, 2016)
(C) Publication of the "Comprehensive Annoucement" and introduction of the Yield Curve Control (Sep. 21, 2016)

Figure 17: Monthly Type BL2 Japanese MPU (article count)

A Difference between the content-based MPU and the keyword-based MPU

The difference between the content-based MPU and the keyword-based MPU lies in the difference in the results of determining which articles have monetary policy uncertainty in each method. Table A1 compares the number of articles that the keyword-based method and the content-based method identify uncertainty in monetary policy, respectively. There are 895 articles in total, which is about 33% of all articles, that the keyword-based MPU and our content-based MPU disagree with in identifying uncertainty.

Among the articles that are in disagreement, there are 671 articles in which the keyword-based method does not find uncertainty, but the content-based method does. The keyword-based method identifies uncertainty when an article includes at least one term in the five categories: “economy,” “policy,” “uncertainty,” "monetary policy," and "Japanese monetary policy." Of the 671 articles, 586 articles (87.33% of the 671 articles) do not contain keywords representing “uncertainty."[9] That is, our content-based approach captures MPU even in articles that are automatically ruled out by the keyword-based methodology.

Conversely, there are 224 articles in which the keyword-based approach finds uncertainty, but the content-based approach does not. By looking at these articles, we find that 83% of the articles do not mention on Japanese monetary policy. Concretely, 18.3% of these articles were about uncertainties associated with monetary policy in the U.S. and Europe, 20.5% were uncertainties related to Brexit, 50.4% were general uncertainty in economic conditions, and 33.5% were uncertainties associated with the Japanese economic and fiscal policy, including social security. By judging by article contents, our index is able to exclude articles that could be included in the keyword-based MPU.

		Key-word base MPU		
		No uncertainty	Uncertainty	Total
Content-based MPU	No uncertainty	1,523	224	1,747
	Uncertainty	671	241	912
	Total	2,194	465	2,659

Table A1: Comparison between the number of articles in which the keyword-based and the content-based approach identify MPU

[9]Specifically, uncertainty terms include “uncertain,” “uncertainty” or “concern.”