



Munich Personal RePEc Archive

Central Bank Communication in Ghana: Insights from a Text Mining Analysis

Omotosho, Babatunde S.

15 November 2019

Online at <https://mpra.ub.uni-muenchen.de/98297/>

MPRA Paper No. 98297, posted 25 Jan 2020 02:18 UTC

Central Bank Communication in Ghana: Insights from a Text Mining Analysis

Babatunde Samson Omotosho[†]

Abstract

Effective central bank communication is useful for anchoring market expectations and enhancing macroeconomic stability. In this paper, the communication strategy of the Bank of Ghana (BOG) is analysed using BOG's monetary policy committee press releases for the period 2018-2019. Specifically, we apply text mining techniques to investigate the readability, sentiments and hidden topics of the policy documents. Our results provide evidence of increased central bank communication during the sample period, implying improved monetary policy transparency. Also, the computed Coleman and Liau (1975) readability index shows that the word and sentence structures of the press releases have become less complex, indicating increased readability. Furthermore, we find an average monetary policy net sentiment score of 3.9 per cent. This means that the monetary policy committee expressed positive sentiments regarding policy and macroeconomic outlooks during the period. Finally, the estimated topic model reveals that the topic proportion for "monetary policy and inflation" was prominent in the year 2018 while concerns regarding exchange rate were strong in 2019. The paper recommends that in order to enhance monetary policy communication, the Bank of Ghana should continue to improve on the readability of the monetary policy press releases.

JEL codes: E52, E58, E65

Keywords: Central bank communication, text mining, monetary policy

1. Introduction

The need for effective central bank communication was articulated by Woodford (2005), who noted that the Alan Greenspan era at the Fed was characterised by a Federal Open Market Committee (FOMC) that communicated openly about its current and future policy actions. In the pre-Greenspan era, however, the secrecy with which monetary policy activities were conducted was based on the belief that monetary policy could be made more effective by "taking the markets by surprise". Woodford (2005) argued that the strategy of "taking the markets by surprise" generates counter-productive effects in the achievement of the Fed's

[†] Adam Smith Business School, University of Glasgow, United Kingdom.

monetary policy objectives and concluded that an effective communication strategy is a pre-requisite for any central bank to be successful in the attainment of its policy objectives. There is a consensus in literature that central bank communication is a useful tool for enhancing policy dialogue with the public, anchoring market expectations, determining asset prices, improving monetary policy predictability, and achieving macroeconomic stability (Blinder, 1999; Bernanke and Reinhart, 2004; Sturm and De Haan, 2011; Berger et al., 2011; and Oshima and Matsubayashi, 2018). This consensus has paved way for increased monetary policy transparency across the world.

According to Blinder et al. (2008), central bank communication refers to the quantity and quality of information released to the public regarding the central bank's monetary policy objectives, monetary policy strategy, economic outlook, and signals about future policy trajectory. The growing popularity of central bank communication has been due to the greater monetary policy transparency required for the implementation of an inflation targeting framework of monetary policy as well as the increasing level of operational independence being enjoyed by central banks around the world (Coenen, 2017). Thus, over the years, a number of central banks have developed strategies for adequately disseminating their policy objectives and decisions to the public. These include the Bank of Canada (BoC), which releases four monetary policy reports annually; the European Central Bank, which holds its monetary policy meeting every six weeks and conducts a press conference after each meeting; and the Fed, which issues eight monetary policy statements each year. Other central banks have got similar strategies in place, including the Bank of England, the Reserve Bank of Australia, the Sveriges Riskbank, the Central Bank of the Republic of Turkey, Bank of Japan, the Reserve Bank of New Zealand, Bank of Korea, the Bank of Thailand, amongst others.

In Ghana, the Monetary Policy Committee (MPC) of the Bank of Ghana (BOG) is responsible for setting the monetary policy interest rate that helps in the achievement of the government's medium-term inflation target of 8 (\pm 2) per cent. As stated on the BOG's website, the MPC meets bi-monthly based on a pre-announced calendar of meetings published at the beginning of each year. The MPC meetings are held for two days, after which a press conference is done on the third day. A number of communication channels are used by the BOG to announce its policy arguments and decisions, including the economic reports, the monetary policy press releases, and the transcript of press briefings. The monetary policy press release provides a summary of the developments in the global and domestic economic environments, the BOG's perception about economic outlook, and the policy decisions of the MPC.

The increased level of central bank communication as well as the availability of relevant automated algorithms have enabled the growth of a strand of research focused on the use of text mining to extract useful insights from monetary policy documents (see Park et al., 2019; Shapiro and Wilson, 2019; Oshima and Matsubayashi, 2018; Luangaram and Wongwachara, 2017; and Shirota, 2015). While the communication strategies of central banks in developed countries have been analysed (see Siklos, 2013; Shapiro and Wilson, 2019; Hubert and Fabien, 2017; Kahveci and Odabas, 2016; Luangaram and Sethapramote, 2016; Binette and Tchegotarev, 2019), the literature for central banks in developing countries (including Ghana) is still relatively scarce. To our knowledge, no study has analysed central bank communication in Ghana using automated text mining techniques.

