

**Effectiveness of Central Bank Communication on Financial Markets in
Emerging Economies, with a Special Focus on China**

By

Shiwei Su

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Abstract

Central bank communication has become an important monetary policy tool. This is because it helps to improve the effectiveness of monetary policy by sharing information, which reduces uncertainty. Previous research on the topic has concentrated on central banks in developed economies, such as the Bank of England, the European Central Bank, and the Federal Reserve. This research contributes to the literature by providing insights from the perspective of emerging economies, where communications of Chinese and Indian central banks are examined. The first empirical chapter investigates the effectiveness of communication of People's Bank of China (PBOC) on Chinese financial markets: the interbank money market, the equity market, and foreign exchange markets, are analysed using time-series models. The main focus of the chapter includes an analysis of PBOC's credibility, construction of a new communication index on global economic outlook, more detailed communication indexes, and addressing 'how-to-communicate' questions in the PBOC's communication strategies. The results indicate that the PBOC has credibility and its communication generally reduces volatility in these markets. The second empirical chapter looks at the role of the PBOC's communication in predicting policy rates, using an ordered probit model. The communication indexes constructed in the chapter cover both formal and informal communications of PBOC for 2009 to 2015 and a new communication index on money supply was also constructed. The main finding is that PBOC's communications (particularly on inflation) are useful for predicting PBOC's monetary policy stance. The money supply communication index has some, but not much predictability powers. Finally, the third empirical chapter compares central bank communications in China and India. The contribution of the chapter lies in the comparative analysis of two central banks' communications of developing economies, which were overlooked in the extant literature. It shows that the communications on the countries' monetary policy inclination have influence on macroeconomic variables of the countries, particularly, the short-term inflation expectations. The findings, therefore, suggest the effectiveness of communications as an unconventional monetary policy tool in emerging economies.

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List of Abbreviations

BOE	Bank of England
BRICS	Brazil, Russia, India, China and South Africa
CI	Communication index
ECB	European Central Bank
DEO	Domestic economic outlook communication index
Fed	The Federal Reserve
INF	Communication index based on information on inflation
IT	Inflation targeting
IP	The industrial production index
M2	The money supply (broad money)
MPI	Monetary policy inclination communication index
PBOC	People's Bank of China
RBI	Reserve Bank of India
SHIBOR	Shanghai Interbank Offer Rate
SSE	Shanghai Stock Exchange Composite Index
WEO	World economic outlook communication index

Chapter 1

Introduction

1.1 Background

The central bank plays an important role in an economy by conducting monetary policy to help achieve the desired macroeconomic goals. Until recently, various aspects of central bank activities including the decision-making process of monetary policies were mostly kept in secret. However, there is an increasing demand for transparency of central bank policies that requires central banks to reveal the ‘purdahs’ of those policies. As a result, central banks have started placing emphasis on transparency, which has been argued to be beneficial. Since the adoption of rule-based monetary policy in developed economies, central bank communication has been increasingly used in managing market expectations.

The emergence of central bank communication in the literature and practice can be viewed as responses to major trends in global economies as discussed by Amato *et al.* (2002). First, increasing demand for central bank independence requires transparency and accountability to succeed, which will improve the credibility of the monetary authorities. Second, the adoption of an inflation targeting (IT) regime requires not just setting a number as a target, but also clear communication on how the target will be met and to chart the future inflation path. Finally, volatility in financial markets requires further transparency, and development of media technology facilitates much easier information transmission. The market trading hinges on future expectations of return and profitability. Thus, communication plays an important role in signaling future path of economic outlook or monetary policy stances.

The main reasons for research in central bank communication can be summarized into three. First, central bank communication could have an impact on asset prices and their volatility. This is because, in addition to monetary policy changes, central bank communication contains valuable signals on the likely future changes in monetary policies, for example, to signal the reduction of the money supply or interest rate. Therefore, hints from communication could help

central banks influence the markets. This has been analysed in Chapter 4 in respect of three Chinese financial markets. Second, one of the most important roles of central bank communication is proper management of market expectations. Some researchers, such as Blinder (1998) and Reeves and Swicki (2007) argue that a key determinant of success of monetary policy is the proper management of market expectations. This is because the long-term trend is influenced by short-term expectations, which directly links to monetary policies as well as effective communication on monetary policies and its future paths. For example, it is argued that the forward guidance policy can guide market expectations, therefore affecting various rates and asset prices, and eventually the whole economy. The forward-looking element of communication serves an important role in expectation management. Central banks of developed economies, such as the Bank of England (BOE), The Federal Reserve (Fed), and European Central Bank (ECB), have been increasingly adopting and implementing forward guidance monetary policy. This motivates the work in Chapter 5. Considering the nature of irregular policy rate changes of the People's Bank of China (PBOC), communication may help in understanding the PBOC's inclinations even when there were no actual policy rate changes.

Third, central bank communication can be seen as an unconventional monetary policy that supplements conventional monetary policy, particularly in unique circumstances. This is also related to the expectation management discussed above. For example, during the financial crisis of 2007-2008 when the interest rates were cut to the lowest levels, central bank communication became vital in the conduct of the monetary policy. This is because it provided comforting effects by signaling policy path and, therefore calming down market turbulence and worries. In addition, communication effect has been found to be larger during the financial crisis when it is used as part of unconventional monetary policy tools (e.g., Hayo *et al.*, 2012b; Born *et al.*, 2014; Coenen *et al.*, 2017). A good example is when the British pound was hit by the news of Brexit. The BOE's governor gave a press briefing where he assured the markets about the BOE's firm determination to stabilize the pound. This went very far in calming down the currency markets. Communication is found to be effective in influencing market expectations in the zero-lower bound (e.g., Burkhard and Fischer, 2009). Chapter 6 analyses this role of communication in two developing economies' central banks, the Reserve Bank of India (RBI) and the PBOC.

There is numerous research on different aspects of central bank communication in the literature. In the Fed's case, there are studies about the 'what-to-communicate' questions on signaling communication. For example, Moessne (2014) finds that the Federal Open Market Committee's forward guidance increases levels of the US equity market and reduces volatility of the US bond market. 'How-to-communicate' questions that focus on communication channels were looked at, among others, Hayo *et al.* (2012b) who provide evidence that informal communication has a larger influence on equity returns than target rate surprises. Communication design that analyses characteristics of communication was also examine. This includes work of Jansen (2011) who investigates Humphrey-Hawkins testimonies of the Fed and reports that clear communication results in lower volatility in financial markets.

However, as can be discerned above, this research concentrates on central banks of developed economies and mainly, the BOE, the Fed, and the ECB. Emerging economies are becoming increasingly significant in global economies. Despite their importance, central bank communications in these economies were overlooked in the extant literature. This thesis fills in the gap in the literature by looking at effectiveness of central bank communication in the emerging economies of China and India.

1.2 Central Bank Communication in Developed and Emerging Economies

Research on central bank communication has been increasing since 2000. Up to around 2005, most research in the area had been theoretical. Relevant empirical research has become popular since 2005, with research questions mostly focus on the following. First, the 'what-to-communicate' question focuses on contents of various communication. Second, communication channels have been researched to identify suitable conduits for effective communication. Third, the timing of communication, for example, publication lags of formal communication. Optimal communication strategy for better communication design is also examined. In this process, factors of communication that are of great interest including frequency of communication, dispersion of communication, and decision-making process of monetary policy committees. Finally, impact of communication on markets was looked into in the existing literature.

