THE NATURE OF MONETARY POLICY COMMUNICATION FOR A SMALL OPEN ECONOMY - THE CASE OF THE CENTRAL BANK OF MALAYSIA

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ABSTRACT

This paper deploys text analysis techniques to explore the nature of 134 MPS released by BNM between May 2004 and July 2025, a topic that has not been examined before. The word cloud presentation suggests that topics such as economic growth, price levels, and economic development, both domestically and globally, are frequently discussed, which aligns with the Term Frequency-Inverse Document Frequency (TF-IDF) analysis. The Latent Dirichlet Allocation (LDA) analysis outlines five topics covering the real economy, prices and financial markets, with Topic 2 (general price trend) receiving the most coverage over 87 months (May 20024-July 2011). Finally, the co-occurrence analysis reveals that monetary policy is primarily discussed in the context of the real sector of the economy, rather than inflation and prices, likely due to semantic content. The MPS coverage aligns with the BNM's role by emphasising the real sector and price levels, especially on global fronts. It is recommended that BNM redesign its communications to explicitly link the MPS to the price levels and consider additional channels for information dissemination.

Keywords: Bank Negara Malaysia; Co-occurrence analysis; Latent Dirichlet Allocation; Monetary Policy Statement; Term Frequency-Inverse Document Frequency

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1. INTRODUCTION

Central bank communication has become critical following the awareness of forward guidance as a monetary policy tool. This paper explores the characteristics of Malaysia's monetary policy statement (MPS) for several reasons. It is a small and open economy (Ang & Tang, 2023, p. 44), yet it has recorded Southeast Asia's third-largest gross domestic product (GDP), after Indonesia and Thailand. In recent decades, however, such rankings have been far behind those achieved before the 1997 Asian Financial Crisis. Numerous economic recovery strategies and policy actions have been implemented to restore the country's economic prosperity and achieve high-income status by 2030 (MIDA, 2024a). In reviving the economy, the Bank Negara Malaysia (BNM, henceforth) (the Central Bank of Malaysia) plays a crucial role in complementing the government's responses, such as fiscal policy, to revive the economy. As Ang and Tang (2023, p. 44) note, there was no stand-alone study of the MPS for Malaysia at that time. Malaysia remains dominant and issues central bank communication on monetary policy in the most systematic way (Ho & Karagedikli, 2025, p. 4). According to Ho and Karagedikli (2025, p. 15), Malaysia is a non-inflation-targeting emerging market economy, whereas past studies have focused on either advanced economies or inflation-targeting economies. Indeed, Malaysia has achieved a strong standing in global monetary policy, ranking 10th for sound money and 13th for its regulatory framework in 2023 (New Straits Times, 2025). It will be interesting to study the nature of MPS in Malaysia, given its economic and monetary policy performance.

The primary objective of BNM's monetary policy is to promote monetary stability, including both price and financial system stability, which is conducive to the sustainable growth of the Malaysian economy. The BNM also fulfils its role with additional responsibilities, among them are issuing currency, managing the country's

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international (foreign exchange) reserves, supervising the money market, promoting financial inclusion, serving as a banker and adviser to the Government, advising on macroeconomic policies, and managing public debt (BNM, n.d.). Given the fundamental responsibilities, the BNM is required to convey the monetary policy decision(s) to the public and financial markets through monetary policy statements (MPS, hereafter) as authorised by the Central Bank of Malaysia Act 2009 (Act 701). Hence, a better understanding of, and more transparent, monetary policy is not only a necessary and sufficient condition but also critical for ensuring the policy remains effective in achieving its objectives amid evaluations of the financial system and global uncertainties. As practised by many countries, including Malaysia, an MPS document is published and made available as open access on the same day on the central bank's official website after the monetary policy committee (MPC) meeting has made a monetary policy decision to increase, decrease, or maintain the current interest rate. The public release of MPS enables a central bank to communicate its policy decisions directly to the public and markets, providing economic justifications based on both external and internal economic conditions and factors. It also serves as an effort by the BNM to improve and ensure a high level of central bank transparency. Therefore, further discovery of the nature (more precisely, the characteristics) of MPS released by the BNM is necessary for the public and the market to better understand, predict, and effectively assess the relationships between MPS and monetary policy (i.e., interest rates) in Malaysia.

Central bank communication generally occurs through two channels: the policy-making committee (through meeting statements and official publications, including Inflation Reports and Monthly Bulletins) and individual committee members (through testimonies, speeches, and interviews) (Ehrmann & Fratzscher, 2005, p. 7), and both matter for policy transmission. In the case of Malaysia (BNM, 2008), it is to ensure that the central bank's communication helps the public and financial markets better understand the BNM's monetary policy actions and decisions. The MPS not only announces monetary policy decisions but also outlines the BNM's assessment of economic performance, inflation, and relevant policy issues. Comprehensive communication is crucial, as it provides more information and detailed explanations of the central bank's role and policy objectives, including the assessment and rationale behind its monetary policy stance. Policy communication is the recognition of the need to manage expectations effectively. Central bank communication on its commitment and strategies is essential to ensure price stability, promote public understanding and confidence that long-term inflation will remain low, thereby encouraging economic agents to respond appropriately and supporting efficient monetary policy transmission (such as through the interest rate channel). As an example given by BNM (2008, p. 91), in the bond market, expectations of the future path of interest rates influence firms' cost of raising funds, effective communication enables more rapid transmission of policy rate into the pricing of credit and longer-term rates, improving the overall efficiency of the monetary transmission mechanism.

In the past, the characteristics of the monetary authority's communication tool have been ignored, including in Malaysia, even though a poorly designed communication tool could undermine the effectiveness of monetary policy. The attention to it only increases with the popularity of textual analysis techniques. This paper primarily utilises the Latent Dirichlet Allocation (LDA, hereafter) method, a widely employed technique for identifying topics in documents, which is based on a probabilistic distribution over a fixed vocabulary of words. It is a Bayesian network for modelling automatically extracted topics in textual corpora. Such LDA analysis is also complemented by the so-called co-occurrence analysis and Term Frequency - Inverse Document Frequency (TF-IDF) analysis to extract hidden but important information from a document. Text mining provides new insights for this topic. Past studies (Chong & Ho, 2023; Ang & Tang, 2023) focus on MPS, while Ho and Karagedikli (2025) use a high-frequency event study to identify two factors in monetary policy announcements (a policy rate surprise and a path factor reflecting revisions) to the expected future policy path (i.e., long-term government bond yields). According to Bholat et al. (2015), text mining comprises a range of computational tools and statistical techniques that quantify text by processing and summarising large volumes of documents (text), including extracting patterns and meanings that may be overlooked manually or technically by human readers. Although still relatively underused by economists, text mining is important for central bank(s) because it makes a range of data sources tractable for assessing monetary and financial stability, especially when such information cannot be analysed quantitatively by traditional methods. It can be applied to either a single document or a corpus comprising MPC member speeches, staff notes, and field reports. Its advantages are its simplicity and scalability. Su et al. (2025) note that textual analysis can extract valuable insights that enhance understanding of central bank actions. Silva et al. (2025) highlight that test mining is effective in constructing, compiling, and processing comprehensive datasets. It enables systematic analysis of central bank communications along four key dimensions, namely, topic (inflation, interest rate, economic activity, etc.), communication stance (forward-looking vs backwards-looking), audience (financial sector, business sector, general public/households, etc.), and sentiment (Hawkish, Dovish, risk-highlighting, etc.), offering a comprehensive framework for evaluating monetary policy messages.

