SBP Research Bulletin
Volume 15, Number 1, 2019

Effectiveness of SBP's Monetary Policy Communication

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Abstract: *This study investigates the impact of monetary policy communication of the State Bank of Pakistan (SBP) on two different aspects. First, whether the information in Monetary Policy Statement (MPS) alters the way market analyzes the economy, using a text-mining approach. Second, whether the voting pattern disclosed in the Monetary Policy Committee (MPC) minutes provide market with some direction about the future path of the policy rate. The results show that the communication of monetary policy decisions changes the market sentiments in accordance with the information provided in the MPS. Moreover, we find that the voting record provided in the minutes of the MPC meetings guides the market about future path of interest rates. These findings support the effectiveness of SBP's monetary policy communication, which is one of the requisites in implementation of the inflation targeting framework.*

JEL Classification: E52, E59

Key Words: Monetary Policy, Effectiveness of Monetary Policy Communication, Textual Analysis, Voting

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1. Introduction

Effective communication by central banks have gained much importance in recent times. As described in Filardo and Guinigundo (2008), central bank's communication approach has changed significantly due to three main reasons. First, the recognition that monetary policy action would be more effective if understood better by the markets. Second, an emerging consensus that a clear communication of targets and policies is a form of accountability process for an unelected central bank in an era of increased central bank independence. Third, rising popularity of the conduct of forward looking inflation targeting monetary policy strategy across the world that puts a lot of emphasis on a well-defined communication strategy.

Apart from the stated reasons, communication becomes altogether important in presence of large informal sector in the economy as it can have an anchoring role in managing inflation expectations of agents outside the ambit of formal financial channels.

Literature on central bank's communication has continuously been evolving and communication by central banks across the world has taken various forms. Mostly, the central banks use press conferences as a mean of communication to provide details of their monetary policy stance and outlook. Publication of meeting minutes also plays an important role in communicating various views of the decision-making committee. Forward looking inflation reports and monetary policy reviews are also playing important role in anchoring inflation expectations. Advance announcement of monetary policy meeting schedules is adding on to the certainty and confidence in the market.

For Pakistan, State Bank of Pakistan (SBP) operates under a dual mandate to stimulate economic growth given the optimal utilization of available resources along with maintaining monetary (price and financial) stability. The need to have stability in these macroeconomic objectives safeguards against short-term economic shocks and has broad based positive dividends for the economy. In this regard, policy communication by SBP has to be simple, clear and credible.

In moving towards transparency and openness regarding monetary policy formulation, SBP has achieved several milestones and gradually improved its communication in line with best international practices, particularly in the last decade. Increased focus on economic outlook, regular and frequent assessment of economic conditions, press conferences and speeches are some of the important features of SBP's enhanced communication practices. Both the monetary policy framework and its communication have also experienced important improvements over time. To further strengthen SBP's independence and bring transparency in policy making process, the SBP Act (1956) was amended in 2015 to constitute the statutory Monetary Policy Committee (MPC). MPC was established with six internal and three external members (economists of good reputation) with a mandate to formulate, support and

recommend the monetary policy (SBP Act 1956: Section 9E). Globally, it has been recognized that the creation of the MPC is a major achievement towards the establishment of an independent and autonomous central bank (Blinder 2004, Vandenbussche 2006). However, in the context of international best practices, some tasks are yet to be undertaken by the SBP. For instance, these include the need to provide a schedule of monetary policy meetings to be held in, at least, next one year. Moreover, the central bank can think of providing the names of MPC members along with their choice of vote towards decision making.

At present, the ***monetary policy statement (MPS)*** and ***minutes of the MPC*** are the most important documents pertaining to information on monetary policy decisions for the stakeholders. In order to communicate the MPC decision, MPS is published on alternative months carrying policy rate decision along with brief discussion on trends and developments of the economy. After publication of MPS, minutes are published after a gap of one-month. It includes detailed information on MPC discussion as well as voting pattern of its members. Disclosing voting records with attributes i.e. names of the MPC members, has not been adopted yet.

Given the two sources of monetary policy information, this study aims to analyze the impact of both MPS and MPC minutes on market sentiments and future path of interest rates respectively. Accordingly, we divide our analysis in two parts.

First part attempts to see whether the information contained in MPS affects market perception by analyzing the contents of the statements and compare it with market perception and market reaction before and after its release, respectively. As the market looks forward to the announcement of policy rate, it comments on the expected policy change. Important sources of this discussion include brokerage house reports and newspaper articles. The purpose is to find out that how effective is the communication of the SBP in shaping up the views of the market regarding important economic variables. Methodology of textual analysis/text mining technique has been used to gauge the impact. Similarly, tone of the documents and market commentary is also analyzed using Loughran/McDonald dictionary. The results disclose that market sentiments do adjust after release of the MPS. Market participants not only align their focus in line with the extent of attention to issues discussed in the MPS but also the tone of their sentiments is affected.

Second part investigates if the voting records published in MPC minutes provide market with additional information regarding future path of the policy rate. Specifically, it tests the hypothesis whether voting details explain changes in future policy rate in Pakistan. The econometric evidence reveals that the voting details comprehend significant evidence about changes in future policy rate both with and without incorporating the element of market expectations. The findings support the effectiveness of SBP's monetary policy communication, one of the desirable conditions in implementation of inflation targeting framework.

In terms of the contribution of this study, we have not found any comparable study for Pakistan focusing on change in both sentiments and tone after policy level decision making. Also, use of MPC voting pattern to infer direction of the future policy rate is a new area of policy research in the context of Pakistan as no earlier evidence exists regarding public decision making on basis of voting. Both these aspects highlight the emerging importance of effective communication regarding monetary policy. The need to understand its impacts is going to be extremely useful to design the appropriate flexible inflation targeting framework that the SBP plans to implement going forward[2].

Paper is organized as follows. Section 2 describes procedure and results of the textual/content analysis of MPS and market reports. Section 3 presents econometric evidence on importance of voting details, published in minutes of MPC, for future policy rate. Last section concludes the discussion.

2. Monetary Policy Statements and Market Reaction- Textual Analysis

Content analysis, also termed as textual analysis, is a well-known methodology in the social sciences to quantify various patterns in communication. Many words of similar meaning or of similar class are classified into fewer classes (Weber 1990). The core assumption of content analysis is that the words and phrases cited and stated most often in a text or series of texts are those that reveal the most important apprehension of that particular discussion (Muema & Mutisya, 2012). Textual analysis is an exploration process that necessitates the examiner to meticulously study the content of communication rather than the structure of the content. Historical documents and narratives have been widely analyzed using this technique.

Initially, the research involving textual analysis was performed in different fields. For instance, areas of psychology (Sexton and Helmreich 1999) and communications (Stephen 1999) were analyzed using text mining techniques. The research scope was also extended to multiple fields like political science (Gentzkow and Shapiro 2010), religious studies (Dershowitz et al. 2011), finance (Tetlock 2007) and literature (Koppel et al. 2002). However, in economics, it's still in its developing phase since there has been very few studies on the subject. Konsik (2014) seems to be the first mainstream study in economics employing textual analysis. He conducted frequency analysis of word choice in the "Hydroelectric Dam Contract License" of U.S covering 30 years period along with traditional regression techniques to find out "completeness" of the contracts. His results show that contracts are becoming flexible over time instead of rigid as environment concerns increases. Similarly, another attempt was made by the same author in 2015 investigating research focuses of economists over last 50 years in top seven journals. He found that microeconomics dominates the research attention.