The findings generally indicate that central bank communication influences activities of financial markets. It is understandable that developed economies are the pioneers of central bank communications strategies. However, with increasing globalization, developing economies and their central banks have also been making efforts to improve their central bank communication processes. However, there is lack of research on central bank communication for China and India, two important developing economies and members of ‘BRICS’¹. Furthermore, both countries’ central banks have tried to improve their communication processes, for example, the RBI has established Department of Communication, that is saddled with responsibility of effective communication of its policies. These two economies and their central banks are the focus of this thesis.

1.3 The Research findings and Contribution

The main aim of this thesis is to look into whether there are roles for monetary policy communication in the emerging markets, with a focus on China and India. Chapter 4 analyses the impact of PBOC’s communication on Chinese financial markets and Chapter 5 examines the effects of PBOC’s communication on predicting repo changes in the short-term, while Chapter 6 is on PBOC and RBI.

The specific contributions of the thesis can be summarized as follows. First, Chapter 3 is the first contribution that presents central bank communication in practice. Second, the communication indexes of the two banks were extracted from a comprehensive dataset, which have been used in the analysis in the empirical chapters. Third, the PBOC’s communication strategies during 2010 to 2014 is given consideration in the first empirical chapter, Chapter 4. Fourth, the comparison of the communication indexes of PBOC and RBI is also done in the third empirical chapter, Chapter 4. Finally, the review on various communications of PBOC and RBI has been carried out and provided in Appendix.

The contributions and findings in each chapter are summarized as follows:

¹ An acronym for five developing economies, Brazil, Russia, India, China and South Africa.

1. Chapter 3 was preceded with discussion of central bank communication in practice. This is from an international perspective including the cases of two developing economies, China and India, and two developed economies, the UK and the US. The aim is to provide background on communication in practice considering different types of economies, therefore revealing differences and potential improvement of developing economies' central bank communication.
2. Chapter 4 looks at PBOC's communication and its influence on Chinese financial markets, using time-series models. First, the analysis of the PBOC's credibility is a new aspect. Second, considering the main interest about various communication, it includes a larger dataset on the PBOC's communication where all the communication on the PBOC's formal website from 2009 to 2015 has been analysed, therefore providing more detailed communication indexes. Third, besides the communication indexes about domestic economic outlook and monetary policy inclination, communication index about world economic outlook was created because of the motivation during data collection and the importance of global financial stability. Fourth, in addition to the interbank money market and the equity market, foreign exchange market was added for more thought. Fifth, 'how-to-communicate' questions and particularly the three PBOC's communication strategies found during the data collection are new points. The main finding is that the PBOC's communication generally reduces volatility in the three financial markets of China. And the informal communication is more effective than the formal communication. Results are generally consistent with the literature (e.g., Ji and Zhou, 2012; Wang and Liu, 2016).
3. Chapter 5 examines the short-term role of central bank communication in the PBOC's case: management of market expectations and predictability of policy rates. Following selected studies in the literature, Taylor rule with forward-looking elements are used in an ordered probit model. Compared with the previous literature focusing only on the PBOC's quarterly monetary policy report, first, this chapter uses more comprehensive communication indexes including formal and informal channels to better capture communication effects. Second, the communication about money supply was found during data collection, which is also a new interest on the study of the PBOC. Third,

communication channels are analysed for the ‘how-to-communicate’ question. In general, this chapter found some but not much communication effects on predictability of repo changes. The communication channels still matter while the element of money supply has less effect. The findings also show that the PBOC’s informal communication based on inflation could be watched more by the markets. The chapter presents consistent findings with the selected studies about communication in the developed economies and developing economies (e.g., Jansen and De Hann, 2009; Li, 2011; Ehrmann and Fratzscher, 2013).

4. The potential role of communication as an unconventional monetary policy tool is the focus of Chapter 6 where the RBI’s case is included. India is one of the largest developing economies and shares similarities with its close neighbor China. The literature shows that studies mostly focus on one central bank’s communication and its economy, the main contribution of this chapter is the comparative analysis of PBOC and RBI. It is understandable that differences between central banks and economic background are usually presented in different economies, such as the irregular changes of PBOC’s policy rates that may yield less desired results. However, the aim is to find common effects of central bank communication in developing economies from the two cases. Impulse response functions of central bank communication in monetary policy transmission mechanism in the two economies are compared. The principal finding is that central bank communication acts in monetary policy transmission, mainly by influencing on inflation expectations. This shares similar findings with some research about developing and developed economies (e.g., Wang, 2012; Neuenkirch, 2013; Sethaparmote and Luangaram, 2016).

1.4 The Thesis Outline

The thesis is composed of seven chapters, including an introduction and conclusion. Chapter 2 reviews the literature and identifies the potential gaps in the literature. Chapter 3 documents central bank communication practices of four central banks; two developed economies’ central banks (BOE and Fed) and two developing economies’ central banks (PBOC and RBI). Chapter

4 assesses the role of PBOC's communication on asset prices and volatility in Chinese financial markets. Chapter 5 investigates the PBOC's communication and its predictability of future monetary policy stances. Chapter 6 examines and compares central bank communication of PBOC and RBI. Chapter 7 concludes and discusses potential areas for future research.

Chapter 2

Literature Review

2.1 Introduction

This chapter reviews the literature on central bank communication, based on six general research questions. These questions focus on: (i) what to communicate, (ii) how to communicate, (iii) when to communicate, (iv) the communication environment, (v) the determinants of optimal communication strategy, and (vi) the impact of communication. It also reviews the commonly used data and methodologies in the empirical literature.

The rest of this chapter is organized as follows. Section 2.2 presents the background of central bank communication. Sections 2.2 discusses the six general questions stated above within the extant literature. Sections 2.3 provides an overview of the commonly used data and methodologies in the literature, while Section 2.4 concludes the chapter.

2.2 Background of Central Bank Communication

Central banks make and implement monetary policy. The objectives of monetary policy include maintaining output stability, moderating inflation, and maintaining financial stability. Central bank transparency was not treated with great importance in the past. However, since the 1990s, there is a clear trend in that central banks have been enhancing transparency in their policy formulation and implementation (Geraats, 2002). Further, with increasing central bank independence – which requires accountability – central banks became more willing to provide information on issues such as policymaking, economic outlook, and monetary policy inclination. Central bank communication is the provision of information by central banks to the public on various aspects of monetary policy decisions and implementation (e.g. objectives of monetary policy) through various formal and informal channels, such as reports, press conferences, and speeches (De Haan *et al.*, 2007).

i. The Importance of Central Bank Communication

Central bank communication impacts on market expectation, which matters for financial markets and the general economy (Blinder, 1998). Therefore, well-communicated information helps to promote market efficiency, which will lead to lower volatility (Kahn, 2007). Such communication, therefore, helps central banks achieve monetary objectives, as the problem of asymmetric information is mitigated. In addition to the role of moving the markets in the desired directions, acting as an unconventional monetary policy platform, and aligning market expectations, the importance of communication is based on the target group. First, for central banks and policymakers, communication clarifies policy to the public and increases central bank credibility, particularly when the ‘words match the deeds’. For the fundamental roles of explaining and signalling monetary policy, communication in itself is a monetary policy action (Holmes, 2009). Second, from the economy-wide perspective, communication may reduce monetary policy transmission lags, which promotes economic stability. Lastly, communication is essential to market participants, because communication helps them to better understand policy transmission mechanisms and to create strategies with better portfolio allocation. Therefore, the research on this topic could contribute central bank design and benefit the public.

ii. General Questions on Central Bank Communication

Central bank communication has received increasing attention in both theoretical and empirical research since the last century. Specifically, six research questions have emerged as important: i) what-to-communicate questions focus on the content of information, for example, economic outlook; ii) how-to-communicate questions target optimal ways of communicating (formal or informal channels), the intermediaries (media), and receivers (the general public); iii) when-to-communicate questions address issues such as whether to communicate in intermeeting or prior-meeting time; iv) the role of communication as an unconventional monetary policy to deal with unusual situations, such as during financial crises or when interest rates approach the zero lower bound; v) determinants of optimal communication strategy, such as clarity, frequency, and consistency of communication; and vi) communication effects, for example, looking into the effects of specific communication on market expectations. In general,

research findings vary across research questions. However, both theoretical and empirical literature has shown that central bank communications, mostly those of developed economies' central banks (e.g. the ECB), have significant effects on financial markets. For example, Eusepi and Preston (2007) theoretically supports the importance of communication and argues that the announcement of how an inflation target will be achieved is important. Coenen *et al.* (2017) empirically found that the use of forward guidance lowers market uncertainty in the case of the ECB. Research in the area is generally dominated by empirical rather than theoretical studies.