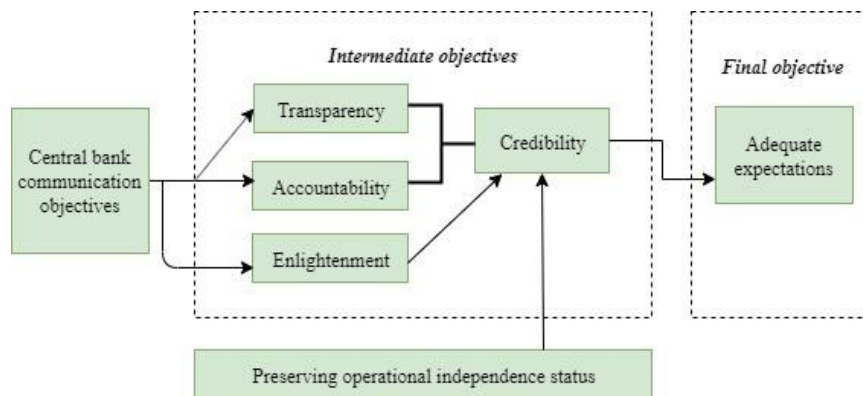
The aim of this study is to analyse Bank of Ghana's communication strategy during the period 2018-2019 using text mining techniques. Our approach allows us to analyse the linguistic contents of the BOG's monetary policy press releases over the sample period with a view to generating meaningful quantitative insights from them. Specifically, we assess the readability of the press releases based on the approach of Coleman and Liao (1975). Second, we generate monetary policy sentiments expressed by the MPC during the sample period in order to gauge the policy makers' perceptions regarding the risks to the achievement of BOG's monetary policy objectives. Lastly, we identify the main topics in the press releases over the sample period by estimating a

Latent Dirichlet Allocation model. For ease of exposition, the paper is organized into five sections. In the next section, we review some related literature on the application of text mining techniques to central bank communication. The third section describes the data and the text mining procedures employed. The results are presented in section four while section five concludes.

2. Related Literature

The need for central banks to effectively manage agents' expectations is one of the key policy challenges in the aftermath of the 2008 global financial crisis (Naghdaliyev, 2011). It has, however, been recognised that central bank communication plays an important role in the management of expectations. According to Naghdaliyev's (2011), a central bank is able to avoid information overload that could lead to the "deterioration of the rational decision-making process by the public" by developing a clear communication objective. Such a communication objective should encompass both intermediate and final objectives as shown in Figure 1.

Figure 1: Central bank communication objective



Source: Naghdaliyev (2011).

The intermediate objectives of central bank communication address the issues relating to monetary policy transparency, accountability, and credibility while the final objective relates to the effective management of expectations. As argued by Naghdaliyev (2011), the intermediate objective relating to credibility is the most important for the central bank's ability in adequately shaping market expectations. In this section, we present a brief review of studies that have applied text mining techniques to understand central bank communication.

A number of authors have also assessed the communication strategies of central banks in terms of the readability of published monetary policy documents. In a study of the Bank of Canada's monetary policy report, Binette and Tchegotarev (2019) found that the published reports were quite complicated for an average Canadian to understand and that the level of readability of the reports declined during the occurrence of important macroeconomic events in Canada. On the other hand, Coenen et al. (2017) showed that the ECB's monetary policy statements have become easier to understand over time. In order to determine the level of readability of monetary policy documents in a wide range of countries, Luangaram and Wongwachara (2017) analysed monetary policy statements across 22 central banks using text mining techniques. It was found that the monetary policy reports have become more readable over time.

In a study aimed at determining the usefulness of central bank communication in predicting the future path of monetary policy, Apel and Grimaldi (2012) analysed the published minutes of the Riskbank's monetary policy meetings. They obtained a text-based indicator of net hawkishness from each minutes and found that increases in interest rate in Sweden were associated with high degree of net hawkishness in Riskbank's communication. In a related study, Luangaram and Sethapramote (2016) augmented the standard Taylor-type rule specifications with text-based indicators generated from the Bank of Japan's monetary policy reports and found that the

inclusion of the computed indicators improved the performance of the Taylor-type rule specifications in predicting future policy interest rate in Japan. Also, Sturm and De Haan (2011) found that the text-based indicators obtained from the ECB monetary policy documents were useful for predicting the Banks future policy decisions.

A strand of the literature has investigated whether central bank communication is related to macroeconomic developments. For instance, Luangaram and Sethapramote (2016) applied text mining techniques to extract useful text-based indicators from the monetary policy documents published by the Bank of Japan and it was found that the inclusion of the computed indicated into their structural vector autoregression model increased output response to an interest rate shock. Also, Oshima and Matsubayashi (2018) studied the impacts of Bank of Japan's communication on the Japanese financial market over the period April 2013 to September 2017. Their results showed that the Bank's communication affected market reactions, especially on the days the minutes of the policy committee were released to the public. In a study of the United States for the period 1986-2013, Shapiro and Wilson (2019) computed a measure of monetary policy sentiment from the Fed's monetary policy documents and found a negative relationship between FOMC's negative sentiments and United States' output growth.