This paper employed text analysis techniques to explore the nature of MPS, drawing on publicly available MPS documents from May 2004 to July 2025. The objective is to better understand the characteristics of MPS in the context of a small open economy, Malaysia, while considering the major economic crises during the period, such as the global financial crisis (2008-2009), the COVID-19 pandemic recession (2020-2021), and post-pandemic inflation and global uncertainty (2022-). That is, to examine whether monetary policy decisions are determined differently during these crises. Currently, only two papers examine MPS-related topics in the context of Malaysia: Chong and Ho (2023) and Ang and Tang (2023). Both papers derived MPS sentiment reflecting the BNM's monetary policy stance (either hawkish or dovish) and examined its impact on financial indicators. The latter examines its influence on monetary policy decisions, particularly interest rates. However, neither study provides a comprehensive analysis of MPS's nature (characteristics) or accounts for the influence of economic crises on the thematic (topics) focus covered by MPS throughout the study periods.

Additionally, they employed lightweight dictionary- or lexicon-based approaches to extract the topics (i.e., hawkish and dovish words) documented in the MPS. These approaches often overlook contextual information within MPS sentences, which is ignored in sentiment analysis. Indeed, Herbausen et al. (2025) summarise that, unlike the dictionary-based approach, the LDA handles text analysis differently by using a probability-based model to identify the underlying topics in a text, which is easy to implement and produces interpretable and meaningful results. Dictionary approaches, on the other hand, identify sentiment or keywords by using predefined dictionaries, but they may omit hidden messages, which are meanings, themes, or sentiments that are not explicitly stated or not easily identified by surface-level word matching (or searching).

This paper contributes to the existing body of literature on Malaysian monetary policy by providing fresh empirical insights into the conduct and communication of monetary policy, based on a comprehensive, in-depth analysis of the MPS issued by the BNM, all available between May 2004 and July 2025. Furthermore, this paper is relevant to the design of communication tools used by the BNM, particularly for conveying important economic information to the public and markets, including inflation, interest rates, employment, economic growth, exchange rates, corporate earnings, consumer confidence, and so on. Lastly, these findings contribute to understanding the degree of transparency in economic and monetary information in Malaysia by examining what information is covered in an open official document.

This paper demonstrates that the BNM has taken into account both local and foreign economic and price factors, as well as uncertainties, in designing its monetary policy, as supported by the word cloud, word frequency, and TF-IDF analyses. Besides, five topics have been identified through the LDA analysis, encompassing issues related to the development and current status of prices, output, and financial markets. A series of economic events, both internal and external, explains the topic's appearance in the MPS. Lastly, monetary policy decisions have become more closely tied to the real economy, rather than prices and financial markets.

This paper is structured as follows. The related past studies are reviewed and discussed in the next section. The methodology, including the data and analysis methods, is presented in Section 3. Section 4 reports the empirical results and discussions of the findings. The last section concludes this paper.

2. LITERATURE REVIEW

Studying the context of a monetary policy announcement is related to the monetary transmission mechanisms. Casiraghi and Perez (2022) summarise that a monetary announcement should address different groups in society to improve monetary policy transmission, reinforce accountability, increase financial literacy, and coordinate among different authorities. Crudaj and Nguyen (2025) add that forward guidance, which aims to shape market expectations, has been part of monetary policy tools since the adoption of unconventional monetary policy approaches; effective communication strategies become significant in shaping firms' and households' expectations. However, they acknowledge that conveying a complex message to the public is challenging. A clear and credible announcement by a central bank also reduces uncertainty about economic variables, such as interest rates, thereby lowering liquidity and term risks (Sen et al., 2026). Eventually, the market interest rate will be lower, affecting consumption and investment. Lastly, clear communication eliminates information asymmetry, helping individuals and firms to make effective decisions (Nicolay & de Oliveira, 2019). The rationale is that asymmetric information will cause the public to adjust their expectations and fail to understand a government's true intentions regarding monetary policy.

The following discussions cover the previous research, comprising two parts. It begins with a review of the two empirical studies on the content of MPS issued by BNM. Malaysia. Ang and Tang (2023) discovered the

implications of the BNM's MPS on the policy rate by looking at how the decisions regarding the overnight policy rate (OPR) are determined by the key characteristics extracted and observed from the BNM's MPS. In their estimation, they crudely assessed both positive and negative sentiments in the MPS by capturing hawkish and dovish tones using 12 selected keywords. These tones were manually identified by counting the occurrences of the keywords searched from 106 MPS released by the BNM between May 2004 and November 2020. The findings showed that MPS content explains the OPR decisions. That is, more precisely, the hawkish (dovish) dominated MPS leads to a higher (lower) OPR, showing that MPS can reflect the monetary conduct of the BNM. Additionally, the study found that the day of the week when a particular MPS was released, along with Zeti's leadership between May 2000 and April 2016, influenced the decision to increase the OPR. However, the number of days between the release of two MPS documents is associated with decreases in OPR. Therefore, Ang and Tang's (2023) study suggests that the MPS could serve as a reliable and informative document about the BNM's monetary policy conduct.

Instead of manually collecting data from MPS as Ang and Tang (2023) did, Chong and Ho (2023) employed automated content analysis to calculate MPS sentiment from August 2004 to September 2020. They considered the difference between the number of hawkish (positive) and dovish (negative) words as expressed as a ratio of total word count. The study found that OPR changes and sentiment are positively associated, with the impact of dovish sentiment (tone) being stronger on the financial markets than that of hawkish sentiment. More specifically, changes in swap and Malaysian Government Securities yields tend to exceed the magnitude of OPR adjustments when a dovish bias dominates the MPS. They pointed out that the wording in the BNM's MPS is informative for the financial markets, particularly during periods of stress such as the global financial crisis (2008-2009) and the COVID-19 pandemic. Later, Ho and Karagedikli (2025) estimated the linkage between sentiments in the MPS and the path factor that reflects the expected future policy direction in Malaysia. Using two different dictionary-based sentiment indicators, the authors estimate that MPS sentiment correlates with the path factor.

The research by Ang and Tan (2023), Chong and Ho (2023), and Ho and Karagedikli (2025) has uncovered various aspects of the BNM's MPS, including the association between MPS sentiment and the OPR decision, and between MPS sentiment and financial markets, respectively. These recent papers also highlight the rising interest in examining the effectiveness of MPS as a central bank communication tool. Nevertheless, the nature of BNM's MPS remains a vacuum in the existing literature. This paper distinguishes itself by addressing this gap in the literature through a more precise and systematic exploration of the nature of MPS, particularly its key characteristics.

The literature review then shifts to the empirical application of LDA on the central banks' MPS worldwide. The existing literature has used LDA to understand comprehensively and deeply the particular topics covered by central banks' MPS and/or minutes of the MPC meetings via machine learning methods (Rybinski, 2019; Feldkircher et al., 2021; Pavelkova, 2022; Petropoulos & Siakoulis, 2021; Aguilar & Perez-Cervantes, 2022; Perez & Minozzo, 2022; Angino & Robitu, 2023; Johansen & Martin, 2023). Other technical methods include readability analyses (Lim, 2017; Batac et al., 2019), content analysis (Lim, 2017) and semantic orientation scores (Lucca & Trebbi, 2009), which have also been used for the same purpose. For example, Hansen and McMahon (2016) used LDA to identify 15 distinct topics in the Federal Open Market Committee (FOMC) statements released by the Federal Reserve Board, the central bank of the United States. The top five topics related to the economy have been identified: inflation, economic outlook, labour, and growth. Meanwhile, Luangaram and Wongwachara (2017) examined the readability, identified topics, and tone of MPS available for 22 central banks worldwide between 2000 and 2015. They employed the LDA method to identify 15 topics from the monetary policy decision(s) related documents, which can be grouped into six topics, namely monetary policy, financial market, inflation, growth, price, and the Euro area. Interestingly, the study found that central banks' inflation-targeting policies are primarily focused on curbing inflation.