[2] http://www.sbp.org.pk/spd/StrategicPlan-2020-Eng.pdf

For central banks, the use of this methodology is also new. However, in presence of its growing popularity, recently, an attempt was made to comprehend central bank communication; The Bank of England (2015) noted in their publication named "*One Bank Research Agenda",* the potential use of textual information and text sources that could help improve the understanding of economic and financial systems. In the same context, for Pakistan, Mahmood and Munawar (2016) performed textual analysis on monetary policy statements issued by the SBP from January 2006 to September 2015 to investigate the structure of MPS. They concluded that trends in inflation and external sector developments play key role in forming decision and the document lacks forward looking content.

Methodology

Over the usage of textual analysis, present literature has identified three broad areas: 1) measurement of information in the documents related to particular theme i.e. theme mining; 2) analyzing market reaction to statements/news/documents i.e. opinion mining; 3) tone of discussion gauging presence of negative, positive or uncertain pattern in the discussion i.e. sentiment mining. These aspects now make the approach more intuitive and powerful to address relevant questions as compared to using the traditional word-counter based textual analysis.

There exists a range of methodologies while performing textual analysis. For instance, *Boolean Technique* treat variables as binary entity. It tests a document for presence of any key term. *Dictionary Technique*, somewhat similar to Boolean Technique, scans the document given a dictionary (list of key words) to capture the defined theme. *Weighting Words technique*, on the other hand, assigns weights to word list according to their importance whereas *Vector Space Models* are used where we are comparing similarity of topics between the two documents, instead analyzing a standalone document. *Latent Symantec Analysis* assumes that words in the text are not independent rather are associated together. This technique permits algorithms to arrest the close link between words and latent variables without using pre provided list of words the way Boolean and Dictionary based techniques do (Bholat et.al. (2015)). The simplest form of content analysis is word frequency count (Stelmer, Steve (2001)), however, it can be extended beyond this.

Among various text-mining approaches, our study employs Dictionary Text Mining approach to analyze market's discussion focus before and after the release of monetary policy statement. For this purpose, the MPS itself, reports of major brokerage houses and articles along with news coverage appearing in newspapers before and after the decision are used for this analysis. Being deductive in nature[3], it starts with a predefined list of words, motivated by a general theory as to why these

[3] Boolean and dictionary techniques are considered deductive approaches as a certain pre-defined list of words are provided at the start according to some theory and then a particular document is tested for validity of that theory.

words matter. Simplicity and scalability is considered the merit and strength of this particular methodology. Dictionary technique is typically performed in two steps, a) a list of key words are formulized initially to apprehend the information of interest; b) then each document/article analyzed is denoted in terms of the (normalized) frequency of words in the dictionary. However, this approach only focuses the predefined words and ignores the context as well as any other phrase having same meaning, which may undermine the strength of this method.

From the existing literature, some examples can be quoted where dictionary techniques have been utilized to analyze financial and economic texts. For instance, Tetlock (2007) is a well-known and highly recognized research in this particular case. The author used dictionary (aka lexicons) to scale the tone of the column "Abreast of the Market" from 1984 to 1999 published in Wall Street Journal. His research employed the Harvard IV- 4 dictionaries, comprising word lists of positive and negative sentiments. His findings suggests that greater variation in word counts across columns reflects swings from optimism to pessimism and that the next day's returns are much responsive to negative news and discussion in the market. Aase (2011) also employed Dictionary Technique in his paper and investigated the impact on asset prices from the context of finance.

Over the implementation front, there are various software packages available to perform content analysis. However, in our study, instead of employing text analysis software, an algorithm is constructed to extract the word count of required category. For instance, if dictionary pertaining to any economic field, $D_{E,}$ having $(x_1, x_2, \ldots x_n)$ words, then we can present each separate document/article d_i as the share $s_i d_i$ of words in the dictionary, i.e.,

$$S_{i\ d_i} = {}^{D_{i\,E}} \Big/ _{\sum_{i=1}^{n} D_{iE}} \tag{1}$$

In our study, each document was loaded into the Excel (in text file format) and given algorithm was executed over each and every report/ newspaper item along with the MPS.

Over the selection of target documents, with an objective to analyze the effect of monetary policy communication, MPS along with market discussion in form of brokerage houses reports and newspapers have been selected[4]. Rationale for using brokerage house reports is the importance of their views over change in policy rate, as Bloomberg incorporates their opinion/vote while devising "Economist estimates of the SBP Target Rate" before the announcement of monetary policy decision of SBP. Internally, SBP also prepares a market expectation report before the announcement of

[4] Market reports include reports by JS Research, Elixir Securities, Topline Research, BMA Research, AKD Research, Next Capital Research, Optimus, InvestCapital and Shajar Capital whereas news items include Business Recorder, Financial Daily, The News, The Express Tribune, The Nation, Daily Times and Dawn.

policy rate where it gathers view/opinion from a sample of senior executives at banks, brokerage houses, asset management companies and some corporate bodies.

In terms of sample reports included in the study, the research departments of brokerage houses publish multiple reports on the state of economy, financial stability (banking sector), external sector and real sector. However, some brokerage houses also publish pre monetary policy analysis discussing policy rate expectations. Similarly, some research houses also publish post monetary policy discussion on the MPS. In our study latter version of the reports have been included. In addition to brokerage houses, newspapers also publish news and opinion pieces/articles about the upcoming meeting of MPC. Similarly, post MPS analyses/opinions are also published in these newspapers.

In terms of sample frequency, on average 5 discussions (reports, news, and opinions) are included while forming aggregate view. In total, we have reviewed 8 monetary policy statements and around 90 news items, articles and brokerage house reports have been analyzed. Generally, pre-MPS opinions/discussions start getting published 4 to 5 days before the meeting of MPC. However, most of such discussion is published a day before the MPC meeting takes place. Similarly, post MPS analysis generally gets published a day after MPC meeting takes place. In newspapers, such analysis mostly gets published by maximum of one week. All such opinions/discussions are then included in forming pre and post monetary policy discussion.

Over the discussion content in the MPS as well as market reports, we identified five main macroeconomic themes for textual analysis which are generally emphasized in reports discussing monetary policy. These themes include trends in inflation, real sector, external sector, monetary sector and fiscal variables. While analyzing five sectors, each sector is further decomposed to various words pertaining to particular sector. For instance, real sector is a broader term, the words such as LSM, GDP growth, and services have been clubbed together for detailed text analysis to refine the search pattern. Similarly, to analyze the external sector discussion, export, import, balance of payments, reserves, remittances and financial inflows are included in external sector dictionary. Likewise, same procedure is executed for other two macroeconomic themes (for details see Appendix A: Table A).

Further, to add meaningful value to our work, i.e. to know the tone of the discussion, dictionary text mining approach is employed. The dictionary categorizes words into positive, negative and uncertain categories. In our tone analysis exercise, which has been conducted for the same sample period mentioned earlier, we have used the Loughran and McDonald (2011) word list[5].

[5] A dictionary published in Journal of Finance containing a list of positive, negative and uncertainty words according to the Loughran and McDonald finance specific dictionary. It is relatively better at apprehending tone in business text compared to Diction, a commonly used mean to determine the tone of business document.

To compile this classification, we computed the frequencies of all words appearing in MPS and analysts' reports after and before the announcement of monetary policy statement. Then, from among the most frequent words we choose the words belonging to these three groups: (1) positive words, (2) negative words, (3) words indicating uncertainty. For instance, symbolically, tone dictionary can be represented by

$$P= \{x_1, x_2, x_3 \ldots x_n\} \quad (2)$$

$$N= \{x_1, x_2, x_3 \ldots x_n\} \quad (3)$$

$$U= \{x_1, x_2, x_3 \ldots x_n\} \quad (4)$$

Where P, N and U are sets of positive, negative and uncertain words respectively as per defined by Loughran and McDonald dictionary where each document is represented by

$$Sa = \sum_{i=1}^{n} Pi \,/ \sum_{i=1}^{n} Pi + Ni + Ui \quad (5)$$

$$Sb = \sum_{i=1}^{n} Ni \sum_{i=1}^{n} Pi + Ni + Ui \quad (6)$$

$$Sc = \sum_{i=1}^{n} Ui \sum_{i=1}^{n} Pi + Ni + Ui \quad (7)$$

Where Sa is share of positive words in total words attributing sentiments, Sb is share of negative words and Sc is share of uncertain words.