Kahveci and Odabas (2016) investigated the linguistic content of central bank communication before and after the 2008 global financial crisis by analysing monetary policy statements released by the Fed, ECB and Central Bank of Turkey (CBRT). It was found that the Fed's policy statements have expressed less optimistic tone after the crisis while the tones of the policy statements for the ECB and CBRT have remained unchanged even after the crisis. Also, Siklos (2013) analysed the monetary policy documents published by five central banks (the Reserve Bank of Australia, the Bank of Canada, the Reserve Bank of New Zealand, the Bank of England and the U.S. Federal Reserve) and found that concerns regarding financial stability and economic uncertainties were quite prominent during the crisis. In a slightly different study, Hubert and Fabien (2017) studied the relationship between monetary policy sentiment and the term structure of private short-term interest rate expectations in the US and the Euro area. They applied computational linguistics to relevant monetary policy documents and found that positive shocks to monetary policy sentiment leads to an increase in interest rate expectations.

It is important to note that while different documents relating to monetary policy communication are being published by Bank of Ghana, especially since the beginning of 2018, no study has analysed such documents in terms of their readability as well as the monetary policy sentiments expressed by the Banks monetary policy committee. Thus, our study fills this gap in literature. In the next section, we describe our data sources as well as the methods of analysis employed.

3. Data and Research Methods

In this study, we employ textual data sourced from monetary policy press releases of the Bank of Ghana available at https://www.bog.gov.gh/mpc_press_release/. The BOG's monetary policy release communicates the MPC's assessments regarding global and domestic economic developments, the outlooks for the global and domestic economies, and the committee's policy decisions. The documents analysed in this study cover the period 2018-2019, reflecting the period for which the monetary policy press releases are available in downloadable form on the Bank's website. Thus, our corpus comprises a total word count of 18,512 words, distributed across 12 monetary policy press releases as shown in Table 1.

In line with standard procedures for text mining analysis, we pre-process our corpus by removing numbers, punctuations, white spaces, and special characters from the documents. We also convert all the characters in the corpus to lower. Next, English stop words that provide no additional value to our analysis are removed.

Furthermore, certain redundant words such as “respective”, “trillion”, “ghana”, “press”, etc are excluded from the data set.

Table 1: Word count for BOG’s monetary policy press releases, 2018-2019

Meeting No.	Meeting Month	Word count
80	Jan-18	1374
81	Mar-18	1297
82	May-18	1427
83	Jul-18	1372
84	Sep-18	1353
85	Nov-18	1618
86	Jan-19	1468
87	Apr-19	1746
88	May-19	1724
89	Jul-19	1550
90	Sep-19	1569
91	Nov-19	2014
Total word count		18512

Finally, we stem the corpus by dropping letters or combination of letters such as “e”, “c”, “ing”, “ed” from the end of words. These steps are applied to all the documents in the same order and based on the same rules (Gefen et al., 2017). Having completed the pre-processing procedure, 8, 322 words were dropped leaving us with a total number of 10, 190 words for analysis.

3.2. Readability analysis

The readability index developed by Coleman and Liau (1975) was employed to in order to investigate the level of readability of the BOG’s monetary policy press releases. The Coleman-Liau Readability Index (CLI) computes the level of understandability of a document based on the word difficulty in the document (i.e. the number of characters per word) and the sentence difficulty (i.e. the number of words per sentence). The index is computed as:

$$CLI = 141.8401 - 0.214590 \times \frac{100 \times N_{ch}}{N_w} + 1.079812 \times \frac{N_{st} \times 100}{N_w} \quad (1)$$

where N_{ch} denotes the number of characters, N_{st} represents the number of sentences while N_w denotes the number of words in the document. It is clear from equation (1) that a higher value of CLI for a document is implies easier readability.

3.3 Sentiment analysis

Following the approach in Binette and Tchegotarev (2019), the BOG’s monetary policy net sentiment score ($MPSS$) for each document in our corpus is derived as follows:

$$MPSS = \frac{N_{positive} - N_{negative}}{N_{total}} \times 100 \quad (2)$$

where $N_{positive}$ denotes the number of words expressing positive sentiments, $N_{negative}$ is the number of words expressing negative sentiments, and N_{total} is the total number of words in the document. Thus, any positive sentiment term used in a document takes the value of +1 while a negative sentiment term takes a value of -1. It is implied in equation (2) that a value of $MPSS > 0$ indicates positive sentiments while $MPSS < 0$ signifies the expression of negative sentiments. The computed $MPSS$ enables us to derive useful insights regarding the

BOG’s perception regarding the upside and downside risks to the achievement of the Bank’s policy objectives.

3.4 Topic extraction

We employ the Latent Dirichlet Allocation (LDA) modelling approach developed by Blei et al. (2003) to cluster the texts in our corpus into meaningful categories that describe the main topics in the BOG’s monetary policy press releases. Based on the procedure outlined in Calvo-González et al., (2018) and Shirota et al. (2015), the LDA generative process for our corpus is described as follows:

Step 1: For each topic k , draw a distribution φ_k over words according to a Dirichlet distribution $\sim Dir(\beta)$, where β is the parameter of the Dirichlet prior on the per-topic word distribution. A high value of β means that each topic comprises most of the words in the corpus, whereas a low beta means that each topic features fewer words.

Step 2: For each document D : we draw a vector of topic proportions θ_d according to a Dirichlet distribution $\sim Dir(\alpha)$, where α is the parameter of the Dirichlet prior on the per-document topic distribution. A high value of α means that each document comprises a mixture of most of the identified topics whereas a low α means that each document features fewer topics.

Step 3: For each of the N words w_n : we choose a topic assignment z_n based on a multinomial distribution \sim Multinomial(θ) according to the topic proportion θ_d . Next, we choose a word w_n from $p(w_n|z_n, \varphi)$ based on a multinomial probability conditioned on the topic z_n ; where z represents the per-word topic assignments.