To summarize, in this chapter, general questions on the topic are discussed within the existing literature. Gaps are identified to facilitate motivation for the research in the empirical chapters of this thesis. The main idea in carrying out the empirical research on this topic is the following. The previous empirical work in the area uses methods such as times-series models and discrete choice modelling techniques. Daily and monthly data are mostly used, although high-frequency and survey data are also employed. The key to this research, the communications themselves, are normally coded by narrative approach and then transformed into indexes (e.g. Ehrmann and Fratzscher, 2007). This technique classifies the tone and size of communications, then further transforms codes into aggregated indicators. Other approaches quantify communications indirectly by counting information units in communications per topic (e.g. inflation). In terms of case studies, most research in central bank communication focuses on developed economies, such as the EU, the US, and the UK. There is very little research in this area that looks into emerging and developing economies. Furthermore, previous studies generally focus on a single central bank or country. Very few papers compare central bank communications of two or more countries, or examine the spillover and integration effects of such communication.

2.3 Main Research Questions in the Literature

2.3.1 What to Communicate

First, central banks decide what information to communicate. Common aspects of monetary policy such as policy decisions, objectives, strategy, the economic outlook, and the path of future policy rates are normally the content of such information.

i. Policy Decisions

Policy decisions are policy choices of central banks in the conduct of monetary policy. There are authors who investigate the impact of communicating policy decisions on an economy's performance. For example, Brand *et al.* (2010) look at the communication effects of the ECB's policy decisions and find that the related communication affects money market rates and predictability of monetary policy stances. Rosa (2010) finds that exchange rates respond to explanations provided by the Fed's monetary policy actions and statements.

Communication on policy decisions contains valuable information that promotes a deeper understanding of the rationales behind policy changes. Such communication has been found to have impacts on financial markets (e.g. Sturm and De Haan, 2010; Berger *et al.*, 2011). For example, the introductory statements of the ECB have been widely researched, confirming that these statements contain important information for financial markets (Sturm and De Haan, 2010; Berger *et al.*, 2011). Other aspects relate to communication effects on scenarios such as the sovereign debt crisis. Moessner (2015) finds that the ECB's communications on balance sheet policy announcements affect the long-term inflation expectation. In general, explanation of policy decisions is found to be significant and can be beneficial to an economy when more information is provided to markets.

ii. Objectives and Strategies

There are approximately 20 economies that have adopted inflation targeting (IT) regimes in their monetary policy. The debate about whether central banks should have, and also

communicate, an explicit numerical target has received attention in the literature (Morris and Shin, 2005). It is argued that concentrating on too many objectives may bring undesired effects (Rozkrut *et al.*, 2007). However, there appears to be agreement that not just the inflation target should be communicated, but also the way to achieve it is needed (Eusepi and Preston, 2007). Ehrmann *et al.* (2012) argue that there are sizeable effects of objective communications explaining inflation and output. Besides inflation, communication about other objectives is also investigated and found to be significant. For example, Born *et al.* (2012) found that with some major central banks such as the ECB and the Fed, communication about macro-prudential supervision significantly affected stock markets in emerging economies.

iii. Economic Outlook and Monetary Policy Stances

Central banks communicate formally or informally to discuss future macroeconomic policy, inflation and interest target rates, and monetary policy inclinations. Research on economic and inflation outlooks receives attention in the literature. In the case of Fed, Hayo and Neuenkirch (2010) find that the Fed's communication about policy rate changes improve predictability of its repo changes. Some research supports the argument that communication on the economic outlook is a driver of stock returns (Rosa, 2011; Hayo *et al.*, 2012b). Central banks normally talk about domestic economic outlook, however, it also communicates its view about world economy. The previous studies mostly focus on communication about domestic economic outlook, the new communication index about world economic outlook could be considered, which is also analysed in Chapter 4. Siklos and Bohl (2007) find that communication on inflation and exchange rates impacts on financial market volatility. Similarly, communications on inflation outlook have also been found to influence both short- and long-run levels of inflation and output. They also affect the yield curve (Andersson *et al.*, 2006; Lamla and Lein, 2011; Neuenkirch, 2013). Different central banks tend to have their preferences on their communication about economic outlook, which is also shown in next chapter about communication in practice.

In addition to information about the macro economy, monetary policy inclination is of great interest. Central bank independence and transparency requires explanation of aspects of

monetary policy, particularly its inclination. Communications on this aspect have attracted a lot of research (e.g. Hayo *et al.*, 2012b). In general, empirical research reports effects of central bank communications on monetary policy inclination.

iv. Paths of Future Monetary Policy

Some central banks have adopted the forward-looking approach to their monetary policy, where factors such as future policy rates are communicated to the public. By communicating the possibility of policy rate changes in advance, such communication helps central banks manage market expectations. A remarkable communication policy in this regard is the cornerstone policy of some countries' central banks (forward guidance) such as in the UK and Sweden. Kahn (2007) argues that communicating policy paths is important for financial markets. Explicit numerical policy targets may have a small marginal effect, however, while forward guidance that focuses on the path of future policy rates has potentially large effects on markets (Pincheira and Calani, 2009; Hallett and Acocella, 2012; Bascand, 2013). In practice, talking about future paths is an increasing trend among central banks. The BOE and the Fed both introduced forward guidance in 2013. For example, the announcements of asset purchase programmes and the use of forward guidance are found to lower market uncertainty in the case of the ECB (Coenen *et al.*, 2017). In developing economies, forward guidance is less used. It is found that the RBI, for example, has introduced forward guidance in some of its quarterly reviews of monetary policy. In the literature, research supports the effectiveness of forward guidance, as reported by studies that examined the effects of these communications, such as in the case of the Fed (Campbell *et al.*, 2012; Clark and Bednar, 2013; Moessner, 2014).

2.3.2 How to Communicate

Once the contents of communication are decided, the next question is how to communicate the information. Work on this topic includes that of Ehrmann and Fratzscher (2013) and Hayo and Neuenkirch (2013a). Monetary policy is mostly determined and communicated by monetary policy committees, rather than by individuals. Communication channels, such as monetary policy statements and speeches, can be categorized into formal or informal channels. Central

banks choose channels of communication based on their preferences or needs, which will be discussed in the next chapter examining communication in practice. Communication strategies are influenced by objectives of decision-making committees. Research on this question focuses on three aspects of communication: the senders, the intermediaries, and the receivers.