Results

While performing the exercise of dictionary based textual analysis, the behavior of the market for eight monetary policy statements, i.e. September 2017-November 2018, and brokerage houses reports before and after the announcement of MPS have been analyzed. The word-count result shows that, on aggregate level, monetary policy statements influenced market discussion to a significant level Figure (1). For instance, before publication of MPS market has been giving greater weightage of its discussion to inflation. However, after publication of MPS market changed their concern towards growth as well as other sectors, as shown in the Figure 1. Likewise, on disaggregated level, it has been observed that MPS of other months also changed the focus of market discussion almost in line with MPS (for details see Appendix D: Figure A1-A8).

While analyzing tone of the documents, before publication of MPS, element of uncertainty dominates the market discussion before the policy announcement whereas MPS mostly consists of positive arguments. However, after the publication of MPS, market reaction reports adopted the tone of monetary policy statement to some extent (for details see Appendix D: A9-A16).

On aggregate basis (Appendix B for disaggregated analysis), market showed uncertainty over the policy decision and economic conditions while discussing inflation concerns mostly whereas MPS kept positive outlook over growth and within the target inflation, specifically (Figure 2). It is important to note that the sample period analyzed, consists of stable, uncertain and challenging economic environment.

Figure 1: Weightages of Sectors in Discussion

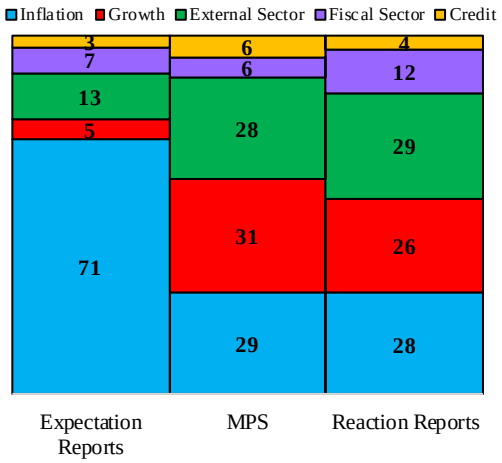
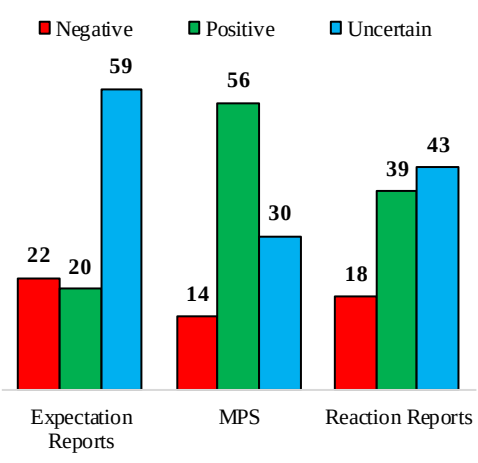


Figure 2: Weightages of Tone in Discussion



Thus, dictionary based text mining suggests a) market analysts focus on inflation dynamics as their major concern while commenting on the expected policy outcome before the announcement of MPS, b) MPS tries to discuss all five sectors of economy while deliberating for the policy decision, with a greater focus towards, inflation, growth and external sector developments, c) before the announcement of policy rate, market analysts mostly exhibit uncertainty in their discussion, d) the tone of the MPS is relatively positive, e) Market perception changes in line with the MPS to a certain extent, i.e. the extent of positivity increases while that of uncertainty and negativity falls (Figure 2).

Going forward, in presence of higher content and importance to inflation concerns of the market as well as central bank, in their discussions as per the adopted approach, there seems to be a greater scope of flexible inflation targeting regime that requires strong communication for anchoring expectations. Though the conclusion is insightful, caveats of the methodology, such as only examining predefined words and ignoring the context of discussion, as discussed earlier as well, need to be kept in perspective while devising policy.

3. The Voting Record and Future Policy Stance

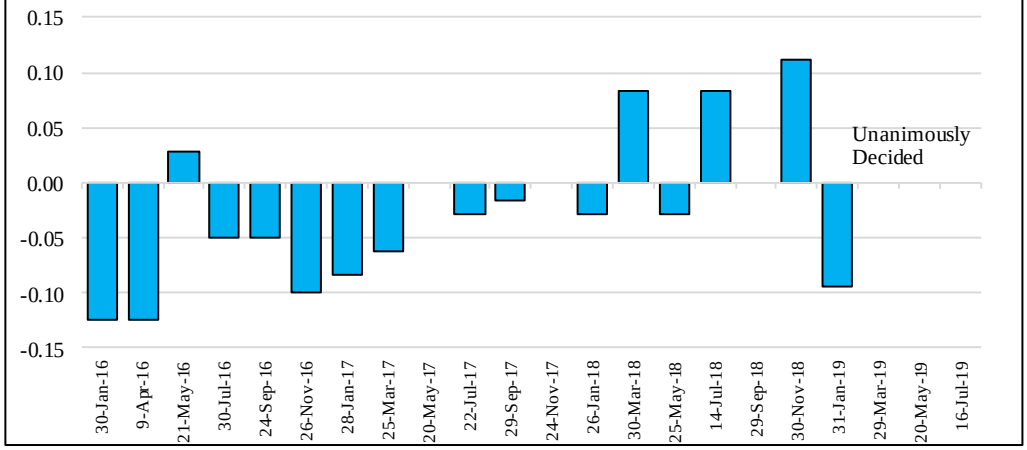
Minutes of the MPC is the second important document regarding monetary policy communication and contain important information of voting pattern of the MPC

members. This section attempts to analyze the question whether the publication of voting record contain useful information about future policy/interest rate changes.

Given the importance of central bank's clear communication and transparency, Buiter (1999) links the transparency of a central bank to publication of minutes. While justifying the need for disclosure of voting pattern and individual's preferences, most voting records provide practical information on diversity in a monetary policy committee, even though they do not provide readily accessible information on policymaker's individual preferences (Jung, 2011). On the other hand, opponents of publication of voting pattern argue that the broadcast of the information regarding the dissents may create confusion among the general public with reference to the policy stance (Issing 1999) and that publication of minutes may be uninformative for the market as substantial information already exists in the market (Bini-Smaghi and Gros, 2001). In the given perspective, we attempt to contribute to the existing literature on the subject by investigating the voting records of MPC of the State Bank of Pakistan.

Figure 3: Skew

Difference between Policy Rate and Average rate voted for



Among prominent studies on impact of disclosure of voting patterns on future interest rates, Shagi and Jung (2015) analyzed minutes of MPC and their impact on future course of monetary policy for Bank of England using Ordered Probit model. Their research favored the premise that voting pattern does have an impact on expectation formation regarding future policy direction. Riboni and Ruge-Murica (2014) estimated regression for the Bank of England showing that recent disagreement by a committee member can be useful in predicting the forthcoming votes of other members. Horváth et al. (2012) explored that information about disagreement amount MPC members, called skew, contains important information regarding future changes in the policy rate for five inflation-targeting central banks. Reeves and Sawicki (2007) estimated that minutes affect only short-term interest rates expectations for Bank of England. Gerlach-Kristen (2004) pointed out that skew calculated from MPC's voting information encloses important hints for the future interest rates. Studies conducted

for US (Kohn and Sack (2003)) and Bernanke, Reinhart and Sack (2004)) advocates that interest rate expectations are transformed by publication of minutes.