By going through steps 1 – 3 above, the distribution of the parameters φ , θ , and z , that are most likely to have governed the generation of the documents in our corpus can then be inferred. Thus, given our documents and the Dirichlet priors (α and β), the LDA model computes the posterior distribution of the latent variables as follows:

$$P(\theta, z, \varphi|w, \alpha, \beta) = \frac{P(\theta, z, \varphi|\alpha, \beta)}{P(w|\alpha, \beta)} \quad (3)$$

Calculate the maximum likelihood for equation (3) is computationally costly. Thus, we follow the practice in literature by using the collapsed Gibbs sampling algorithm to approximate the posterior distributions of the hidden variables given in equation (3) by running 5,000 iterations. As noted by Shirota et al. (2015), the collapsed Gibbs sampling algorithm is a useful procedure for approximating posterior distributions that are difficult to compute directly. Once the posterior estimates for φ and θ are derived, the algorithm then returns the topic representation of each document in the corpus. The number of topics in our corpus is taken as four ($k=4$).

4. Results and Discussions

4.1 Frequency distribution of words by character length

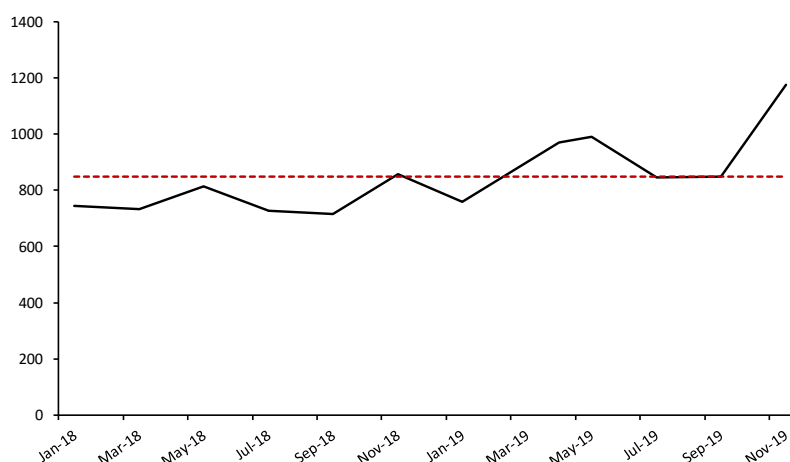
The cumulative frequency distribution of words in our term document matrix (TDM) analysed by their character length is presented in Table 2. The table shows that there are 588 unique words in the TDM with a minimum character length of 3 and a maximum character length of 13. The published monetary policy press releases of the BOG are dominated by six-character words with a frequency of 158 or 26.9 per cent. This is followed by four and five-character words with a frequency rate of frequency percentage of 17.9 per cent each. Overall, about 67.4 per cent of the words contained in our press releases are between 3 – 6 characters in length. However, words with 10 characters and above account for only 3.1 per cent, indicating that the policy releases are expressed in short words.

Table 2: Cumulative frequency of words by their character length

Word length	freq	cum.freq	percent	cum.percent
3	28	28	4.76	4.8
4	105	133	17.86	22.6
5	105	238	17.86	40.5
6	158	396	26.87	67.4
7	96	492	16.33	83.7
8	55	547	9.35	93.0
9	23	570	3.91	96.9
10	11	581	1.87	98.8
11	4	585	0.68	99.5
12	2	587	0.34	99.8
13	1	588	0.17	100.0

4.2 Word count for published MPC press releases

Figure 2 shows the distribution of the remaining 10, 190 words analysed in our study over the 12 monetary policy releases. The red horizontal line indicates the average word count for the documents, which is 849 words. As can be seen, the word count for the published policy releases has increased systematically over the years, indicating increased central bank communication. Particularly, the BOG communicated more in the year 2019 compared to the previous year.

Figure 2: Word count of BOG’s monetary policy press releases, 2018-2019

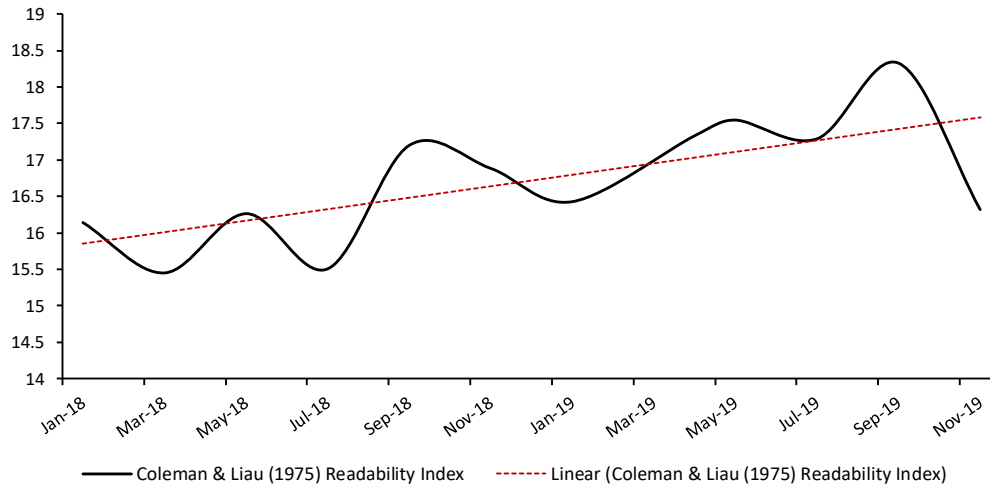
The highest word count (1, 177 words) was recorded in the monetary policy press release of November 2019. This coincided with the period in which the BOG expressed concerns regarding limited access to credit and high domestic interest rates. Thus, the monetary policy press release issued after the MPC meeting of November 2019 communicated the BOG’s intention to “introduced new prudential and market conduct regulatory measures to help foster more competition in the banking sector and in the process help lower lending rates”.