Senders (Monetary Policy Committees and/or Individual Members)

i. Committees or Individuals

Communication is conveyed by the monetary policy committee (MPC) and/or its individual members. There is no consensus yet on whether communication should be made by the committee or by individuals. Some argue that communication by committees is more effective, for example, because of the committee's expertise (Berger *et al.*, 2006) and knowledge pooling (Berk and Bierut, 2011). However, members in the committee may have different weights on their information assessment (Hayo and Neuenkirch, 2011). Therefore, this heterogeneity results in problems of dispersed communication, which reduces the predictability of future monetary policy (e.g. De Haan, 2008; Ehrmann and Fratzscher, 2013) and creates communication bias (Hayo and Neuenkirch, 2013). The effectiveness of communication carried out by the committee or individuals also depends on other factors. For example, a factor affecting the choice of medium of communication is the economic situation faced by the bank. Blinder (2006) reviews the literature in the area and concludes that when dealing with complex problems, communication by committees is more effective. Weber (2010) finds that when members compromise over the economic outlook, the committee's communication increases short-term welfare.

ii. Decision-Making Committees

The MPC discusses and votes for changes of monetary policy. Therefore, the decision-making process strongly influences the subsequent communication. In practice, the main question is whether communication of the decision is made by an individual member or the whole group. Voting patterns of different central banks seem to vary. Ehrmann and Fratzscher (2005) argue that the Federal Open Market Committee (FOMC) is highly collegial and tends

to vote with internal consistency, while the MPC of the BOE is a highly individualistic committee, with members having divergent views. They discover that the effectiveness of communication relates to decision-making processes, types of committees, and communication strategies used. This is supported by Geraats (2006) and Berger *et al.* (2006), who argue that communication strategies are unique according to the monetary policy frameworks and the nature of the committee. An example is the Czech Republic National Bank investigated by Rozkrut *et al.* (2006), who show that its committee characterised by individualism, but adds information to decisions. Some researchers argue that individualism tends to increase dispersed communication (e.g. Ehrmann, and Fratzscher, 2013).

iii. Communication Channels

Central banks communicate through various channels, such as speeches, minutes, etc. In recent years, researchers have placed importance on the role played by these channels in disseminating effective communications (Siklos and Bohl, 2007; Jansen, 2011). Not only do different channels affect markets differently (Jansen and De Haan, 2009; Hayo and Neuenkirch, 2011), but they also can combine with each other to influence markets with greater efficiency (Goyal and Arora, 2011).

Findings on the effectiveness of communication channels differ. For example, Reeves and Swicki (2007) report that the BOE's speeches have less effect than its minutes and inflation reports, however, several speeches in the data sample about economic conjuncture are found to influence largely on the financial markets. Hayo *et al.* (2010) provide evidence that statements and testimonies are effective in both the EU and Pacific markets, while speeches and reports have larger effects in the EU only. They conclude that speeches have a larger impact than infrequent reports and testimonies. Farka and Fleissig (2011) evaluate communication channels on financial stability, showing that statements and press conferences are more efficient than written reports in their influence on market prices.

Formal channels mostly comprise the central bank's minutes, quarterly reports, and financial stability reports. Press conferences and statements are also important (e.g. Conrad and

Lamla, 2010; Berger *et al.*, 2011; Hussain, 2011) as they are found to have effects on financial markets. For examples, Conrad and Lamla (2010) and Berger *et al.* (2011) focus on the ECB's introductory statements, while Hussain (2011) analyses the ECB's press conferences. Two studies by Moessner (2014, 2015) assess balance sheet policy announcements by the FOMC and the ECB respectively.

Effects of informal communication have also been looked into and found to have important effects (Ehrmann and Fratzscher, 2007; Hayo *et al.*, 2008; Neuenkirch, 2011; Hayo and Neuenkirch, 2011). Speeches are the most common informal communication. Siklos and Bohl (2005) find that the Bundesbank president's speeches about inflation, exchange rates, and economic policy improve the predictability of monetary policy decisions. Hayo and Neuenkirch (2010) report similar results in the case of the Fed. Hayo and Neuenkirch (2011a) show that speeches and testimonies have effects in the US and Canada, and Hayo *et al.* (2012a) state that informal communication is important for market participants in the US and in equity markets of emerging economies, particularly speeches that contain bright economic outlooks.

Some research also places emphasis on verbal interventions in markets, such as foreign exchange markets, as a complementary monetary tool. Although some argue that such communication may have less impact (e.g. Fratzscher, 2006; Jansen and De Haan, 2007), research confirms the potential effects of verbal communication. For example, Fratzscher (2008) analyses G3 economies where verbal intervention moves exchange rates in the desired direction and is independent of monetary policy as well as actual intervention. Burkhard and Fischer (2009) find that the Swiss franc responds quickly to verbal interventions from the Swiss National Bank. Verbal intervention is also found to be important during the financial crisis period (Egert and Kocenda, 2013).

The Intermediary (Media)

Just as a company needs to convey its ideas using advertisements, the media is the main intermediary as a communication transmission mechanism. In addition to formal publications, most communications are made by MPCs, but these are also transmitted via the media. Research

on the topic undertaken since 2010, for example, examines how media reports affect and build central bank credibility (Berger *et al.*, 2011). Hayo and Neuenkirch (2011b) examine newswire reports in Canada and find communication effects on equity markets. When the media spends more time putting out certain statements of central banks, it is likely to increase public awareness of them. Based on this view, the favorableness of media reports is of high interest. Berger *et al.* (2011) report that the favorableness and extent of media coverage is highly responsive to the type and content of the ECB's communications. Following this work, Bohm *et al.* (2012) find that the more dispersed the central bank communication, the greater will be the favorableness and coverage of the media.

The Receivers (General Public and Market Participants)

Central banks ultimately communicate to receivers to help them shape market expectations, referred to as 'the art of monetary policy' (Blinder *et al.*, 2008). The receivers' responses in financial markets can be extracted from changes of asset prices and survey data. Due to the increasing demand for central bank transparency, receivers play an important role. Communication is argued to reduce asymmetric information. Research shows that market understanding about expected components of communication has increased (Rosa, 2010; Rosa, 2011a), but markets still display undesired responses, such as the inability to process information (Rozkrut *et al.*, 2007), misconceptions about interest rate rules (Schmidt and Nautz, 2012), and reflection bias or asymmetric news effects (Smales, 2012). All the same, the receivers' feedback on central bank communication is found to be influential and beneficial for central banks. For example, when market participants assimilate more information from central banks, central bank transparency increases (Crowe and Meade, 2008). Theoretically, central bank transparency deeply influences the learning processes of participants (Eusepi, 2010). More research is need, for example, on the information perception (Rosa, 2011a; Aikman *et al.*, 2011).

2.3.3 When to Communicate

The timing of central bank communication is important. Discussion on this topic focuses on periods of financial crisis, business cycles, communications around meeting days, and changes

in communication strategies. The frequency of communication is also related to this question and is reviewed in the later part.

Papers have analysed communication effects during certain periods, particularly with regard to crisis management. An important reason for communications in a crisis is the potential role of clarifying facts. For example, misconceptions by experts are likely to increase during a financial crisis (Schmidt and Nautz, 2012), therefore, communication becomes important. This potential effectiveness has been supported by some research findings. Hayo *et al.* (2012b) report that, in the financial crisis, communication has large effects on equity markets, particularly in the emerging markets. Since emerging economies are likely to be influenced by financial turbulence, communication is highly necessary during crisis periods in these economies (Born *et al.*, 2012; Egert and Kocenda, 2013). Another role of communication in crisis is the management of market expectations. Rosa (2011a) supports the statement of Woodford (2005) and reports that communication helped in managing market expectations during the recent financial crisis. In the European sovereign debt crisis, Buchel (2013) reveals that the ECB's central bankers use more dovish words to signal an intention to save markets. When communicating in this scenario, the timing of communication is found to matter for financial stability, for example, the ex-post disclosure of negative information may increase volatility (Geraats, 2010). Associated with financial crises, communication in different states of the business cycle is assessed. Some findings show that communication has its own effect on financial markets in the business cycle (Hallett and Acocella, 2012; Kurov, 2012).