Econometric Specification and Findings

The voting pattern in MPC minutes shows the view of *each* committee member regarding the suitable level of interest rate for the economy. Policy Rate (PR) is decided by the *majority* votes of Monetary Policy Committee. The Monetary policy stance is communicated to the public through announcement of the PR. The difference between the average votes of the committee members and policy rate settled by the majority votes in the meeting can be shown through an indicator called *'skew'*. This indicator reflects the skewness in the voting pattern and is defined as follows

$$\text{Skew} = \frac{\sum_i^n PR_i}{n} - PR \tag{8}$$

PR_i is vote of i^{th} committee member for appropriate level of monetary policy rate. If all MPC members vote for the same policy rate, then the skew is zero as the general assessment concerning the suitable level of the policy rate corresponds with the policy rate decided in the meeting. Conversely, if some committee members vote for a lower policy rate, the average of PRi proposals is below PR leading to a negative skew. The larger the minority favoring a lower policy rate differs from the rate maintained by the majority, the more the average departs from the policy rate. Thus the skew is a measure of disagreement and takes negative (positive) value when the average stands below (above) the policy rate. In this study, skew lies between -12 to + 11 basis points during the period starting from January 2016 to July 2019 (Figure 3**)**.

We follow Gerlach-Kristen (2004) to check that whether voting disagreement (skew) contains evidence about fluctuations in future policy rate and estimate the following specification.

$$\Delta PR_{t+1} = \alpha Skew_t + \beta \Delta PR_{t-1} + e_{t+1} \tag{9}$$

We specify the date of the interest rate decision as t - 1 and the date of publication of the minutes after lag of around a month as t. In Pakistan, MPC meets bi-monthly to decide the change in policy rate, if any. Since policy is adjusted every eight weeks, the next policy rate decision in this framework is announced at time t+1, therefore the change in policy rate is the difference between the policy rate between t+1 and t-1 and denoted by ΔPR_{t+1}. The specification (9) also controls for the autocorrelation in the policy rate changes. The signs of α and β are expected to be positive. If some members of the MPC favor higher policy rate, i.e. a positive skew and α is positive, future policy rate is likely to increase. A positive β reflects the attempt of central bank to avoid any sudden policy reversals.

Three different mutually exclusive decisions can be made by the MPC: a policy rate hike, a cut in the policy rate or a status quo. The dependent variable ΔPR_{t+1} in (1) is a discrete variable and, as defined by El-Shagi and Jung (2015), has been categorized as: -1: interest rate decrease, 0: no policy change, 1: interest rate hike. We estimate specification (9) for the sample period starting from January 2016 to September 2018. As done in previous studies we use the Ordered Probit technique, which is econometrically suitable for the discrete changes in the policy.

The sign of α shows the direction of the change in the probability of falling in the endpoint rankings (in our, case a cut or a hike) when skew changes. Probability of policy rate cut changes in the *opposite* direction of the sign of *alpha* and probability of policy rate hike changes in the *same* direction as the sign of *alpha*. Analogously, the coefficient for other explanatory variables can be interpreted.

Table 1: Voting Record and Prediction of Policy Rate Changes
Dependent variable is ΔPR_{t+1} i.e. change in policy rate in period t+1.

Variable	Baseline Model	Baseline Model without lag dependent
$Skew_t$	11.46** (5.810)	9.1*** (3.59)
ΔPR_{t-1}	8.89** (3.43)	
$\gamma = 0$ (Status Quo)	-2.7*** (0.71)	-2.56*** (0..55)
$\gamma > 0$ (Rate Hike)	1.53*** (0.40)	0.71*** (0.23)
Pseudo R-squared	0.57	0.14

Note: The parameters $\gamma = 0$ and $\gamma > 0$ are switching points for policy rate stance of status quo and rate hike. ***, ** and * reflects significance at 1 percent, 5 percent and 10 percent levels respectively. Standard errors are mentioned in the parenthesis.

The estimation results of equation (9) are presented in Table 1. The estimates of baseline model advocate that the voting record is positively useful about changes in future policy. The coefficient for skew i.e. α, is positive and significant at 5 percent level. This means that if some MPC members propose a higher policy rate than average; it is indication of a policy rate hike in future.

In other words, up to an extent, contradicting votes possess some predicting power over future votes of majority of committee members. The lagged dependent variable is positive and significant, signifying that generally monetary policy aims at smoothing interest rates and avoids abrupt changes in the course of interest rates. We also obtain the switching point estimates of $\gamma < -0, \gamma = 0 \; and \; \gamma > 0$ for policy rate stance of status quo and rate hike. The switching points are significant at 1 percent level. The estimates indicate that the probability of a cut is given as:

$$F(\hat{\gamma} < 0 - \hat{\alpha} Skew_t - \beta \Delta PR_{t-1}) \qquad (10)$$

where F denotes the cumulative density function of the normal distribution. With an assumption that there is no change in the last policy rate and with a $Skew_t$ of -10 basis points, the probability that there is a cut in next monetary policy decision is 7.90 percent. Similarly, the probability of a status quo and a policy rate hike is respectively determined by

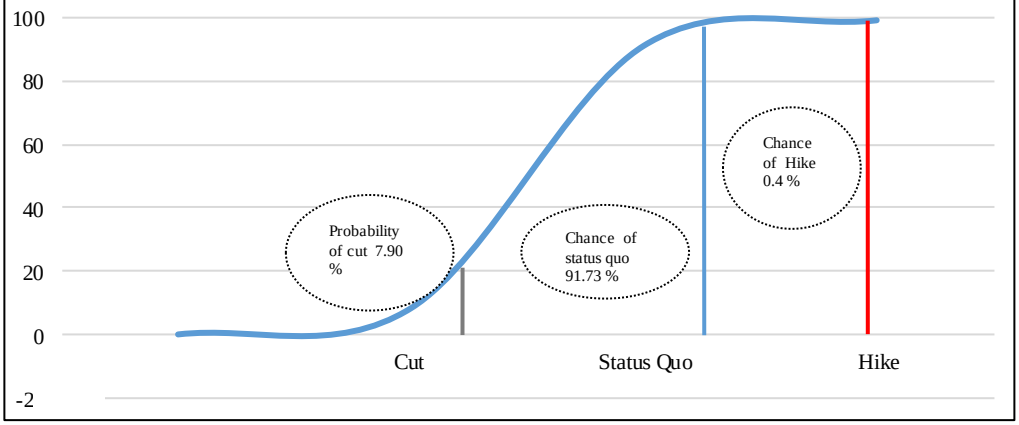
$$F(\hat{\gamma} = 0 - \hat{\alpha}Skew_t - \beta\Delta PR_{t-1}) - F(\hat{\gamma} < 0 - \hat{\alpha}Skew_t - \beta\Delta PR_{t-1}) \quad (11)$$

and

$$1 - F(\hat{\gamma} = 0 - \hat{\alpha}Skew_t - \beta\Delta PR_{t-1}) \quad (12)$$

With the previously mentioned assumptions, the probability of a status quo and a rate hike is respectively 91.73 percent and 0.4 percent. We also estimate the baseline equation without lag dependent. Overall, results remain unchanged.

Figure 4: CDF for Montary Policy Decision
With an assumption that there is no change in the last policy rate and with a $Skew_t$ of -10 basis points



Robustness

Financial markets use the available information on macroeconomic variables. The slope of the term structure of interest rates may indicate the expectations future course of policy rate if the market uses the same data as the MPC. Hence, it is possible that voting record will not reveal any extra information in addition to that presented in the market expectations. Therefore, we also control for the market expectations regarding the policy rate change in future. Expectations of a hike in policy rate are reflected in an upward-sloping term structure reflecting higher longer-term market rates. Since publication of the minutes affects the market interest rates, we use the market rates prevailed one day before the broadcast of the minutes. Following Gerlach-Kristen (2004) we use overnight, one-month, three-month, and twelve-month rates from the day before release of voting record and estimate equation (13):

$$\Delta PR_{t+1} = \alpha Skew_t + \beta \Delta PR_{t-1} + \delta Spread_{t-1} + e_{t+1} \quad (13)$$

We control for different spreads. Specifically, we employ the 1 month -7 days, 3 months -7 days and 6 months -7 days spreads.