4.3 Assessing the readability of the MPC press releases

In Figure 3, the computed Coleman and Liau (1975) readability index for each of the published policy press releases during the period 2018-2019 is plotted. The red dashed line represents the linear trend fitted to the data over the sample period. The average readability level for the press releases is 16.7 per cent, which is slightly lower than the level found by Bruno (2017) for the Financial Stability Reports (FSR) published by the

Bank of Italy. Also, the obtained average readability level corresponds to that expected of a college student and other higher qualifications. The fitted linear trend appears to suggest that the readability level of the BOG’s monetary policy press releases is increasing.

Figure 3: Coleman and Liau (1975) readability index for BOG’s policy releases

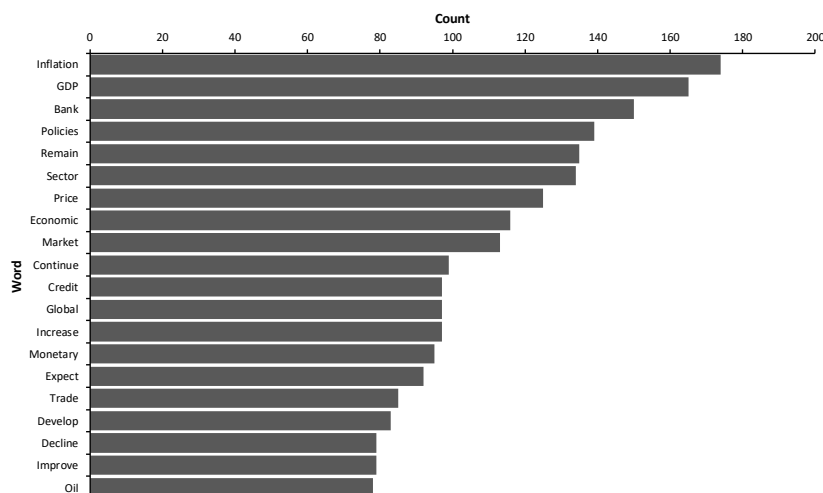


However, the readability index declined sharply in November 2019, implying increased complexity of word and sentence structures of the monetary policy release of that month. As earlier noted, the policy release issued after meeting number 91 of the BOG’s monetary policy committee addressed specific issues that were of additional concerns to the Bank. However, this paper suggests that the BOG’s MPC needs to pay attention to the readability of its press releases whenever specific policy measures are to be introduced.

4.4 Frequent terms in the MPC press releases, 2018 – 2019

Figure 4 shows a plot of the most frequent terms in BOG’s monetary policy press releases for the period 2018-2019. This helps to identify the key issues that were of concern to the BOG’s MPC during the sample period. As can be seen, the most frequent word used in the policy press releases is “inflation”, occurring about 174 times. Following this are terms such as “GDP”, “bank”, “policies”, “remain”, “sector”, “price”, “economic”, “market”, “continue”, “credit”, “global”, etc.

Figure 4: Frequent terms in the Document Term Matrix



“monetary”, “loan”, “debt”, “international”, “dolar”, “foreign”, “real”, “demand”, “export” with high probabilities (Figure 6). Therefore, this topic is ascribed a label that relates to “monetary policy and inflation” (Table 3, Figure 6).

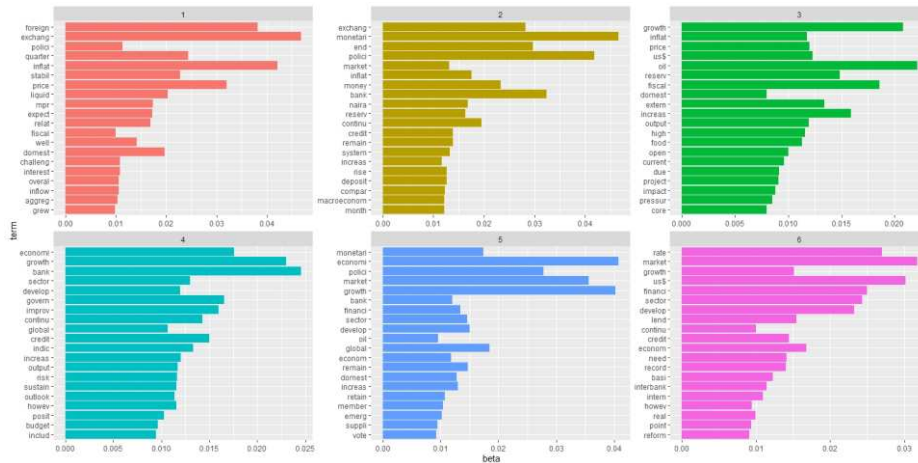
Table 3: Identified topics and their probable terms