Kawamura et al. (2019) aim to examine the characteristics of the Bank of Japan's (BoJ) Monthly Report on the phases of the business cycle. Using the LDA method, they have identified four topics from a series of Monthly Report released by the BoJ from January 1998 to March 2015 and analysed the ambiguity and sentiment polarity of these topics. They found that ambiguous expressions tend to appear more frequently in conjunction with negative expressions. This tendency is more pronounced during recessions such as the Asian financial crisis (1997-1999), the dot-com bubble (2001-2002), the global financial crisis (2008-2009), and the European debt crisis (2012-2013). Omotosho (2020) examined six topics covered in the Central Bank of Nigeria's 2016 economic recession communique. Text mining techniques were used to perform readability and sentiment analyses and to extract topics. The study shows that the communique covers oil price shocks, external reserves, and inflation.

Coco and Viegi (2020) identified six topics within the MPS of the South African Reserve Bank (SARB) and analysed the distribution of these topics over the sample period of 2000-2018. They found that the statement topics reflect either specific themes or a focus during certain periods. Using the same text-mining techniques, Du Rand, Erasmus, Hollander, Reid and van Lill (2021) have identified six topics contained in the MPC statements of the South African Reserve Bank (SARB) between 1994 and 2020. The topics are exchange rate policy, financial stability, financial and payment systems, inflation targeting, external financial risk, and growth, development and inflation. The study considered the volume, complexity, scope, and sentiment of communication from the collected MPC statements. The SARB's MPC statements were found to be consistently and narrowly focused on the mandate. Speeches capture more detail on how SARB policymakers' thinking evolves, and monetary policy communication can serve as an effective channel for reducing uncertainty and enhancing credibility in the public sphere.

Damane (2022) employed LDA to extract the key identified terms from the Lesotho Central Bank's MPS released for the period from February 2017 to January 2021. The LDA assumes that three, four, or five topics could be identified, such as global risks and prices, domestic economic growth, credit performance, COVID-19 and global economic measures, and global banks. Some discrepancies were detected by the LDA, which involved different numbers of topics. Perez and Minozzo (2022) reported twenty topics using LDA in the meeting minutes of the Central Bank of Mexico's Board of Governors. Their study aimed to construct an uncertainty index by identifying topics related to "risk" and "uncertainty" and then obtaining the probability of each topic in an individual document. Astuti et al. (2022) applied natural language processing techniques to examine topics identified in the central banks' press releases and meeting minutes in the Czech Republic, Hungary, and Poland. They found that communication may be a complementary and effective monetary policy tool for central banks in emerging economies.

Undoubtedly, the outcomes of the LDA analysis have also been utilised to assess the impact of central bank communications on the financial markets, particularly the stock market. For instance, Huning (2020) employed the LDA method to identify the possible sentiment in the Swiss National Bank's statement and investigated its potential influence on investors' uncertainty. The study showed that an optimistic tone in statements reduced investors' uncertainty, whereas a more uncertain tone had the opposite effect. Parle (2022) developed and computed a topic index using a dictionary and LDA to estimate its impact on the responses of two stock markets, namely the Euro Stoxx 50 and the SX7E Index. The study found that a hawkish tone was positively correlated with future economic performance, which explained higher stock market returns. Ortiz (2023) considered two unsupervised machine learning methods (i.e., LDA and algorithm clusters) to identify the topics contained in Donald Trump's tweets, and clustered similar topics into two variables, namely, policy-related clusters and content-independent measures. It showed significant market uncertainty movements following presidential announcements made via Twitter. Additionally, the frequency of tweets and the intensity of tweet sharing are significant factors in stock market uncertainty; the impact peaks were observed approximately two hours after publication of such announcements.

3. DATA AND TESTING METHODS

This paper utilises a total of 134 MPS released by BNM, available between May 2004 and July 2025. Such MPS documents are publicly available from the BNM's official website via https://www.bnm.gov.my/monetary-stability/mpc-meetings. It is worth noting that the frequency of annual MPS publications varies throughout the study period, depending on the economic circumstances under consideration and regulatory requirements. A total of five MPS documents were published by BNM in 2005, while six and eight MPS documents were published for the period 2010-2025 and 2006-2009, respectively.

The first text-mining procedure involves preprocessing the corpus, a systematic collection of written texts used for linguistic analysis. In this study, the corpus comprises 134 MPS documents from the BNM, all in PDF format. The raw corpus has 53,833 words, with an average MPS length of 401.74 words. The vocabulary size is 1813 words. Secondly, the corpus undergoes a standard process of converting all text (words) to lowercase, removing numbers, and common English stopwords, to improve the quality and relevance of the textual data for subsequent analysis. To note that, stopwords are commonly used but semantically meaningless in English as well as in the BNM's MPS documents, such as "a", "the", "is", "are", "shall", "will", "statement", "negara", "Malaysia", "opr", and "malaysian" among others. This paper considers an additional 160 domain-specific stopwords generated from the MPS, which comprise approximately 10 per cent of the 1578 in the term-document matrix after preprocessing. TF-IDF analysis is employed to identify customised stopwords, as terms with low TF-IDF scores are less informative for distinguishing documents within the corpus. A 10% threshold is used to remove the lowest-ranked terms, balancing noise reduction with the retention of meaningful information for topic extraction. This choice

reflects a trade-off: lower thresholds retain more noise, while higher thresholds risk excluding economically meaningful terms, particularly given that additional preprocessing steps (including stopword removal and stemming) have already reduced the text's dimensionality. Equally important, the relatively moderate vocabulary size (approximately 1,600 terms) in this research, after extensive preprocessing, a higher threshold, such as 15%, would remove a substantial proportion of the remaining terms and risk excluding economically meaningful but less frequent words. Therefore, a 10% cutoff is adopted as a more conservative approach to balance noise reduction and information retention. In addition, stemming is applied to further reduce vocabulary sparsity by consolidating word variants into common roots. Besides, all punctuation is removed, except for dashes between words, and any extra whitespace in the PDF documents is eliminated.

This paper applies the LDA method, an unsupervised text-mining technique, to extract important messages from the available BNM's MPS documents. Bholat, Hansen, Santos, and Schonhardt-Bailey (2015) described the LDA method as a probabilistic method used to identify latent topics in a document, which has been conventionally employed in economic research. More precisely, a single document can typically encompass multiple topics, each associated with a specific probability. Indeed, every single topic is assumed to have its specific probability. And, each individual word in the document could appear across several identified topics. According to Jagadeesh and Wu (2017), the probability that a document belongs to a topic follows a Dirichlet distribution of order k, where k is the number of pre-defined topic numbers. Meanwhile, the probability of a word being assigned to a topic follows a multinomial distribution. The full technical descriptions of the LDA method are widely available for reference; among them are Biel (2012) and Huning (2020). Finally, the document-specific topic structure is derived by applying Bayes' rule, with Gibbs sampling used to compute the posterior distribution over it. It is worth noting that Mardones-Segovia et al. (2022) reported that Gibbs sampling outperforms its alternative, variational expectation maximisation, in terms of accuracy when the average text length is short, as is the case in this paper, which is usually limited to a single A4 page.