Table 2: Voting Record and Prediction Policy Rate Changes in the Presence of Market Expectations

Dependent variable is ΔPR_{t+1} i.e. change in policy rate in period t+1.

Variable	With (1 Month-7 Days) Spread	With (3 Months-7 Days) Spread	With (6 Months-7 Days) Spread
$Skew_t$	11.62**	11.30*	11.46*
	(5.83)	(5.92)	(6.04)
ΔPR_{t-1}	8.39**	8.14**	8.29**
	(3.54)	(3.55)	(3.68)
Interest Rate Spread	-0.47	0.20	0.001
	(1.87)	(1.31)	(1.17)
$\gamma = 0$	-2.76**	-2.66**	-2.7***
(Status Quo)	(0.74)	(0.76)	(0.79)
$\gamma > 0$	1.46***	1.59***	1.53*
(Rate Hike)	(0.47)	(0.58)	(0.59)
Pseudo R-squared	0.57	0.57	0.56

Note: The parameters $\gamma = 0$ and $\gamma > 0$ are switching points. ***, ** and * reflects significance at 1 percent, 5 percent and 10 percent levels respectively. Standard errors are mentioned in the parenthesis.

Table 2 shows the estimates of specification (2). The results suggest that even after controlling for the market expectations, the coefficient for skew remains significant at 5 percent level while pseudo R^2 remains 0.57. The coefficients for interest rate spreads are insignificant. It suggests that market sentiments regarding policy rate changes in subsequent monetary policy are different from the information contained in the voting record about future policy. This may be due to the fact that MPC use richer data set than the market to decide about the future policy rate. The overall findings indicate that skew is very informative about the future changes in policy rate even after controlling for market expectations. Hence, the broadcast of minutes of MPC meetings and voting record increases the transparency of monetary policy. Moreover, the information regarding the voting pattern also affects the market yields if the number of dissents increases in the MPC minutes (for details see Appendix C).

4. Conclusion

The objective of the paper was to examine the impact of monetary policy communication of SBP, particularly, the monetary policy statements and voting records of the minutes of MPC. First, we analyze monetary policy statements and market reaction using textual analysis and present market aligned discussion to monetary policy statements. Moreover, we also review the tone of the documents and market commentary. We find that monetary policy statements mostly incorporate positive words in the statements and the markets generally follow the trend. Transition of market's choice of words post MPS discussion suggest that positive tone in the MPS alleviates the uncertainty in the market, noticeably prevailing before the

policy announcement. Second, we investigate the prediction power of voting records for future interest rates and the market behavior over the publication of minutes. The findings suggest that the voting record provided by the SBP in the minutes of the MPC is insightful about changes in future policy. The results are robust to inclusion of market expectations in the econometric specification. Our findings imply that transparency of the actions of central bank is very important in the monetary policy effectiveness.

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Appendix A: Word Lists Across Monetary Policy Statement and Market Reports in Sample for Textual Analysis

Table A: Word Lists Across Monetary Policy Statement and Market Reports in Sample for Textual Analysis

Inflation	Real Sector	External Sector	Fiscal Sector	Monetary Sector
Inflation	Crops	Export/s	Fiscal	Credit
Price/s	GDP	Import/s	Debt	Consumer Financing
CPI	LSM	Remittance/s	Tax/es	
	Services	External	Budget	
	CPEC	Trade		
	Investment/s	Depreciation		
		Inflow/s		
		BOP		
		Reserve/s		

Appendix B: Disaggregated Analysis of MPS and Market Reports

The sample monetary policies episodes (September 2017-November 2018) choosen for textual analysis consists of stable, uncertain and challenging macroeconomic conditions as policy rate, during this period, was stable initially then started to incresae gradually according to macroeconomic conditions.

Period from September 2017 to December 2017 can be considered stable , specifically September 2017, when SBP maintained staus quo with positive real sector dynamics coupled with within the target inflation. However, concerns over external sector sustainibility started to emerge. Same message can be drawn from Figure A1, A9. Figure A1 depits market expectation bar giving more weight to inflation discussion whereas MPS emphais was more on the positive growth aspects. Following MPS direction, market commented positively on the decision as well as macroeconomic conditions.

In January 2018, when SBP rose the policy rate by 25 bps after 13 quarters spell of status quo, market's much focus was increasing inflation having pessimistive cannotation, whereas, MPS maintained its balance discussion with increased focus on external and fiscal sectors vulnerbilities. This was aided by increased use of words sending gloomy picture of the economy (Figure A11). The decision of increase in the policy rate was percieved positively by the market as is also visible from the Figure A11. Usage of positive words increased accordingly.

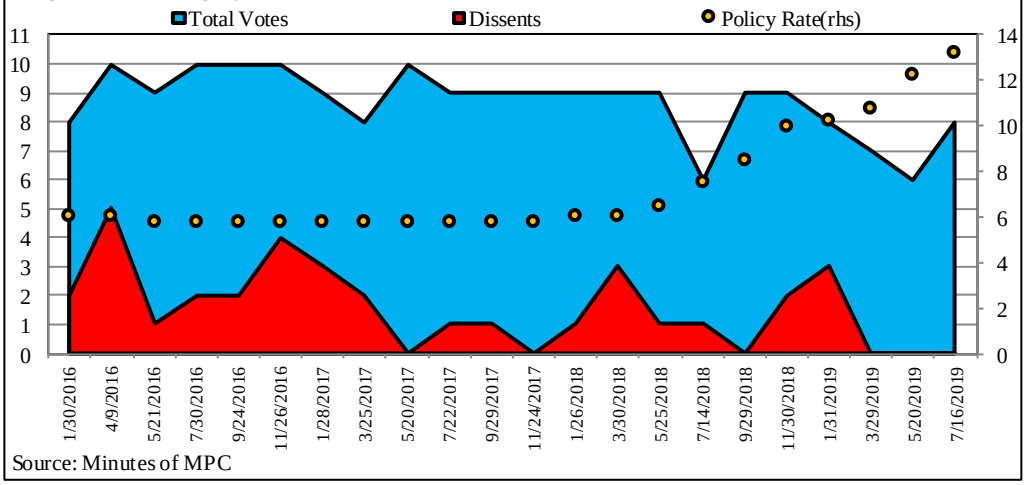
In March 2018, market expressed much uncertainity over the increase in core inflation and expected change in the policy rate as well (Figure A4 & A12). Whereas, MPS remained much optimistic about the growth prospects and achieveing an 11 year high growth rate and with in the band inflation rate. Market somehow aligned its discussion accordingly.

In July 2018, when interest rate was increased by 100 bps, much emphaisi was given to fiscal sector imbalances compared to previous MPS along with increase in the inflation and external sector vulnerbilities. Usage of negitive words increased in the MPS which in turn effected the positive perspective of the market and increased uncertainity amid sudden rise of 100 bps in the policy rate.

During September and November 2018 MPS, increased use of pessimistive words was observed in MPS due to escalating challenges at external, fiscal and inflation front. Which, in turn, diverted the post MPS discussion accordingly. Similarly, increased external sector vulnerbilities also changed the MPS focus more towards external sector discusssion. Market accordingly aligned its discussion to theses sectors after the annoucement of MPS. During this perios, policy rate was increased by 250 bps.