The timing of communication can be categorized as pre-meeting, intermeeting and post-meeting. There are short silence periods around intermeeting time, although this has only been researched in some cases (e.g. the ECB). Ehrmann and Fratzscher (2007) notice some systematic patterns in the timing of communications. They find that before changes in target rates, the intensity of communication increases, while during the preparation time for meetings, the frequency of communication increases. Ehrmann and Fratzscher (2008) continue their studies on the Fed and find that financial markets react more to central bank communications around policy meetings. Another case is Hayo and Neuenkirch (2011a), who find that

communication in the prior-meeting time is more useful for predicting target rate changes compared with the after-meeting time.

Lastly, some central banks have changed their communication strategies over time, for example, the adoption of forward guidance by the BOE and the Fed. These changes could be directly relevant to communication effects, an argument supported by some papers that find the predictability of future monetary policy has increased over time with these changes of strategy (Filipozzi, 2009; Nautz and Schmidt, 2009; Hayford and Malliaris, 2012). There is research on the communication of early years of the European Monetary Union (EMU) (e.g., Jansen and De Haan, 2006; Jansen and De Haan, 2009). In general, this research question receives less attention, but it is usually analysed with other related research interest in the literature.

2.3.4 Communication Environment

Central banks are likely to communicate under exceptional circumstances, for example, the adoption of monetary policy regimes such as inflation targeting or money base targeting, or during economic conditions such as zero lower bound interest rates or high nominal interest rates. Unusual circumstances may result in targeted communication strategies and unique communication effects.

i. Monetary Regime and Communication

It has been suggested that research considering communication within a regime and its adopted strategies are important (Ehrmann and Fratzscher, 2005; Geraats, 2006; Hayo *et al.*, 2010; Farka and Fleissig, 2011). Blinder (2006) proposes that the IT regime is a preferred way for anchoring expectations, and a similar argument was advanced by Rossouw and Padayachee (2009). In terms of foreign exchange markets, Neuenkirch (2013b) finds that pegged exchange rate regimes will reduce expectation bias. However, a single set of economic indicators may not be enough for the markets, particularly when the target changes and subsequently more information is needed. Research on this topic tries to identify whether communication helps central banks to maintain monetary policies and examines the relation in general between

communication and monetary policy regimes. For example, Chortareas *et al.* (2001) argue that decreasing inflation rates could be attributed to increasing transparency, with no regard to monetary regimes. Rozkrut *et al.* (2007) find that under the IT regime, additional targets lead to inconsistencies in communication. Egert and Kocenda (2013) conjecture that communication is influenced by monetary regimes and monetary policy conduct. Under the IT regime, the UK provides a unique case of a communications framework. Chortareas and Noikokyris (2014) find that under the IT regime, the BOE's voting records impact on equity prices. Questions such as whether communication is better in the IT regime or not are still an open debate.

ii. Economic Conditions and Communication

Different macroeconomics conditions could be significant for communication as well. There is research on how central bank communication behaves in certain economic conditions (e.g. Andersson *et al.*, 2006; Neuenkirch, 2011). For example, in the EU, there exist diverse cultures, linguistic, and regional characteristics (Berger *et al.*, 2009). The condition of zero lower bound rates is of interest in the literature. Burkhard and Fischer (2009) argue that active communication strategies which provide frequent information when interest rates reach the lower bound are very effective on the markets. Rosa (2011) finds that under the zero lower bound condition, communication eases the financial situation, supporting Bernanke's idea in a speech at an economic symposium in 2010². In the case of the Fed, Campbell *et al.* (2012) contribute the literature by finding that communication can provide monetary easing if the public trusts it. Moessner (2014) finds that explicit FOMC forward guidance reduces market volatility in the zero lower bound state. The empirical findings generally provide evidence of communication effects in the zero lower bound condition.

Empirical findings generally support the argument that transparency and communication are important, along with their links with given economic conditions. For example, transparency is found to be larger in an economy with a more stable political system and a high degree of financial development (Dincer and Eihengreen, 2007). In low-income countries, the effects of

² From the Fed: <https://www.federalreserve.gov/newsevents/speech/bernanke20100827a.htm>.

transparency on reducing expectation bias are very crucial (Neuenkirch, 2013b).

2.3.5 The Determinants of the Optimal Communication Strategy

What, then, constitutes an optimal communication strategy? Are there any possible limits? Research on this topic analyses determinants of communication, such as clarity and consistency, to help with communication design. Several factors that receive much attention in the literature are reviewed here.

i. Frequency of Communication

Central banks communicate to the public with different frequencies. The frequency may depend on the preferences of central banks, where some central banks communicate very frequently such as the ECB and the Fed, while others such as Reserve Bank of New Zealand (RBNZ) and the PBOC communicate less frequently. An example is the BOE's minutes, which come out two weeks after the monetary policy meetings, while the minutes of the Fed come out after a three-week lag. Research on this minor topic has received more attention in recent years (e.g. De Haan *et al.*, 2007). Comparing the central banks of the US and Canada, Hayo and Neuenkirch (2011a) find that the FOMC, which communicates more frequently, outperforms Canadian communication indicators in explaining interest rate decisions. The idea that higher frequency tends to result in a more timelier and accurate flow of information, thereby improving predictability, is shared by Meudoca and Faria (2012) and Hayo *et al.* (2012a). In addition, the frequency of different aspects of communication is examined (Rozrut *et al.*, 2007; Siklos and Bohl, 2007). A consensus shows that an appropriate frequency is a component of optimal communication strategy.

ii. Clarity of Communication

Clear communication tends to have a larger effect on markets. Some theoretical work (e.g. Morris and Shin, 2005; Myatt and Wallace, 2014) focuses on the degree of information precision; however, there is little empirical research on the topic. Some intuitive findings argue that clarity is important. Jansen (2011) investigates Humphrey-Hawkins testimonies of the Fed using

readability statistics, and comments that clear communication results in lower volatility in financial markets. Furthermore, he suggests that although clarity has a decreasing marginal effect, the low cost to pursue communication with high clarity makes it a worthwhile focus. Another study examines the clarity of the ECB's communications (Bulir *et al.*, 2012). Within three scenarios, which are clarity with no shocks, clarity under shocks, and confusion, 85%-95% clear and important communications are found. They further conclude that inflation risk assessment in the ECB's Monthly Bulletins helps in improving clarity, while communication on monetary developments has a small and negative impact on clarity. From another perspective, a related concept to clarity is ambiguity. For example, it can be the case that central bank communication conveys confusing ideas or different inclinations about the economic outlook. For example, Giorgio and Rossi (2012) found that ambiguity in ECB communication affects real economic variables in the EU. In Chapter 4, dispersed communication from the PBOC has also been found and analysed.