The LDA model is computed using the *tm* package (codes), which is executable in the R statistical package for text mining and topic modelling. The steps for conducting the LDA are as follows. First, after preprocessing the underlying documents, they are transformed into a document-term matrix, where rows represent documents and columns represent terms. This matrix serves as the input for the LDA algorithm. Several parameters are being configured to estimate the LDA model. Note that the LDA requires the number of topics, k, to be defined manually. There are two prevailing schools of thought that offer their respective rule of thumb for choosing k. The first consideration is that a priority should be given to the interpretability of either the word-to-topic relationship or the topic itself (Huning, 2020; Parle, 2022). The second is that certain statistical indicators, such as in-sample coherence and out-of-sample perplexity scores, should be considered when deciding k (Ortiz, 2023). A 'seed' is set to reproduce the results.

In this paper, the interpretability of the results is prioritised by strategically setting the start equation k to 5. There are three fundamental justifications behind this choice. Firstly, the MPS documents released by the BNM have focused intensively on both local (internal) economic development and major international (external) development, particularly on two key macroeconomic indicators: inflation and GDP. Hence, a relatively small number of topics, $k = 5$, is sensible and reasonable to safeguard interpretability and reliability, enhance topic coherence, and avoid overfitting and the generation of redundant, incoherent topics. Secondly, a typical BNM's MPS is short, usually restricted to one A4 page in length, so it is challenging to convey much information in each MPS published. Lastly, this paper employed the *ldatuning* command in R to compute and identify the number of topics using the methods proposed by Griffiths and Steyvers (2004), Cao et al. (2009), Arun et al. (2010), and Deveaud et al. (2014). Each of them provides mixed findings, encompassing a minimum of 13 topics, based on the method proposed by Deveaud et al. (2014). In general, having more topics tends to introduce noise, complicating the interpretation of results and diminishing the value of the findings. For example, the theme of economic growth has been discussed in two separate topics, while the themes of inflation and price seem to be highlighted in five topics. Therefore, this paper does not recommend the LDA results based on 13 topics.

The estimations generate a few outputs. First, the ten most frequently used words in the MPS documents were identified through analysis. The word clouds visually present the words that appeared at least 20 times, providing an intuitive overview of common terms. Second, the term frequency-inverse document frequency (TF-IDF) score was applied to highlight the most important terms within the MPS. This score consists of two components, namely the term frequency (TF), which shows the number of times a term (t) appears in a document, d, or $tf(t, d)$, and the inverse document frequency (IDF), which illustrates the number of times a term was mentioned in a document corpus, D. The IDF measurement can be mathematically presented as shown in equation (1).

$$idf(t, D). = \log(\frac{N}{n}) \quad (1)$$

where N is the number of documents in a document corpus, and n is the number of documents that contain a particular term. The TF-IDF measurement, therefore, can be expressed by the following equation.

$$tfidf(t, d, D) = tf(t, d) \cdot idf(t, D) \quad (2)$$

A high TF-IDF score assigned to a term suggests that the term is relevant or significant within a specific MPS document. The frequency of the term frequency-inverse document weights the term-document matrix in this computation. The top twenty words with the highest TF-IDF scores will be reported to highlight their relevance.

The third output shows the top five terms for each topic identified by LDA. These top five terms were chosen based on their beta values, which indicate the probability that a word belongs to their respective topics. This output is necessary to identify the thematic coverage of each topic. Fourth, the composition of topics in each document has been analysed by plotting their respective gamma values, which indicate the per-document-per-topic probabilities. Such visualisation shows which topics, as identified by LDA, receive relatively higher coverage than other topics in each document. Fifth, a co-occurrence analysis is conducted to capture relationships among words appearing in the MPS. In this attempt, the bigram of two is observed, which means the co-occurrence analysis focuses on words that appeared together in the MPS. Studying the bigram of two is considered sufficient and reasonable due to the simplicity imposed by the nature of the MPS. The pairs of words that have been identified are then split into two individual words, and the stopwords identified from this process are excluded from the co-occurrence analysis. Only words that appear at least 50 times are included to ensure meaningful interpretation. Some analyses were conducted to validate the relationship between the topics and their readability. First, the log ratio of beta is used to determine the relationship between the topics and Flesch grade level, Flesch-Kincaid grade level, SMOG, and Coleman-Liau readability indices are presented to verify the level of education needed to understand the MPS contents.

4. EMPIRICAL RESULTS

4.1. Most Frequent Words and Word Cloud

Table 1 tabulates the ten most frequently printed words in the examined MPS documents. The word frequency results are also presented graphically in Figure 1, which displays a word cloud of terms with a minimum frequency of 20 to enhance clarity and interpretability. The top two most frequently appearing words are “growth” and “continu”, highlighting the view that BNM consistently emphasises the importance of sustained economic growth and development in Malaysia during the period 2004-2025. These are followed by “economi”, “inflat”, and “global”, each with a frequency of between 608 and 620. This implies that the MPS documents are strongly focused on economic performance, inflationary trends, and global economic development. Indeed, the frequency of “domest” is 572, slightly lower than that of “global”, suggesting heightened BNM awareness of external factors and influences on Malaysia as a small open economy. The next most frequently appearing words are “remain”, “expect”, and “econom”, which show the concern of BNM with the country’s economic trends and expectations, aligning with the role of BNM in communicating the current and future economic conditions and government policy directions to the public and markets through the available MPS documents. Lastly, “price” is the least frequent word in the list, indicating that the BNM’s discussions focused on the effects of commodity and good prices. In summary, the findings highlight BNM's emphasis on output development, especially on the global front, compared with price development. As a result, BNM has discussed the growth conditions more frequently in its central bank communication strategy. These results also differ from those of Kuncoro et al. (2021), who find that inflation has been mentioned more frequently in Indonesia’s Board of Governors' press statements. This is unsurprising, considering Indonesia is implementing an inflation-targeting policy.

Table 1: Top ten most frequently printed words

Word	Frequency
growth	917
continu	654
economi	620
inflat	609
global	608
domest	572
remain	555
expect	470
econom	399
price	393

Figure 1: Word cloud

4.2. TF-IDF Score

The TF-IDF scores reported in Table 2 show several key terms, including “improv”, “recoveri”, and “measur”, among the most prominent. This finding implies that concepts related to the country's economic conditions and recovery measures (policies) are central themes and more important in the MPS documents. Other important terms related to them are “unchang”, “leav”, “environ”, “pressure”, “uncertainti” and “well”, further highlighting the focus of MPS documents on economic stability and policy responses. The other notable key terms related to external economic development are “trade” and “oil”, highlighting the importance of global factors (or external shocks) in shaping the country’s monetary policy. The financial markets and price dynamics are also crucial, but they are less dominant than the previous category, as “liquidity” and “inflationary” are included in that category, respectively.