Appendix C: Voting Pattern and Market Sentiments

Figure C1: Voting Dynamics-MPC (Jan 2016-Jul-2019)



Source: Minutes of MPC

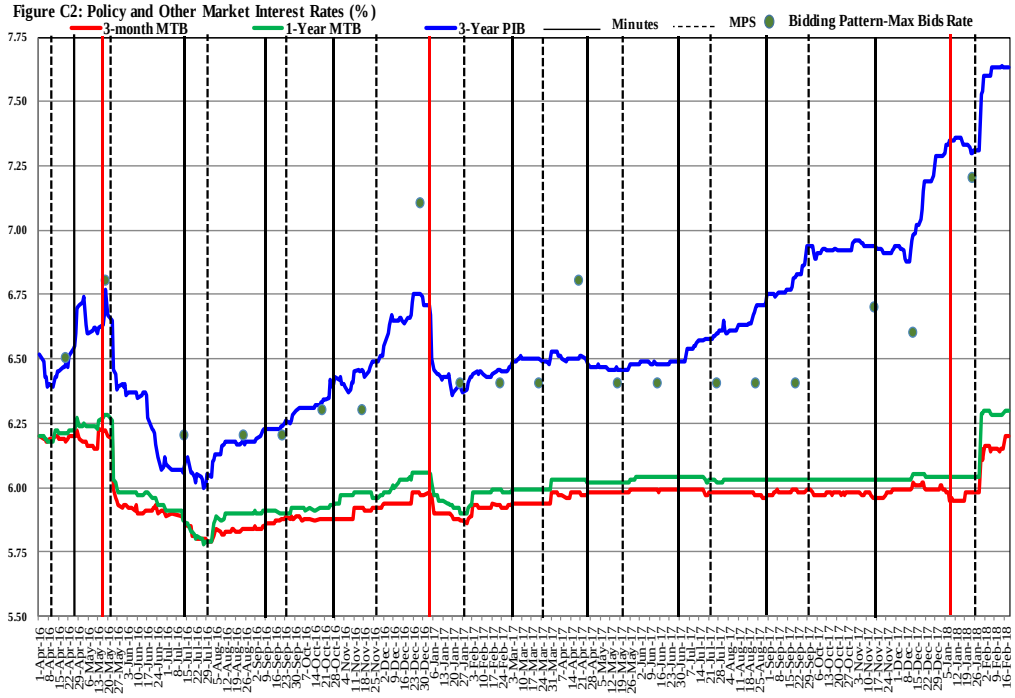
The SBP started publication of MPC minutes in April-2016 and voting pattern of the MPC meetings. Figure C1 and Table C1 broadly depicts the dynamics of MPC members, including presence and voting behavior of the MPC members since the publication of MPC minutes. From the given figure, five major events can be identified associated with the maximum and minimum percentage of dissents. The most important event was of January 3, 2017, when minutes for MPS November 2016 were published. The information of 40 percent dissents to the decision of status quo impacted the market yields significantly. In December-2016, the yields in both primary and secondary money markets inched up initially owing to market expectations about higher future course of interest rates and sentiments concerning rise in inflation in the face of increasing international oil prices. These sentiments were reflected in the bidding behavior of the primary dealers in the auctions of Market Treasury Bills (MTBs) and PIBs, whereby, the banks demanded significantly higher yields. However, soon after the publication of minutes, market yields in the secondary market dropped sharply (Figure C2).

This signifies that market changed its perspective about future interest rate hike owing to minute's results and improved inflation outlook. Interestingly, monetary policy decision of status quo could not affect the increasing trend in yield curve but the minutes altogether changed the yield curve scenario.

Another important event is publication of minutes for MPS held on 9th April, 2016 which revealed that 50 percent of the votes were casted against the status quo decision and chairman casted his vote for the final decision to keep the status quo whereas 50 percent of the members wanted cut in the interest rate. This message clearly signaled the market about the future interest rate decision. The higher volatility in the MTBs

and PIBs rates was observed post minutes publication and rates started to decline before the announcement of next monetary policy, which was in favor of 25 bps cut in the interest rates.

Figure C2: Policy and Other Market Interest Rates (%)



Sources: SBP

Table C1 : Voting Information

Date-MPC	Votes for Status quo	Votes for Increase	Votes for Decrease	Policy Rate
30-Jan-16	6	0	2 (50bps)	6
9-Apr-16	5	0	5(25 bps)	6
21-May-16	1	0	8	5.75
30-Jul-16	8	0	2(25bps)	5.75
24-Sep-16	8	0	2(25bps)	5.75
26-Nov-16	6	0	4(25bps)	5.75
28-Jan-17	6	0	3(25bps)	5.75
25-Mar-17	6	0	2(25bps)	5.75
20-May-17	10	0	0	5.75
22-Jul-17	8	0	1(25bps)	5.75
29-Sep-17	8	0	1(15bps)	5.75
24-Nov-17	9	0	0	5.75
26-Jan-18	1	8	0	6
30-Mar-18	6	3(25 bps)	0	6
25-May-18	0	9(8 for 50,1 for 25)		6.5
14-Jul-18	0	6(5 for 100, 1 for 150)	0	7.5
29-Sep-18	0	9	0	8.5
30-Nov-18	0	0	0	10
31-Jan-19	3	5	0	10.25
29-Mar-19	0	7	0	10.75
20-May-19	0	6	0	12.25
16-Jul-19	0	8(5 for 100, 2 for 75, 1 for 150)	0	13.25

Data source: Minutes of MPC Meetings

Minutes published for MPS held on 21st May, 2016 registered lowest percentage of dissents to the decision of policy cut and market exhibit somewhat volatility in the government securities rates as the yield curve further shifted down.

Fourth major event was observed in the minutes of monetary policy held on 20th May, 2017 with zero percentage of opposition to the decision of status quo. Accordingly, volatility in the MTBs and PIBs, post minutes publication, was low as the decision was aligned with market expectations.

Publication of MPC minutes on 9th January 2018, again reinforced the importance of voting pattern over market response. Similar to the incident of 3rd January 2017, in December 2017, the yields in both primary and secondary money markets inched up initially owing to market expectations about higher future course of interest rates and sentiments concerning rise in inflation. However, with the release of meeting minutes showing unanimous consensus of the MPC members on status-quo over the last decision altered the market perception of hike in the interest rate in the upcoming monetary policy decision despite all dynamics supporting the rise in the policy rate. Resultantly, the market yields got stable until the decision of rise in the policy rate by 25 bps.

The brief analysis suggests that voting pattern, particularly, percentage of dissents affect the market sentiments about the future interest rates.

Appendix D: Weightages of Economic Sectors & Tone in the Discussion

Weightages (%) of Economic Tone in the Discussion of Market Analyts and SBP

Figure A1: September 2017

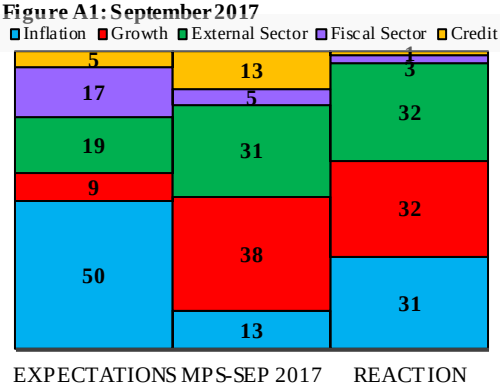
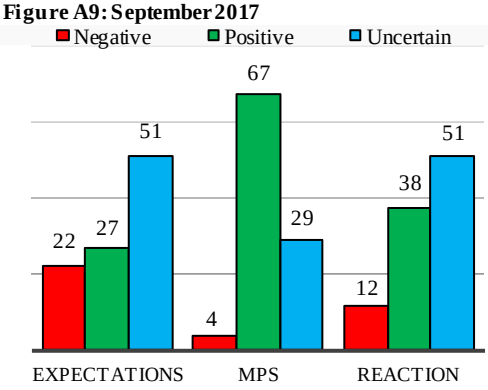