iii. Consistency of Communication

Researchers also focus on whether words match deeds and whether communication itself contains diverse information. Jansen and De Haan (2006) and Rozrut *et al.* (2007) agree that central bank communication should be consistent. In practice, the evidence shows that consistency in the ECB has increased (Jansen and De Haan, 2006). As Mr Mario Draghi stated at a public lecture in 2008, 'a successful communication strategy requires a central bank to be credible. And this, in turn, means matching words with deeds'³. Some central banks have been studied, such as the ECB (Rosa and Verga, 2007; Giorgio and Rossi, 2012), the Central Bank of Chile (Pincheira and Calani, 2009) and the South African Reserve Bank (Reid and Du Plessis, 2010) with regard to the ability to guide future policy. For example, Giorgio and Rossi (2012) find that the ambiguity of ECB members' speeches influences the volatility of market interest rates. The general view is similar to a later research by Ehrmann and Fratzscher (2013), who examine the diversity of communication and report that consistent communication increases the predictability of future monetary policy of the FOMC. Consistency is likely to vary because of

³ From Bank for International Settlement: <https://www.bis.org/review/r080722a.pdf>.

the various natures of central banks. For example, the MPC of the BOE has a collegial communication style with more consistency (Ehrmann and Fratzscher, 2005).

iv. Intensity of Communication

Whether communication with more intensity has larger effects or not, receives some attention. Allard *et al.* (2013) find that intensity in communication on fiscal policy increases in some major central banks during financial crises. The intensity of central bank communication also has effects on the media, as shown by Bohm *et al.* (2012). However, the effects of precision of information on welfare are ambiguous, as reported by James and Lawler (2010).

v. The Optimality of Communication Strategy

The optimal degree of central bank transparency is analysed both theoretically and empirically. The findings have some differences. From a theoretical perspective, too much transparency is argued to be undesired (Amato *et al.*, 2002; Siklo, 2011), therefore, an average degree of transparency of public information is preferred (Hielscher, 2012). Output stabilization and welfare gains are influenced by central bank communication (Hoeberichts *et al.*, 2009; Turdaliev, 2010; Berk and Bierut, 2011; Hahn, 2012), and more precise information is argued to be a double-edged sword (Amato *et al.*, 2002; Myatt and Wallace, 2014). Empirically, some papers provide evidence consistent with the theoretical argument that there are probable limits to transparency (e.g. Ehrmann *et al.*, 2012; Neuenkirch, 2013a). However, the effects of transparency are found in most of the empirical research. For example, Hahn (2012) uses a one-shot signal game model and advocates more transparency, due to its impact on welfare development. In general, striking a balance between degrees of transparency can be summarized as by Aikman *et al.* (2011): although central bank communication is important, too much communication brings results such as misconceptions of markets and aggregated market failures. More research is needed on the optimal degree of central bank transparency and communication (e.g. Lamla and Lein, 2011; Aikman *et al.*, 2011).

A related question is what constitutes an optimal communication strategy. Besides the discussion above, this question may depend on factors such as the nature of monetary policy

committees, varying monetary regimes, and different preferred channels of communication. Some researchers have discussed and commented on this aspect. For example, Blinder (2006) discusses different types of monetary policy committees. Pursuing his research, Blinder (2009) suggests how central bank communication should be designed. The primary thoughts are, first, that committee decision-making is preferred; however, it is not clear about the size of the committee. Second, the nature and structure of the committee needs to be custom-tailored. Types ranging between individualistic (e.g. the BOE) and generally collegial (e.g. the ECB) could be desirable under particular conditions.

2.3.6 Impacts of Communication

Central bank communication is argued to influence financial markets, mainly by reducing market uncertainty and expectation bias. To achieve this, communications of different central banks have been examined, such as the communication effect on market expectations. First, such communication aims to impact on the economy. The role of communication as an unconventional monetary policy is of interest. Then, impacts on different markets have been evaluated, focusing on returns and the volatility of asset prices. Next, effects on market expectations and the predictability of monetary policy stances are usually examined by comparing communication models with Taylor-rule models. Finally, some research analyses the spillover effects and integration effects of central bank communications.

i. Communication Impact on Economy

First, for influences on interest rates, research findings show that communication affects both short-term interest rates (Lamla and Lein, 2011) and long-term interest rates (Rosa, 2011). Under zero lower bound conditions, communication influences the economy by providing complementary monetary easing as an unconventional monetary policy (e.g. Campbell *et al.*, 2012; Moessner, 2014; Coenen *et al.*, 2017). Under financial crisis, communication may also perform as crisis management (e.g. Hayo *et al.*, 2012; Egert and Kocenda, 2013).

Second, communication on inflation is analysed theoretically and empirically. Theoretically,

Turdaliev (2010) proves that communication decreases inflation, but increases its volatility. Eusepi (2010) concludes that communication helps in stabilizing the IT equilibrium. Empirically, an early paper by Chortareas *et al.* (2001) shows a negative relationship between transparency and lower inflation rates, especially in flexible exchange rate regimes. Neuenkirch (2013a) finds that communication has comparable effects with actual target rate changes on inflation rates.

Third, since financial stability is significant, research on communication and financial stability has been carried out. The ability of communication to maintain financial stability is vital; one major proposed communication effect is the ability to move markets in desired directions. How, then, does central bank communication perform under unique situations? Some papers show that financial crisis, zero lower bound rates, and media issues have combined to make communication more challenging (Mishikin, 2011; Mishikin, 2012; Bascand, 2013). In recent years, more evidence has emerged to support the view that communication matters for financial stability; for example, researchers suggest the importance of ‘talking numbers’ and releasing financial information regularly (Geraats, 2010), the changes from open market operations to communication policies of major central banks before, during, and after the financial crisis (Vayid, 2013), and the use of speeches in financial crisis (Born *et al.*, 2012; Born *et al.*, 2014). For further research, Knutter *et al.* (2011) suggest considerations of communication under differing monetary regimes and the case of emerging economies.

Next, some research specifically examines communication effects on asset prices (e.g. Rosa, 2010). A general finding is that communication influences the movement of asset prices (Guakaynek *et al.*, 2005; Ranaldo and Rossi, 2010; Smales, 2012; Wang and Sun, 2016). For example, Farka (2011) examines informative and uninformative statements and shows that the joint effect is greater than the single effect. However, some researchers point out the potential risks of this effect, for example, Hayo *et al.*, 2012 comments that investors need to be concerned that, although expected communication decreases the volatility of commodity prices, surprises and unorthodox measures can increase it.

The impact of communication on yield curves has also been researched. Andersson *et al.*

(2006) show that inflation reports and speeches affect the short end of the yield curve, which supports Kuttner's findings (2001). In the ECB, new releases matter more for the yield curve, while press conferences tend to affect the long-term yield (Brand *et al.*, 2010). Rosa (2011) concludes that the ECB's hawkish words help in protecting the bond yield. Communication by representatives of larger countries is also found to matter more. Demiralp *et al.* (2012), who investigate the surprise components of communication, also report communication effects on the yield curve.