The time dimension also carries important information in MPS documents, such as the terms of "second", "half", "first", and medium", suggesting the importance of covering both the previous and future economic conditions. Surprisingly, the influence of China and the US in the MPS documents is not as significant as one might assume, as the terms "china", "us", "united", and "states" are not among the top 20 terms. Indeed, these words are not found when the analysis is extended to the top 200 terms. A possible reason for such practices of avoiding the specific country names, such as the US and China, Malaysia's largest trading partners, is to prevent communications from appearing critical, politically sensitive, or diplomatically unfriendly. Malaysia is professional in its communication norms, practising neutrality and non-politicisation by using highly formal diplomatic tones and terms to ensure harmony and avoid sensitive topics that could strain relationships (World Business Culture, n.d.). More formally, indirect terms such as "major advanced economies", "global headwinds", and so on are preferred. Indeed, the influences of both the US and China on Malaysia are substantial through various spillover effects, given that Malaysia is a highly open, upper-middle-income economy that wisely balances its strategic ties with both the world's two largest economies (Institute of Strategic and International Studies Malaysia, ISIS, 2025; MIDA, 2024b). In that sense, Malaysia's financial markets are significantly linked to both economies - the Ringgit is essentially influenced by the US monetary policy, while local equity markets are positively correlated with China during periods of regional volatility (BNM, 2023). Therefore, it can be concluded that BNM focuses on the global economy as a whole, rather than the economic performance of the world's two major economic powers, when discussing and delivering its monetary policy decisions. All in all, the TF-IDF analysis suggests that MPS has provided society with key economic information across the dimensions required to make monetary policy decisions. All this information enables economic agents to gauge possible future monetary policy decisions, thereby maximising their welfare and utility. The coverage of policy reactions also differs from the conclusion of Kuncoro et al. (2021), who find that the Board of Governors' press releases in Indonesia have emphasised the economic variables that affect monetary policy decisions.

Table 2: The twenty terms with the highest TF-IDF scores

Terms	Frequency	Terms	Frequency
1. improv	0.7579	11. leav	0.5906
2. recoveri	0.6748	12. uncertaini	0.5784
3. measur	0.6446	13. inflationari	0.5696
4. second	0.6274	14. term	0.5691
5. half	0.6204	15. oil	05678
6. first	0.6145	16. quarter	0.5655
7. unchang	0.6123	17. liquid	0.5642
8. trade	0.6038	18. environ	0.5641
9. medium	0.5985	19. increas	0.5541
10. pressur	0.5923	20. well	0.5504

4.3. MPS Topics from LDA Analysis

The results of identifying the MPS's topics using the top five terms across the five topics are assumed for the LDA estimation. Five topics are identified from the LDA analysis as represented in Figure 2. The top-left panel illustrates the top five terms in topic 1, which discuss global inflation and economic growth outlook in a broad macroeconomic perspective. Topic 2 focuses on the general price trend, highlighting inflation dynamics. Topic 3 concerns the dynamic relationships between economic growth and global financial markets. The terms for topic 4, although similar to those in topic 2, are more focused on the performance of global economic activities. The final topic (i.e., topic 5) is likely related to the domestic economic situation, particularly demand and growth. The study by Luagaram and Wongwachara (2017) and Damane's study on emerging countries also reported a similar focus on local and foreign economic development. Overall, the topics identified by LDA reveal a comprehensive analysis of multiple aspects of economic conditions, encompassing economic growth, inflation, financial markets, and demand conditions. These discussions are not limited to the global perspective but also include domestic contexts, aligning with the findings drawn in the previous analyses.2 Equally significant, the identified topics, except for topic 2, typically have two important terms, as shown in Figure 2, implying that the topics are discussed distinctly but rather involve different dimensions. Hence, the readers are expected to have a basic understanding of the economy or have a high level of education. The requirement of a higher education level to understand the MPS is also found in other countries, such as the US and Korea (Luangaram & Wongwachara, 2017)3

Figure 2: The top five terms based on the beta values

4.3.1. The interpretability of different numbers of k

As explained in Section 3, the number of topics, k, can be examined using the evaluation matrix proposed by Griffiths and Steyvers (2004), Cao et al. (2009), Arun et al. (2010), and Deveaud et al. (2014), as well as coherence scores. As a supplement to the analysis, the results of these matrices and the topics they suggest are presented. The minimum and maximum values of k assumed in this paper are 2 and 15, respectively. It is unusual to have an MPS that contains only 1 topic. The relatively short average document length in each MPS, as highlighted in

Section 3, makes it impossible to have too many topics, thereby setting the maximum at 15. Figure 3 indicates that k equals 13 in Deveaud et al. (2014) and 15 in other evaluation matrices. Additionally, the coherence scores indicate that k=15 is preferred, with values of 0.0229, 0.0256, and 0.0242 for k=5, 13, and 15, respectively.

Figure 3: The evaluation matrix output

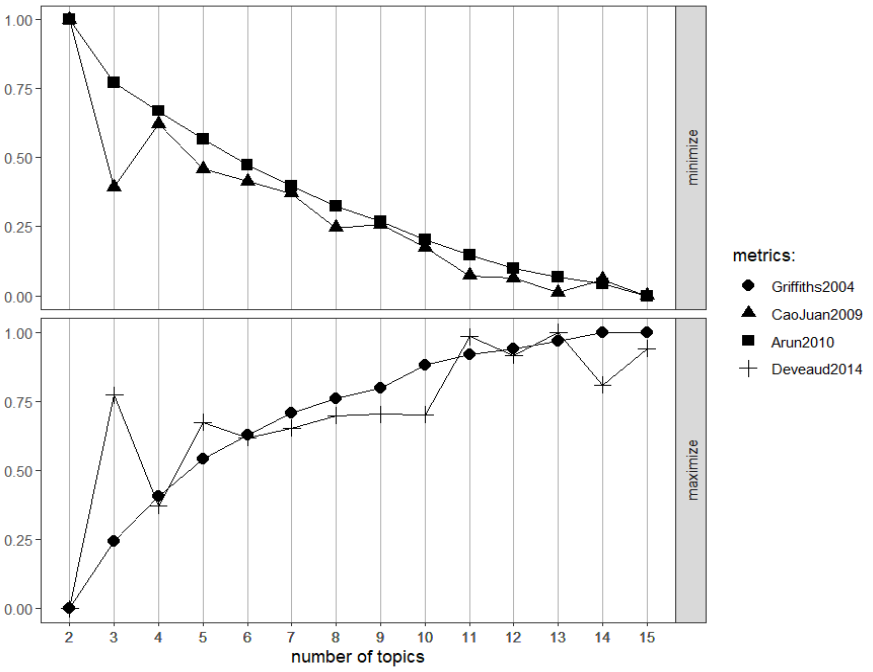
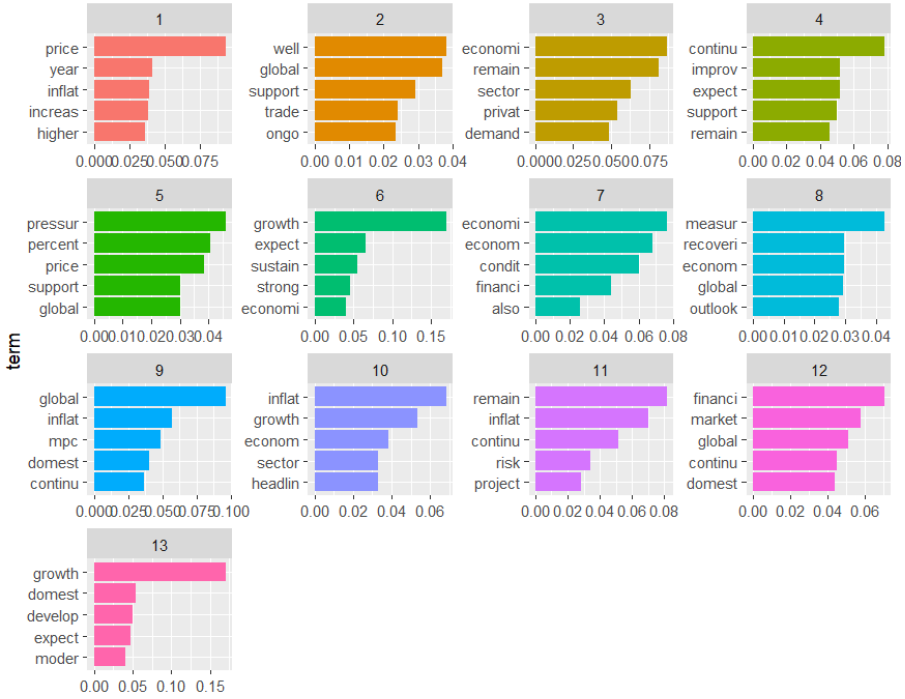