Figure A9: September 2017



Pre-MPS Sample: Shajar Capital, Optimus, Elixer Securities, InvestCapital
Post MPS Sample: Elixer Securities, Shajar Capital, JS Research

Figure A2: November 2017

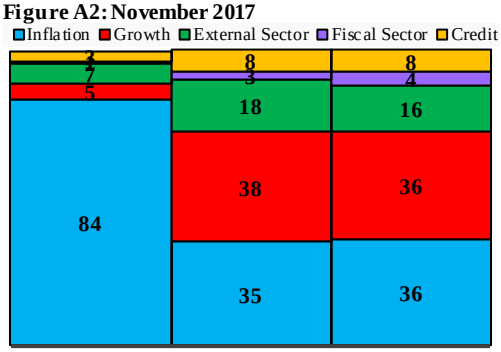
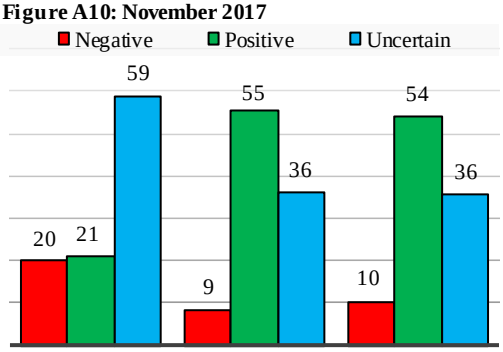


Figure A10: November 2017



Pre-MPS Sample: BMA Capital, Business Recorder, IGI Securities
Post MPS Sample: Daily Times, Pakistan Observer, Pakistan Today, The Nation, The News

Figure A3: January 2018

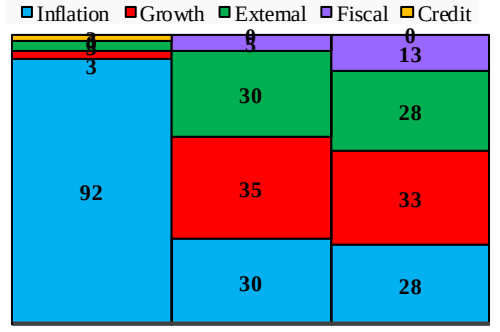
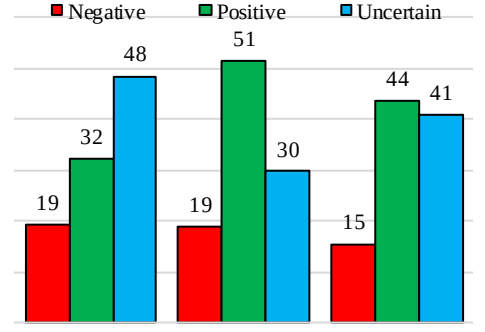


Figure A11: January 2018



Pre-MPS Sample: AKD Reserach, Tribune
Post MPS Sample: AKD Reserach, Tribune, Dawn

Figure A4: March 2018

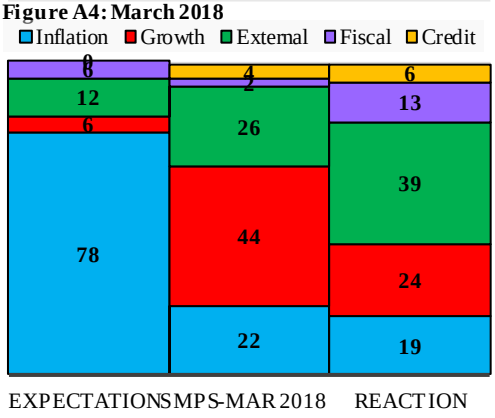
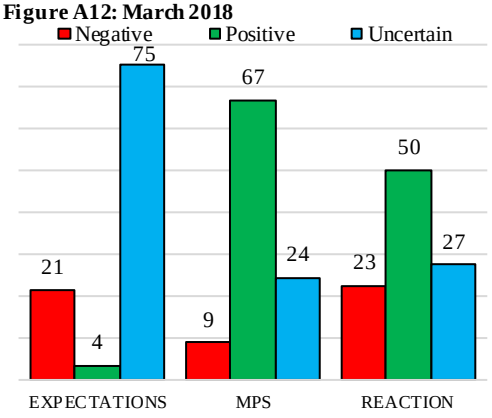


Figure A12: March 2018



Pre-MPS Sample: BMA Capital, Business Recorder, The Financila Daily, Elixer Securities, Shajar Capital
Post MPS Sample: Business Recorder Item 1, Business Recorder Item 2, Business Recorder Item 3

Figure A5: May 2018

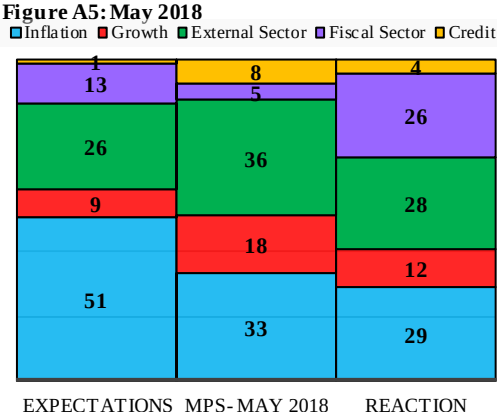
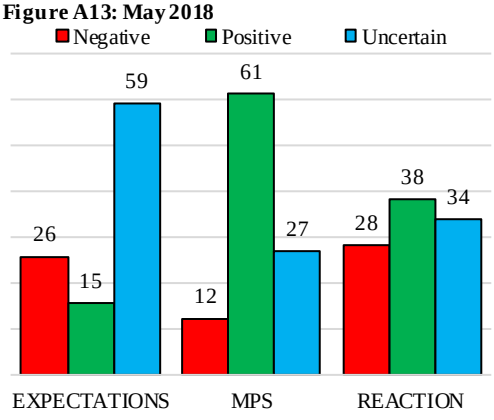


Figure A13: May 2018



Pre-MPS Sample: AKD Reserach 1, AKD Reserach 2, Business Recorder, BMA Capital 1, BMA Capital 2, Elixer Securities, The News, Optimus Capital
Post MPS Sample: AKD Reserach, BMA Capital, Business Recorder 1, Business Recorder 2, Business Recorder 3, Dawn, JS Research, The News, The Nation, Express

Figure A6: July 2018

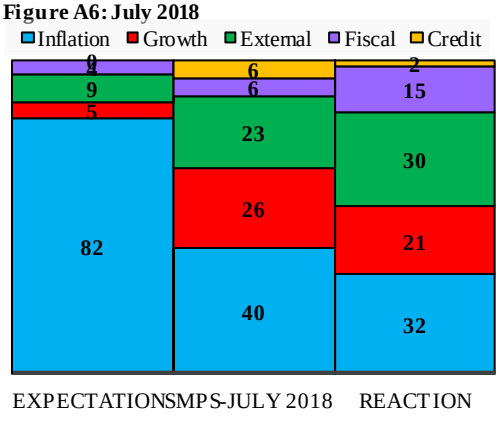
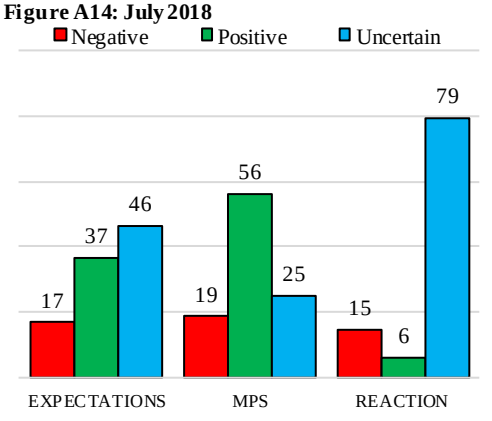