s/n	Topic 1	Topic 2	Topic 3	Topic 4
1	remain	bank	gdp	inflat
2	price	sector	economi	monetari
3	trade	credit	market	expect
4	econom	polici	global	continu
5	strong	domest	develop	declin
6	recent	financi	improv	increas
7	surplus	condit	oil	loan
8	capit	stanc	reflect	emerg
9	month	fiscal	rate	indic
10	risk	money	polici	financ
11	main	deficit	account	balanc
12	moder	project	outlook	posit
13	pressur	broad	crude	debt
14	relat	target	record	trend
15	support	cedi	reserv	intern
16	depreci	lend	asset	includ
17	advanc	bond	core	rise
18	show	industri	increas	dollar
19	current	term	budget	foreign
20	exchang	result	price	real
21	basi	strengthen	interest	survey
22	pace	gain	tension	target
23	higher	perform	measur	demand
24	margin	similar	confid	privat
25	signific	provid	effect	export

Assigned topic	External trade and exchange rate developments	Domestic policies and macroeconomic stability	Global developments and domestic economic growth	Monetary policy and inflation
----------------	---	---	--	-------------------------------

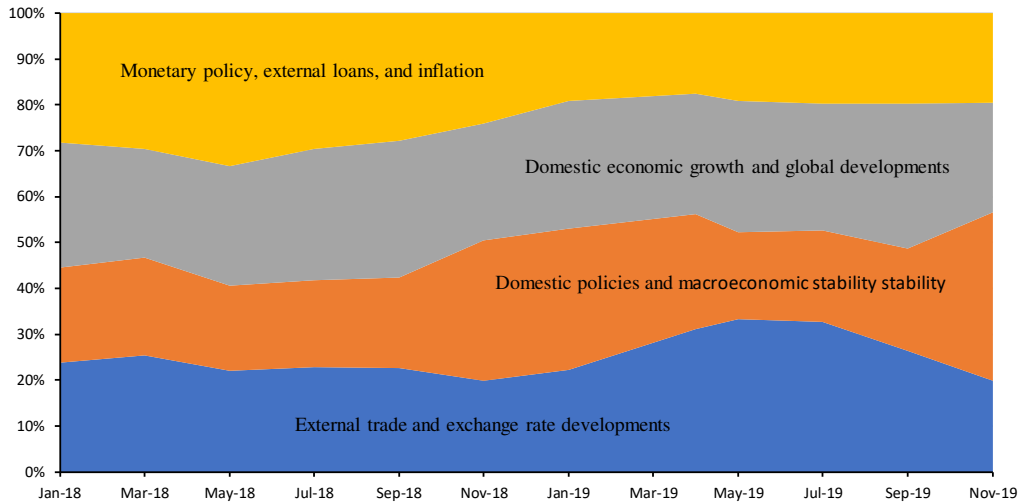
Furthermore, Figure 7 shows the evolution of the topics driving BOG’s monetary policy communication by plotting the topic proportion for our identified topics over the sample period. It is obvious from the chart that the linguistic content of the policy communiqués for the period 2018-2019 has been relatively stable. As can be seen from the chart, the issues relating to “monetary policy and inflation” were predominant in 2018, followed by the impacts of global shocks on domestic economic growth. For instance, a portion of the fifth paragraph of the monetary policy press release of January 2018 expressed the concern of the MPC regarding inflation as follows: “However, since the last MPC meeting, headline inflation has recorded two marginal upticks, mainly reflecting price pressures from domestic food and rising international crude oil prices which translated directly into ex-pump prices. All the Bank’s core inflation measures have generally remained flat until recent episodes of elevation in the last quarter of 2017. The Bank of Ghana’s measure of core inflation, which excludes energy and utility, edged up from 12.3 percent in October to 12.6 percent in December 2017”. This appears to align with our ascribed label for the fourth topic of our LDA model. On the other hand, the topics relating to exchange rate and general macroeconomic stability were less prominent.

Figure 6: Most frequent terms and their probabilities of occurring under each topic



In 2019, the topic proportion for “external trade and exchange rate developments” was quite predominant, especially during the second half of the year. The increased relevance of this topic can be buttressed by the eight paragraph of the April 2019 monetary policy press release, which states as follows: “Ladies and Gentlemen, despite these very strong fundamentals, the cedi came under pressure against the major international currencies in February and March 2019, reflecting episodic depreciation similar to what we experienced in May-June 2018. By March 19, 2019, the cedi’s depreciation had peaked at 8.0 percent, compared to a marginal depreciation of 0.02 percent in the same period of 2018”. The next dominant topic during the year relates to “global developments and domestic economic growth” while the topic proportion for “monetary policy and inflation” was less prominent.