Figure 4: The top five terms based on the beta values for k =13



However, selecting *k*=13 or 15 could make interpreting the topics challenging. Based on Figures 4 and 5 below, the topics identified by k=13 and k=15 are much more complex, in that economic growth and prices appear in many more topics. For example, Figure 4 illustrates that price changes have been discussed in topics 1, 5, 9, 10, and 11, with inflation in the local context found in topics 1 and 10, and global contexts likely covered in topics 5, 9, and 11. A similar issue is shown in Figure 5, in which the price and inflation could have been covered in topics 1, 7, 9, 11, 12, and 13; except for topics 11 and 13, which are likely to cover the global inflation. The other inflation-related topic could be more domestic. This example shows the challenges brought to the interpretability of LDA-generated topics if *k* follows the evaluation matrices. Last but not least, the *LADvis* command in R is available to explore inter-topic relationships via multidimensional scaling. The overlapping circles in the intertopic distance map represent overlapping topics. Based on Figures 6-8, topic overlap could be avoided if *k*=5, but not if *k*=13 or 15. further justifying the appropriateness of *k*=5.

Figure 5: The top five terms based on the beta values for *k* =15

Figure 6: The intertopic distance map (*k*=5)

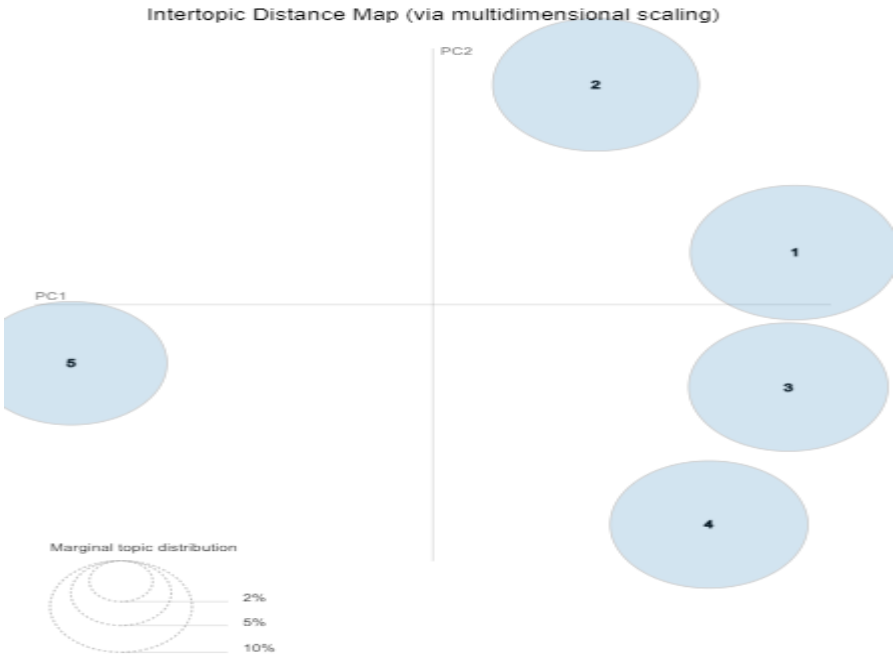


Figure 7: The intertopic distance map (*k*=13)

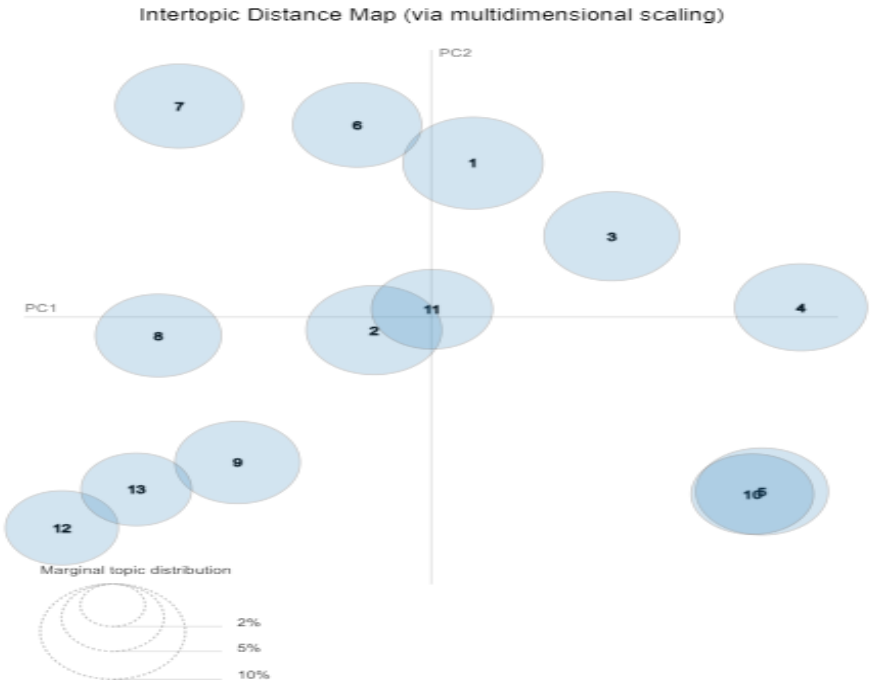
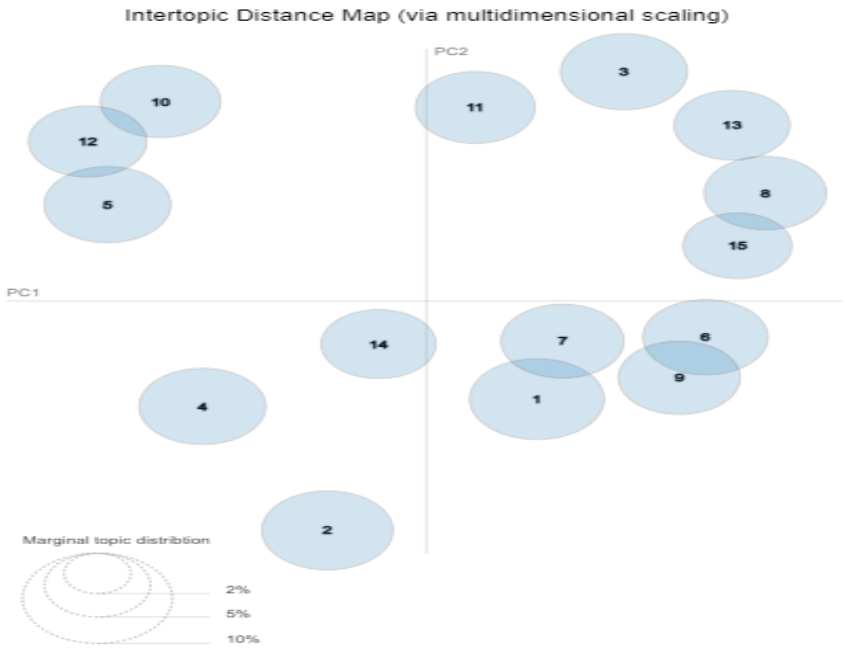