Figure A14: July 2018



Pre-MPS Sample: BMA Capital, Dawn 1, Dawn 2, Dunya News, Express, AKD Research
Post MPS Sample: Elixer Securities, Express, Shajar Capital, The News 1, The News 2, Topline Reserach

Figure A7: September 2018

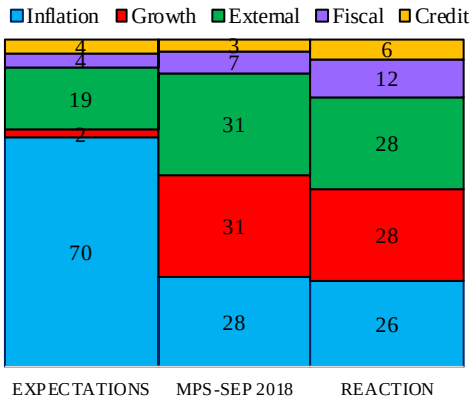
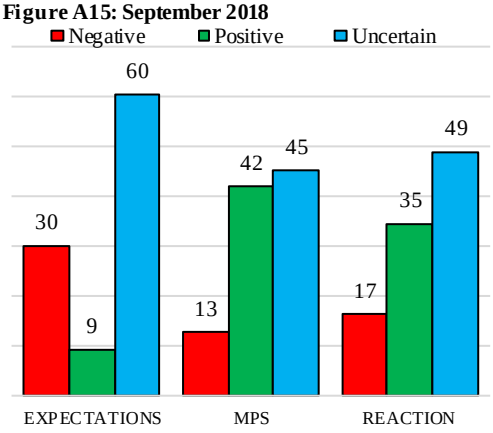


Figure A15: September 2018



Pre-MPS Sample: AKD Reserach, The News, Pakistan Observer, Pakistan Today
Post MPS Sample: BMA Capital, Business Recorder, Daily Times, Dawn, Express, JS Reserach, Pakistan Observer, AKD Reserach, Pakistan Today,The Nation, The News-1, The News-2

Figure A8:November 2018

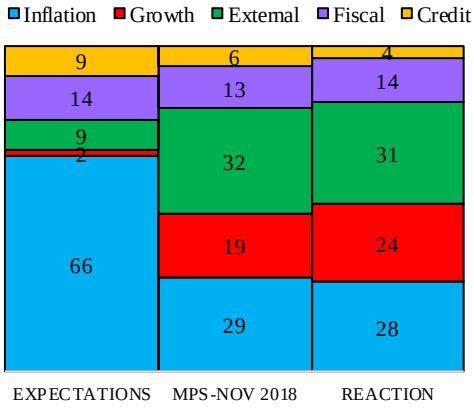
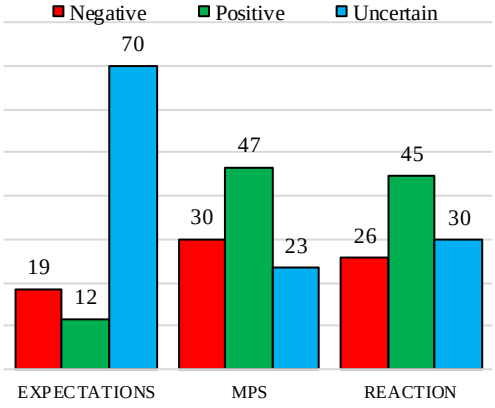


Figure A16:November 2018



Pre-MPS Sample: Business Recorder 1, Business Recorder 2, Dawn Express, Pakistan Observer, The News
Post MPS Sample: Business Recorder, Daily Times, Express, Pakistan Observer, Pakistan Today, The Nation, The News

Appendix E: Loughran McDonald Dictionary (2014 Version)

NEGATIVE	NEGATIVE-Cont.	POSITIVE	UNCERTAIN
abandon	alienation	able	abeyance
abandoned	alienations	abundance	abeyances
abandoning	allegation	abundant	almost
abandonment	allegations	acclaimed	alteration
abandonments	allege	accomplish	alterations
abandons	alleged	accomplished	ambiguities
abdicated	allegedly	accomplishes	ambiguity
abdicates	alleges	accomplishing	ambiguous
abdicating	alleging	accomplishment	anomalies
abdication	annoy	accomplishments	anomalous
abdications	annoyance	achieve	anomalously
aberrant	annoyances	achieved	anomaly
aberration	annoyed	achievement	anticipate
aberrational	annoying	achievements	anticipated
aberrations	annoys	achieves	anticipates
abetting	annul	achieving	anticipating
abnormal	annulled	adequately	anticipation
abnormalities	annulling	advancement	anticipations
abnormality	annulment	advancements	apparent
abnormally	annulments	advances	apparently
abolish	annuls	advancing	appear
abolished	anomalies	advantage	appeared
abolishes	anomalous	advantaged	appearing
abolishing	anomalously	advantageous	appears
abrogate	anomaly	advantageously	approximate
abrogated	anticompetitive	advantages	approximated
abrogates	antitrust	alliance	approximately
abrogating	argue	alliances	approximates
abrogation	argued	assure	approximating
abrogations	arguing	assured	approximation
abrupt	argument	assures	approximations
abruptly	argumentative	assuring	arbitrarily
abruptness	arguments	attain	arbitrariness
absence	arrearage	attained	arbitrary
absences	arrearages	attaining	assume

NEGATIVE	NEGATIVE-Cont.	POSITIVE	UNCERTAIN
absenteeism	arrears	attainment	assumed
abuse	arrest	attainments	assumes
abused	arrested	attains	assuming
abuses	arrests	attractive	assumption
abusing	artificially	attractiveness	assumptions
abusive	assault	beautiful	believe
abusively	assaulted	beautifully	believed
abusiveness	assaulting	beneficial	believes
accident	assaults	beneficially	believing
accidental	assertions	benefit	think
accidentally	attrition	benefited	may
accidents	backdating	benefiting	expect
accidents	bad	benefitted	anticipate
accidents	bail	benefitting	believe
accuse	bailout	better	maybe
accused	balk	growth	compared
accuses	balked	good	guess
accusing	bankrupt	strong	knowledge
acquiesce	bankruptcies	opportunities	expected
acquiesced	bankruptcy	opportunity	expectations
acquiesces	bankrupted	improvement	assumptions
acquiescing	bankrupting	positive	assume
acquit	bankrupts	grow	assuming
acquits	bans	growing	projections
acquittal	barred	improved	forecast
acquittals	barrier	improve	fairly
acquitted	barriers	grew	generally
acquitting	below	ability	perhaps
adulterate	challenging	strength	roughly
adulterated	challenge	gain	reasonable
adulterating	challenges	success	plans
adulteration	decline	favorable	efforts
adulterations	declines	advantage	preliminary
adversarial	declines	outstanding	possible
adversaries	declining	improving	planning
adversary	decrease	improvement	expecting

NEGATIVE	NEGATIVE-Cont.	POSITIVE	UNCERTAIN
adverse	decreased	confident	estimates
adversely	difficult	successful	predict
adversities	difficulty	stronger	forecasting
adversity	inaccuracies	comfortable	forecasts
aftermath	incorrect	excellent	pretty
aftermaths	loss	nice	approximately
against	losses	confidence	might
aggravate	lost	profitable	wondering
aggravated	negative	attractive	enough
aggravates	negatively	optimistic	hope
aggravating	pressure	benefited	potential
aggravation	problem	exciting	comparison
aggravations	problems	wins	assumption
alerted	reduce	safe	
alerting	risk	successfully	
alienate	risks	grown	
alienated	slowdown	strength	
alienates	tough	encouraging	
alienating	uncertainties	perfect	
	uncertainty		
	volatility		
	weakness		
	worse		