Lamla and Lein (2011) suggest investigating the relation between central bank communication and welfare, which has been examined by some researchers. The findings of Turdaliev (2010) and Hahn (2012) indicate that increasing transparency and communication are beneficial to welfare.

ii. Communication Impact on Equity Markets

A motivation for central bank communication is the fast development of financial markets, in which information is processed rapidly. The equity market is one of the most important financial markets to receive attention on this topic. In general, central bank communications of developed economies are reported to affect equity returns and volatility. For example, Hussain (2011) finds that the ECB's press conferences have a clear impact on the volatility of European indexes. Similarly, such statements explain the volatility of equity returns on the FOMC's meeting days (Kurov, 2012). For the FOMC, policy rate guidance also reduces the volatility of equity returns in US (Moessner, 2014). Wang *et al.* (2006) found the Fed's communication effects on equity markets, and a comparable finding is by Rosa (2011a) who documents that surprise components of communication have a large effect on US equity indexes. Furthermore, Hayo *et al.* (2012) discover similar significant effects of informal communication. In terms of developing economies, for example, communication of the PBOC is also found to have some effect on the equity markets by a few studies (e.g. Wu and Pan, 2014; Sun and Liu, 2016).

iii. Communication Impact on Foreign Exchange Markets

Verbal interventions, which have been discussed above, form an important research area

(e.g. Neely and Dey, 2010). There tends to be agreement about the importance of these communication. Frenkel *et al.* (2005) theoretically explain the relative ineffectiveness of verbal communication, supported by Jansen and De Haan (2008), who discover that the ECB's verbal communication has little effect on euro exchange rates. However, Rosa and Verga (2007) provide results comparable with those of Gurkaynek *et al.* (2005). They report that the surprise components of central bank communications have a large effect on euro exchange rates, showing that communication can be an important monetary policy tool of the ECB. Fratzscher (2008) also finds that the ECB's communication moves the exchange rate in the desired level. Consistent with these findings, Siklos and Bohl (2008) also show that verbal communications of the ECB affect the euro exchange rate, although the effect is smaller than actual intervention. Conrad and Lamla (2010) found the importance of the surprise components of communication (particularly in the introductory statement) in terms of foreign exchange markets. Besides the euro, further research shows the effects of verbal communication on exchange rates. Evidence from Fratzscher (2006) shows that in the G3 economies, communication affects the exchange rate in a longer-term fashion than does action; and that communication reduces exchange rate volatility, while action increases it. Proceeding with the research, Fratzscher (2008) finds that in the G3 economies, communication influences exchange rates through coordination channels, which is consistent with earlier theoretical research by Amato *et al.* (2002). The effectiveness of verbal communication on exchange rates is also discovered in the G3 economies (Beine *et al.*, 2009), Switzerland (Burkhard and Fischer, 2009), US (Fischer and Ranaldo, 2011), India (Goyal and Arora, 2012), and the emerging European economies (Egert and Kocenda, 2014). In Chapter 4, some exchange rates such as the US dollar to Chinese yuan have been analysed briefly using communication indexes. This yields some effects; however, the PBOC's communication about foreign exchange market needs to be more open, in line with other banks.

iv. Communication Impact on Predictability

Communication shapes market expectations, therefore increasing the predictability of future monetary policy (e.g. Fillipozi, 2009; Reid and Du Plessis, 2010; Hayford and Malliaris, 2012; Neuenkirch, 2013). An example is the case of Australia, where predictability has increased after

a new communication strategy that adopted target rate announcements was implemented (Smales, 2012). A common approach in the literature is to analyse communication with forward-looking variables, for example, the household surveys of inflation which is used in this thesis.

For inflation expectations, communication is significant (e.g. Eijffinger and Geraats, 2004; Amstad and Fischer, 2009; Pincheira and Calani, 2009; Schmidt and Nautz, 2012; Moessner, 2014). Ehrmann *et al.* (2012) discover a sizeable effect of inflation objective statements and suggest further research on this effect. However, a discussion by Kahn (2007) argues that potential drawbacks of communication should be considered, such as consistency issues and credibility regarding future policy paths.

In addition, other factors could be important. Taking geography as an influencing factor, Berger *et al.* (2009) show that London-based institutions generally display better forecasting ability than those from other regions. Comparable results appear in the research of Hayo and Neuenkirch (2013a), where a regional bias is found in the Fed members' communications. Explicit target criteria and related explanations are essential for improving predictability, as discussed by Woodford (2008). Another factor is the diversity of communication. For example, in the ECB, the monetary policy committee's members significantly reduce predictability (Ehrmann and Fratzscher, 2013) when diverse communication appears.

Finally, some papers examine the relationship between communication models and Taylor rule models. Contrary to the findings of Heinemann and Ullrich (2007) and Rosa and Verga (2007), Jansen and De Haan (2008) argue that communication models do not outperform the Taylor rule models. However, Sturm and De Haan (2011) find that when traditional monetary policy tools are incorporated in the Taylor rule model, communication indicators still tend to improve predictability of interest rates, in line with the research of Jansen and De Haan (2009) on the ECB and Li (2011) on the PBOC. This research perspective could be explored more in the case of developing economies.

v. Spillover and Integration Effects

Some papers target more than a single central bank to make comparisons and identify

common findings or to examine spillover and integration effects of communication. Hayo and Neuenkirch (2013b) emphasize that there are three main channels through which central bank communication and macroeconomic news can affect other economies. First, it can occur through greater economic integration, such as trading flows. The second way is through high capital mobility and the final one is by monetary policy. In the literature, a typical finding is that central bank communication in one economy can affect other economies. However, the research could be carried on more cases. Previous research placed emphasis on the Fed, such as the Fed's effect on the EU and Pacific equity markets (Hayo *et al.*, 2010) and on Argentina's financial market (Hayo and Neuenkirch, 2013). Comparing the ECB and the Fed, Rosa (2011b) concludes that the Fed affects the EU more, due to the longer policy rate cycle in US. Beck *et al.* (2012) compare the US with Canada and find that communication increases the correlation between financial markets, particularly for long-term interest rates. In the case of the Fed, Hayo *et al.* (2012) also report that although the effect is indeed larger in the US, the Fed's communication significantly affects market returns in seventeen emerging economies (e.g. Argentina). Comparisons between developing economies' central bank communications are scarce in the literature.

2.4 Data and Methodologies Used in the Literature

With the intent of achieving a better understanding of how the existing research is carried out, here, the commonly used data and methodologies in the literature are discussed.

2.4.1 Data Used in the Literature

Data used on this topic normally comprise daily market price data, qualitative communication indexes, high-frequency data, and survey data. The types of data depend on the research purposes and models. Data used are of monthly, daily, and intraday frequencies. The data captured in research on this topic normally start from 2000. There are a few papers that focus on earlier data, for example, to research the formative years of the EMU.

First, regarding frequency of data, quarterly data is mostly used with the Taylor rule models, therefore, the predictability of communication can be analysed with discrete choice models, for

example, ordered probit models (e.g. Hayo and Neuenkirch, 2010). The VAR models that focus on impulse responses rely on monthly data in most cases (e.g. Neuenkirch, 2013). Daily and intraday data are usually combined with market-based measures, for example, by Kuttner (2001). Some researchers (e.g. Neuenkirch *et al.*, 2005; Rosa, 2011) discuss the advantages of high-frequency data in this topic, for example, to cope with simultaneous and omitted variables. The former arises because the changes in monetary policy could actually be a response of monetary policy to the changes in the asset price, while the latter arise from the impact of other news on market prices (Neuenkirch *et al.*, 2005). High-frequency data could be better in solving the potential endogeneity and omitted variables problems. However, there are also some drawbacks (e.g. Rinaldo and Rossi, 2010; Rosa, 2010). For example, in the empirical research, not all the variation in asset prices can be explained by communication. Overreactions in the high-frequency data may also exist.