Figure 8: The intertopic distance map (*k*=15)



4.4. Per-Document-Per-Topic Probabilities

Turning to the per-document-per-topic probabilities analysis calculated from the LDA method, which determines which topic appears more frequently (i.e. relatively important) in the MPS documents. The definitions of the early topic are retained for this analysis. The per-document-per-topic probabilities are visualised in Figure 9. As shown in Table 3, topic 1 on global inflation and economic conditions was discussed most frequently in the MPS documents from May 2022 to July 2025, with 20 documents. During this observed period, the global economy has been marked by a series of major economic events, including geopolitical risks (e.g., the war between Ukraine and Russia), which have driven up commodity prices, contributing to elevated inflation levels domestically and globally. Additionally, other events, such as the tightening of monetary policy in advanced countries, developments in the global supply chain, the slowdown of the Chinese economy, and the new trade tariffs imposed by the US administration, collectively affected both global and domestic economic growth and sentiment.

Topic 2, which focuses on price changes, was the most frequently discussed between May 2004 and July 2011, with 50 documents. One possible explanation is the fluctuation in oil prices during that period, driven by international events such as oil price booms and busts, as well as the gradual removal of fuel subsidies by the Malaysian government. Otherwise, topic 3, covering economic growth and the global financial market, is frequently mentioned by 31 documents from July 2014 to July 2019. This period witnessed substantial changes in the global economy and financial markets, which were jolted by a series of major events, such as Brexit, the US interest rate hike, and the onset of the US-initiated trade war. These events triggered volatility in global capital markets and raised concerns about global and domestic economic growth. Topic 4, centred on global economic activities, received greater attention than the other periods from September 2019 to July 2022, largely due to the gradual economic slowdown in several countries, including the US, and the outbreak of the COVID-19 pandemic. The pandemic caused severe economic contractions and widespread disruptions to global supply chains. The economic stimulus packages implemented by their respective governments may lead to fluctuations in economic performance, widening fiscal deficits, and rising debt. The prolonged economic lockdown in China in response to the COVID-19 pandemic for nearly three years (2020 - 2022), and the Ukraine-Russia war, also disrupted the global economic recovery after the pandemic.

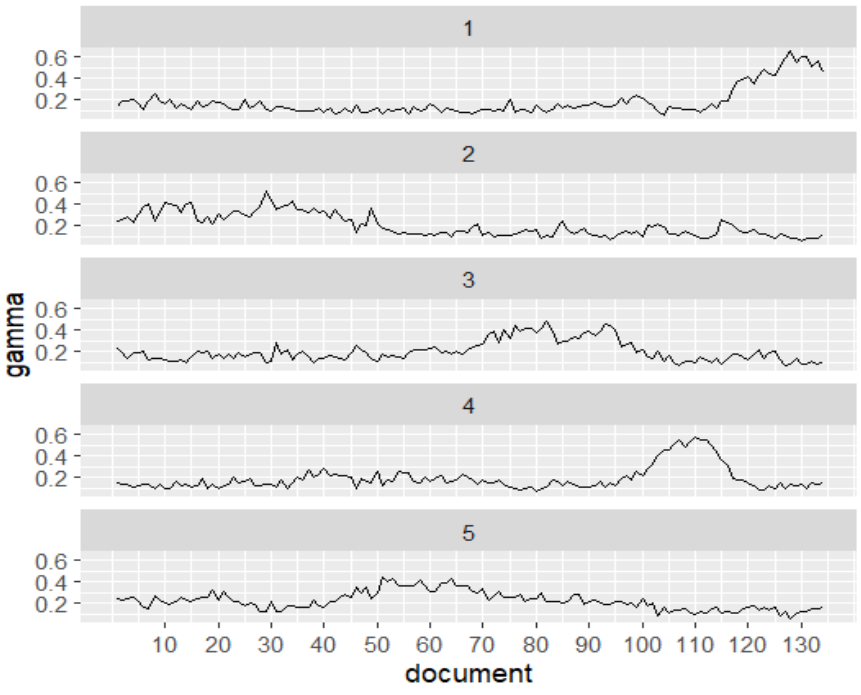
The last topic, which highlights domestic demand and economic growth, has received relatively close attention and was discussed in twenty MPS documents during September 2011 and November 2014, which is likely explained by the relatively strong economic performance of Malaysia during that period, as the quarterly economic

growth ranged between 4 per cent and 6.5 per cent. External economic developments, such as the debt crisis in Europe at its most intense phase between 2010 and 2012, and the policy responses by advanced countries to various economic issues, including the implementation of quantitative easing in the US, also broadened the scope of domestic economic demand. As a small open economy, Malaysia is particularly sensitive and vulnerable to global economic shifts, which further explains the focus on this topic in the MPS during that period. In summary, findings indicate that BNM has been responsive to various global (e.g. oil prices, monetary policy in advanced countries, wars and pandemic) and domestic (e.g. tax reform and stimulus plans) shocks to safeguard economic growth and maintain price stability, therefore helping readers to understand the official views of BNM officials on current and future economic conditions. The discussion of the global and domestic shocks in MPS is critical to limit the economic fluctuations due to crises and the launch of new policies, because, as argued by Nicolay and de Oliveira (2019), without clear information disclosure, the asymmetrical information between the authorities and the public will lead to an ineffective monetary policy.

Table 3: Periods when a topic was more frequently discussed

Topic	The MPS document no. (number of documents)	Month of the corresponding MPS
1	115-134 (20)	May 2022 – July 2025 (39 months)
2	1-50 (50)	May 2004 - July 2011 (87 months)
3	68-98 (31)	July 2014- July 2019 (60 months)
4	99-116 (18)	September 2019 – July 2022 (35 months)
5	51-70 (20)	September 2011 - November 2014 (39 months)

Figure 9: Per-document-per-topic probabilities



4.5. The Co-Occurrence Analysis

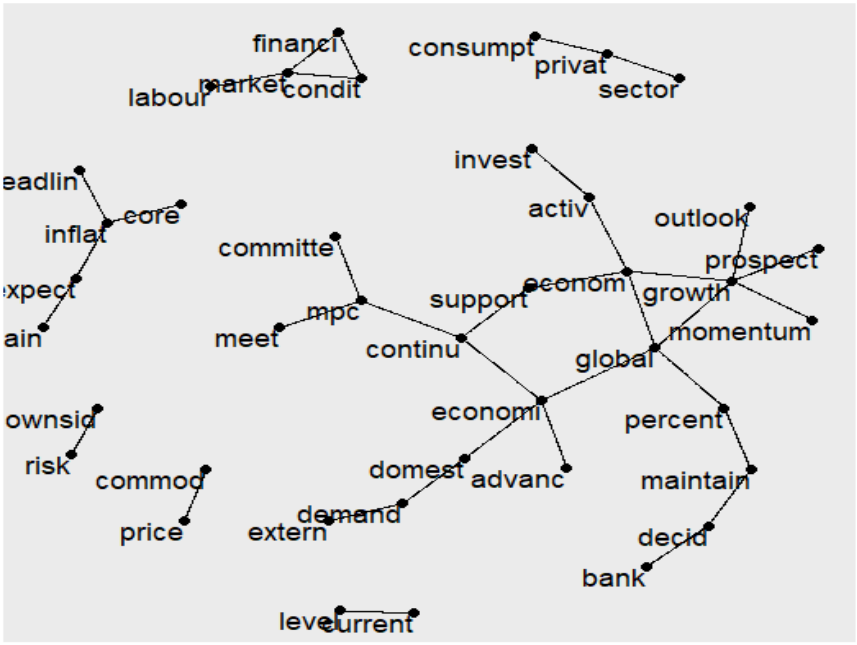
The last part is about the output of the co-occurrence analysis. Figure 10 visually maps the network of frequently appearing words in the BNM's MPS documents under study. The figure shows that the words in the analysis are mostly interconnected, supporting a cohesive thematic structure within and among the MPS documents. The terms related to monetary policy decisions, such as "mpc", have been closely connected to and discussed alongside