Figure 7: Topic evolution of BOG’s monetary policy communication, 2018-2019



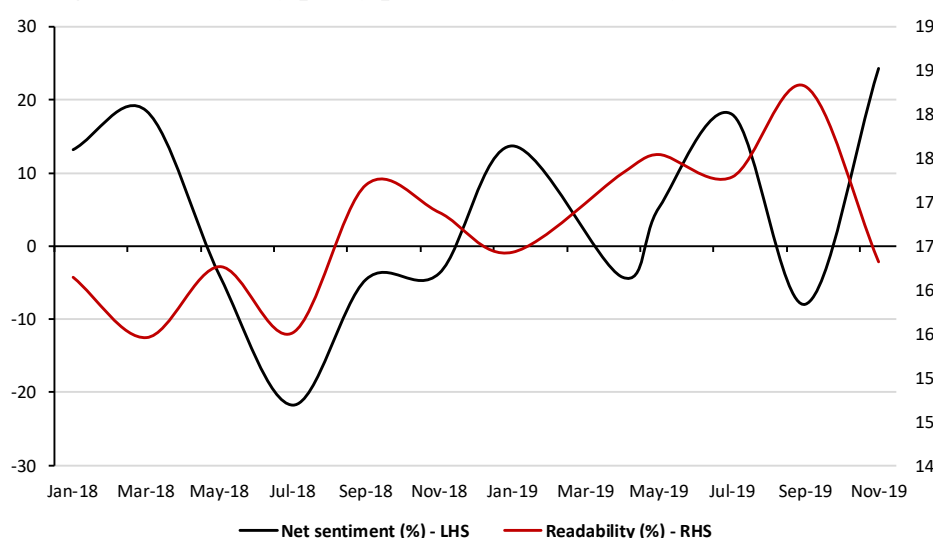
4.6 Monetary policy sentiment analysis

Table 4 presents the plot of the monetary policy net sentiment score (MPSS) computed for each of the monetary policy press releases of the BOG published during 2018-2019. The average MPSS for the 2018-2019 period was positive at 3.9 per cent, reflecting the relatively stable macroeconomic environment experienced in Ghana during the sample period. For instance, the perception of the MPC regarding the influence of global economic developments on the Ghanaian economy was expressed monetary policy press release of March 2018 as follows: “Broadly, these developments in the external environment continue to transmit favourably to the domestic economy”.

Table 4: BOG’s monetary policy net sentiment score, 2018 – 2019

Meeting No.	Meeting Month	Net Sentiment (%)
80	Jan-18	13.2
81	Mar-18	18.5
82	May-18	-4.0
83	Jul-18	-21.7
84	Sep-18	-4.5
85	Nov-18	-3.7
86	Jan-19	13.7
87	Apr-19	-4.2
88	May-19	5.3
89	Jul-19	18.0
90	Sep-19	-7.9
91	Nov-19	24.3
Average net sentiment score		3.9

Also, the positive average net sentiments also reflected the strong domestic output growth recorded during the sample period. This was expressed in the fourth paragraph of the July 2018 monetary policy press release as follows: “The Ghanaian economy continues to record strong growth with a 6.8 percent GDP growth in the first quarter of 2018, compared with 6.7 percent in the same period of 2017. Non-oil growth for the first quarter also picked up strongly to 5.4 percent, from 4.0 percent in the comparative period of 2017. The growth pickup is evidenced in a stronger rebound by the services sector, which rose by 5.2 percent, compared with 3.4 percent in the same period of 2017. The Bank’s Composite Index of Economic Activity (CIEA) also showed a strong pickup reflecting increased industrial consumption of electricity, cement sales and exports. The real CIEA recorded an annual growth of 3.2 percent in May 2018, compared to 2.6 percent in the corresponding period of 2017”.

Figure 8: Monetary policy press release readability index and MPSS

The dip in the MPSS recorded in July 2018 reflects the less than satisfactory performance of government’s fiscal operations, expressed in negative sentiments as follows: “Government budgetary operations for the period January to May 2018, indicated that revenue and grants amounted to GH¢17.4 billion (7.2% of GDP) and 7.6 percent less than programmed. Total expenditures, including arrears clearance, was GH¢22.6 billion (9.4% of GDP) and 6.4 percent short of the target. These developments resulted in an overall cash deficit of

2.6 percent of GDP, higher than the targeted 2.4 percent of GDP for the review period”. Also, in the twelfth paragraph of the July 2018 monetary policy press release, the MPC expressed negative sentiments regarding the foreign exchange market as follows: “These external factors, together with increased demand for foreign exchange from the corporate and energy related sectors, exerted pressure on the domestic currency market”.

Figure 8 appears to indicate a negative relationship between the computed readability index for the monetary policy press release and the monetary policy net sentiment score, except during the second half of 2018. For instance, a decline in the readability index between January to March 2018 is associated with an increase in the monetary policy net sentiment score (MPSS). Similarly, the increase in the readability index in September 2019 was associated with a decline in the MPSS. This sort of relationship seems to suggest that the BOG communicates in a less complex style during periods of negative policy sentiments.

5. Conclusion

In this paper, we analysed the communication strategy of the Bank of Ghana by analysing published monetary policy press releases using text mining techniques. Our corpus comprises of 12 monetary policy releases available on the website of the BOG for the period 2018-2019. A total of 10,190 words distributed over the 12 policy releases in our processed corpus were analysed in order to derive useful insights regarding the readability, topics and sentiments of the documents. We found that the Bank of Ghana’s communication increased over the sample period, implying improved monetary policy transparency. Also, our results showed that published policy press releases have become easier to read over time.

In order to identify the that dominated central bank communication over the sample period, we extracted the most frequent terms in the corpus. Our results showed that terms such as “inflation”, “gdp”, “monetary” etc were quite prominent, indicating that the central bank communication strategy is consistent with the BOG’s monetary policy objectives. Furthermore, results from the estimated topic model showed that the topic relating to “monetary policy and inflation rate” was predominant in 2018 while the topic proportion for “external trade and exchange rate developments” was predominant in 2019. The evolution of topic proportions in the documents reflect the emerging policy and macroeconomic developments being faced by the BOG’s MPC per time. The average monetary policy net sentiment score for the sample period was positive at 3.9 per cent, implying the MPC’s positive outlook and perception about the economy.

This paper represents the first attempt at analysing central bank communication in Ghana using an automated text mining approach. It is hoped that future efforts would utilise other monetary policy documents published by the Bank of Ghana to derive insights that could improve the public’s understanding of monetary policy decisions in the country. Since increased readability could enhance public acceptance for monetary policy decisions, it is also recommended that the Bank of Ghana continues to ensure that the word and sentence structures of the MPC press releases are less complex.

References

- Apel, M. and Grimaldi, M. (2012). The Information Content of Central Bank Minutes. *Riksbank Research Paper Series*, (92).
- Berger, H., Ehrmann, M. and Fratzscher, M. (2011). Monetary Policy in the Media. *Journal of Money, Credit and Banking*, **43**(4), 689–709.
- Bernanke, B. S. and Reinhart, V. R. (2004). Conducting Monetary Policy at very Low Short Term Interest Rates. *American Economic Review* **94**(2), 85–90.
- Binette, A. and Tchegotarev, D. (2019). Canada’s Monetary Policy Report: If Text could Speak, what would it Say? *Bank of Canada Staff Analytical Note*.
- Blei, D. M., Ng, A. Y. and Jordan, M. I. (2003). Latent Dirichlet Allocation. *Journal of Machine Learning research*. **3**(Jan), 993–1022.
- Blinder, A. S. (1999). *Central Banking in Theory and Practice*. MIT press.
- Blinder, A. S., Ehrmann, M., Fratzscher, M., De Haan, J. and Jansen, D.J. (2008). Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence. *Journal of Economic Literature*. **46**(4), 910–45.
- Bruno, G. (2017). Central Bank Communications: Information Extraction and Semantic Analysis. *IFC Bulletins chapters* **44**.
- Coenen, G., Ehrmann, M., Gaballo, G., Hoffmann, P., Nakov, A., Nardelli, S., Persson, E. and Strasser, G. (2017), ‘Communication of Monetary Policy in Unconventional Times. *ECB Working Paper. No. 2080* .
- Coleman, M. and Liao, T. L. (1975), ‘A Computer Readability Formula Designed for Machine Scoring. *Journal of Applied Psychology*. **60**(2), 283.
- Debortoli, S., Müller, O., Junglas, I. and Vom Brocke, J. (2016). Text Mining for Information Systems Researchers: An Annotated Topic Modelling Tutorial. *Communications of the Association for Information Systems*. **39**(1), 7.
- Gefen, D., Endicott, J. E., Fresneda, J. E., Miller, J. L. and Larsen, K. R. (2017). A Guide to Text Analysis with Latent Semantic Analysis in R with Annotated Code: Studying Online Reviews and the Stack Exchange Community. *CAIS*. **41**, 21.
- Hubert, P. and Fabien, L. (2017). Central Bank Sentiment and Policy Expectations. *Bank of England Staff Working Paper 648*.
- Kahveci, E. and Odabas, A. (2016). Central Bank’s Communication Strategy and Content Analysis of Monetary Policy Statements: The Case of Fed, ECB and CBRT. *Procedia-Social and Behavioural Sciences*. **235**, 618–629.
- Luangaram, P. and Sethapramote, Y. (2016). Central Bank Communication and Monetary Policy Effectiveness: Evidence from Thailand. Puey Ungphakorn Institute for Economic Research.
- Luangaram, P. and Wongwachara, W. (2017). More than Words: A Textual Analysis of Monetary Policy Communication. *PIER Discussion Papers*. **54**.

- Naghdaliyev, N. S. (2011). Central Banks' Communication in the Post-crisis Period. *The Harriman Institute, Columbia University*.
- Oshima, Y. and Matsubayashi, Y. (2018). Monetary Policy Communication of the Bank of Japan: Computational Text Analysis. *Graduate School of Economics Working paper*, Kobe University.
- Park, K. Y., Lee, Y. and Kim, S. (2019). Deciphering Monetary Policy Board Minutes through Text Mining Approach: The Case of Korea. *Bank of Korea Working Paper*.
- Shapiro, A. H. and Wilson, D. (2019). Taking the Fed at its Word: Direct Estimation of Central Bank Objectives using Text Analytics. *Federal Reserve Bank of San Francisco Working Paper 2019-02*.
- Shirota, Y., Hashimoto, T. and Sakura, T. (2015). Topic Extraction Analysis for Monetary Policy Minutes of Japan in 2014, in *Industrial Conference on Data Mining*. Springer, pp. 141–152.
- Siklos, P. L. (2013). The Global Financial Crisis and The Language of Central Banking: Central Bank Guidance in Good Times and in Bad. *CAMA Working Paper Series Paper 58/2013*.
- Sturm, J.-E. and De Haan, J. (2011). Does Central Bank Communication Really Lead to Better Forecasts of Policy Decisions? New Evidence Based on a Taylor Rule Model for the ECB. *Review of World Economics*. **147**(1), 41–58.
- Woodford, Michael. (2005). Central-Bank Communication and Policy Effectiveness, in *The Greenspan Era: Lessons for the Future*. Kansas City: Federal Reserve Bank of Kansas City, 399-474.