economic growth and demand, both domestic and global. Interestingly, the words related to price, such as "headlin," "infla" and "core", do not connect with monetary policy terminology - the semantic context could explain this finding. The detailed information on inflation in the MPS documents has frequently been discussed in the broader context of domestic and external economic development, rather than used to rationalise a monetary policy decision. In other words, inflation alone is seldom used to justify an economic condition. Moreover, there is greater information coverage of output conditions than of inflation, as shown in Table 1. It is unlikely that BNM has strategically ignored inflation in its monetary policy decision-making process, given that maintaining price stability is one of its core mandates, as highlighted in the introduction. Indeed, the lack of connectivity among inflation-related terms is more likely to be a matter of linguistic structure. This observation suggests that the BNM should reconsider the format and presentation of MPS documents to strengthen transparency and policy communication by establishing a stronger connection between price condition discussions and the monetary policy decision. More importantly, the connection between price performance and monetary policy should be made more explicit and further emphasised. This will help build BNM's credibility by demonstrating that it will act in accordance with its core mandates: achieving price stability and sustainable economic growth. It is important as the ability of monetary policy to influence the price level and risk premium depends on the expectations of firms and individuals, as suggested by the expectation theories (Crudaj and Nguyen, 2025; Sen et al., 2026). A clear linkage between inflation and monetary policy in any central bank communication tools will strengthen the process of forming appropriate expectations.

Elaborating from the conclusion above, the price conditions, including rising inflation, deflation, and high asset volatility, require corresponding monetary policy decisions, such as contractionary, expansionary, and communicative or strategic adjustment, respectively. Good communication enhances central banks' capacity to make sound policy decisions and improves their legitimacy as public institutions (Macklem & Vardy, 2024). Central banks in advanced, emerging or developing economies alike have been strengthening their communication practices, as they need to determine both the contents and the target audiences of their communication - for example, inflation expectations are important in monetary policymaking, as they serve as a key nominal anchor for central banks in their pursuit of price stability (IMF, 2022). Londono et al. (2024) find robust evidence, based on data from 24 central banks, that communications by central banks represented on more interagency financial stability committees are more effective at mitigating deteriorations in financial conditions. Using laboratory experiments (in a New Keynesian setting), Pfajfar and Žakelj (2018) find that a forward-looking Taylor rule with a reaction coefficient of 4 generates lower inflation variability than rules with reaction coefficients of 1.5 and 1.35. Geromichalos et al. (2007), in their model, demonstrate a clear connection between asset prices and monetary policy: when money supply grows at a higher rate, inflation rises, and the return on money declines. Ehrmann and Fratzscher (2005) compare the communication policies by the Federal Reserve, the Bank of England, and the European Central Bank (ECB) since 1999, and find that the diversity of views among committee members reduces the market's ability to anticipate policy decisions and the future path of interest rates. Central banks aim for price stability, and expectations are crucial in determining short- to medium-term inflation; in the euro area, observed inflation appears consistent with theoretical predications, and the ECB's actions seem to be soundly effective (Bordes & Clerc, 2007). However, according to the European Parliament (2018), central banks had long maintained a high degree of secrecy about their decision-making procedures as excessive transparency might limit their policy decision flexibility. Over the longer term, the ECB faces a communication problem in establishing its commitment to a symmetric 2 per cent inflation target.

Lastly, several words are frequently discussed together, such as those related to economic downturn risks, private-sector consumption, commodity prices, and the labour and financial markets. These co-occurrences signal other core economic considerations that underpin the BNM's policy direction, including risk levels, labour markets, price movements, and consumption patterns. Covering them will enable readers of MPS to grasp the latest economic developments, providing them with the more comprehensive information needed to understand them. It is critical as information sharing is one of the purposes of communication.

Figure 10: Co-occurrence analysis



5. Conclusion

The MPS documents published by BNM have played a crucial role in disseminating monetary policy decisions and related economic information to the public (and markets). However, the messages or content conveyed by MPS documents have not been sufficiently and systematically examined by using a rigorous procedure, i.e. a probability-based method. This paper addresses this vacuum by analysing 134 MPS issued by BNM, available from May 2004 to July 2025, using LDA and supplemented by other analyses. The LDA and word cloud analyses reveal that the MPS documents consistently address all three core monetary policy objectives of the BNM: economic growth, price stability, and financial stability. Also, the topic coverage is associated with the economic events. The rationale of BNM's monetary policy decisions, either increasing, decreasing or maintaining the current policy rate, i.e. OPR, has been frequently linked with economic development, rather than price conditions. The focus on economic development and price levels also suggests that BNM's operations have contributed to sustained economic growth and employment, which are part of the Sustainable Development Goals.

Based on the findings, society should understand the information and topics conveyed in MPS to realise the previous and expected economic trajectories and the key considerations of BNM in making monetary policy, thereby helping them make proper consumption and investment decisions. Furthermore, this paper suggests that BNM has successfully covered important economic information that influences both the broader economy and price levels, which in turn determine its effects on monetary policy formulation and OPR decisions. It is recommended that the BNM reconsider the presentation format of the upcoming MPS documents so that monetary policy decisions appear to be justified by the price stability level, rather than focusing solely on economic growth considerations, thereby facilitating more efficient inflation expectation formation. It could further strengthen the BNM's commitment to enhancing communication transparency and achieving price stability. The requirement that readers have at least a college education means the information should be expressed in terms understandable to the layperson.

Future studies could further consider cross-country comparisons of MPS documents, in particular the nature of MPS, to add insights to the literature on whether they differ from those in other countries, particularly among ASEAN countries. Also, it is suggested to explore the impact of MPS tone and topic framing on Malaysia's financial markets (i.e., foreign exchange, equity, commodities, and cryptocurrency markets), as well as the communication effectiveness and market sensitivity of MPS.

END NOTES

1. The list of stopwords and codes to identify the domain-specific stopwords is available upon request.
2. The log ratio of beta of different topics shows that each topic has different focuses, supporting the summary from the LDA topic analysis. For brevity, the log-ratio results for the beta of different topics are not presented here. The results are available upon request.
3. The Flesch grade level, Flesch-Kincaid grade level, SMOG, and Coleman-Liau readability indices also support this conclusion. All of these indices indicate that a college or degree-level education is necessary to comprehend the MPS effectively. Compared with the median Flesch-Kincaid grade level reported by Luangaram and Wongwachara (2017), which is 13, the readability index score in Malaysia is higher, reaching 15.9 for MPS released from July 11, 2018, to May 3, 2023. The detailed results are available upon request.

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