Second, survey data are used for market expectations, because these directly reflect market perception, which are usually taken by institutions or the media such as Consensus Economics and Reuters. Survey-based data are mostly used to research predictability, such as the research of Ullrich (2008) on inflation expectations in the ECB, the research of Jansen and De Haan (2009) on inflation expectations, with the help of Consensus Economics' survey data, and the work of Berger *et al.* (2012) on the main financing rate in the ECB. In addition, an alternative way to measure market expectations is by market-based measures. For example, one widely used approach is that of Kuttner (2001). This method uses the difference between the futures' rates before and after meeting days to proxy for monetary policy shocks. Thornton (2013) updates the method by dealing with the joint-bias problem that arises from other news shocks. Furthermore, some researchers argue that there can be two factors influencing the performance of asset prices. One is the current target factor, which can be used in the method of Kuttner (2001), and the other is the path target factor, which is concerned with the expectations of future monetary policy. Gurkaynek *et al.* (2005) introduce new factors based on principle component analysis. In the same vein, Rosa (2008) also researches these two factors, using content analysis. There are some drawbacks of survey-based data. For example, survey-based data suffer from subjective errors, and while the mean of survey values is normally used, not every value is

presented. Research into this aspect is also normally undertaken in developed economies, because it may not be easy to obtain survey data in developing economies.

Third, the communication data are extracted from formal and informal channels of central bank communication. On the one hand, some researchers focus on formal communiqués, such as inflation reports and minutes. For example, the introductory statement of the ECB contains valuable information with a standardized style, which is widely used (e.g., Ehrmann and Fratzscher, 2007). On the other hand, some researchers focus on informal communications, such as interviews and newswire reports.

Fourth, announcement effects are taken into consideration, to better identify communication effects. Various macroeconomic announcement days, such as those for the consumer price index and gross domestic production, are considered to control the announcement effects. For example, Hayo *et al.* (2010) and Hayo *et al.* (2012) include the days of macroeconomic announcements as dummy variables into the time-series models.

Last, from a larger perspective, research mostly focuses on developed economies. Little research in the literature specifically focuses on or includes data from developing economies. Research on central bank communication are normally three types. The first approach is research on a particular economy and its central bank, for example, the EU and the ECB (e.g. De Haan, 2008; Berger *et al.*, 2011; Rosa, 2013). Second, in the recent literature, researchers analyse impacts of communication on another economy or on several economies, such as the effects of the Fed's communication on Canada (e.g. Beck *et al.*, 2012). Third, a small body of research looks at several central banks, such as cases of the Fed and the ECB (Rosa, 2011b).

Table 2.1
Central bank communication in developing economies

Economy	Research (Examples)	Methodology	General Findings
Brazil	Mendonca and Faria, 2012	Market-based measure	An increase in central bank transparency and communication improves the efficiency of expectations hypothesis of the term structure of interest rate and the anticipation of changes in the interest rate target.
	Montes <i>et al.</i> , 2015	VAR	The analysis about meetings of monetary policy committee of Central Bank of Brazil found that the economic outlook content affects the inflation expectation.
Chile	Pincheira and Calani, 2009	Theoretical	Communicational bias contains valuable information regarding the future stance of monetary policy. The Central Bank of Chile has matched words and deeds.
China	Li, 2011	Ordered probit	Central bank communication has effects on changes of interest rates; however, the effects are lower compared with the model using macroeconomic news.
	Ji and Song, 2012	EGARCH	Central bank communication has significant effects on money markets and stock markets. The informal communication has larger effects.
Europe	Wilhelmsen and Zaghini, 2011	OLS	The days of policy meetings are special days for financial markets. In addition, the predictability of Federal Reserve, Bank of England, and European Central Bank is fully comparable. Finally, in the euro area (and in other countries) policy decisions are anticipated well in advance.
Emerging economies	Hayo <i>et al.</i> , 2012	GARCH	Central bank communication of the Federal Reserve affects seventeen emerging economies. Informal communication has larger effects than target rates surprises.

Table 2.1 Continues

Central bank communication in developing economies			
Economy	Research (Examples)	Methodology	General Findings
Emerging Economies	Born <i>et al.</i> , 2012 Born <i>et al.</i> , 2014	EGARCH Event study	Financial markets react significantly and systematically to central bank communication about financial stability issues. However, some forms of communication (e.g., speeches) may at times raise volatility and uncertainty. Optimistic financial stability reports (FSRs) lead to significant and potentially long-lasting positive abnormal stock market returns whereas no such effect is found for pessimistic FSRs. Speeches and interviews have smaller effects on market returns during tranquil times but have been influential during the 2007–10 financial crisis.
India	Goyal and Arora, 2012	EGARCH	The impact of central bank communication is analysed with daily and monthly Indian data in the best of a family of GARCH models. Communication channels are found to have potential on foreign exchange markets, but should be used more effectively.
South Africa	Rossouw and Padayachee, 2009	Survey-based measure	The application of the methodology reported in this paper can improve the effectiveness of central bank communication aimed at improving the general knowledge about inflation.
Turkey	Reid and Plessis, 2010	OLS	The Monetary Policy Committee of the South African Reserve Bank has succeeded in signaling their likely future policy decision with consistency over this period.
	Demiralp <i>et al.</i> , 2012	Autoregressive conditional hazard	Central bank communication has improved predictability. The surprise component of policy communication affects the term structure of interest rates. Finally, the relative importance of communication in driving market yields has increased through time.

Table 2.2

Central bank communication on three cases		General Findings
Case One: One Central Bank and its Economy	Research	Methodology
The ECB and the EU	De Haan, 2008	Literature review
	Berger <i>et al.</i> , 2011	Indicator analysis and OLS
	Rosa, 2013	Event study
The Fed and the US	Rosa, 2011	Event study
	Hayo <i>et al.</i> , 2012	GARCH

Various forms of ECB communication lead to more volatility. Communication generally moves financial markets in the intended direction based on coded approach. ECB communication increase the predictability of interest decisions. Inconsistent communication causes agents to make less accurate predictions.

Monetary sector only plays a minor role most of the time. The ECB's statements on the monetary analysis are not an important determinant of its actions.

The surprise component of communication has highly statistically significant effects on exchange rates. The impact of the ECB press conference is economically important. The press conference provides valuable information to market participants.

Both the surprise component of policy actions and official communication have statistically significant and economically relevant effects on equity indices, with statements having a much greater explanatory power of the reaction of stock prices to monetary policy; these results are robust along several dimensions (e.g., generalized empirical likelihood). Central bank communication about its future policy intentions is a key driver of stock returns.

Expected target rate changes and communication decrease volatility, whereas target rate surprises and unorthodox measures increase it. The "calming" effect of communication is reduced during the financial crisis.

Table 2.2 Continues
Central bank communication on three cases

Case One: One Central Bank and its Economy	Research	Methodology	General Findings
The Fed and the US	Ehrmann and Fratzscher, 2013	Tobit models	More active and more consistent communication by committee members improves the predictability of monetary policy decisions significantly. This effect is sizeable as communication dispersion across committee members accounts on average for one third to one-half of the market's prediction errors of FOMC policy decisions. These findings suggest that a collegial communication, which stresses the consensus view on policy inclinations, can enhance the effectiveness of central bank communication.
The Deutsche Bank and the EU	Siklos and Bohl, 2005	Conventional expectations augmented Phillips curve	Speeches by the Bundesbank president dealing with inflation and economic policy are a positive source of conflict in a probabilistic sense. Conflict was not a constant but flared up at times of economic stress and could be exacerbated by the "talking" of Bundesbank officials.
	Siklos and Bohl, 2007	Taylor-rule models	Communication by senior central bank officials represents an instrument of monetary policy that complements changes in interest rates. Moreover, the communication instrument can partly explain how a central bank can respond to real economic developments even as it focuses on an inflation objective. The Bundesbank's President dealing with inflation help explain both interest rate movements as well as the central bank's response to the unemployment rate.
Swiss National Bank and Swiss	Burkhard and Fischer, 2009	Non-parametric	SNB intervention references depreciated the domestic currency for several hours. The case study supports the view that communication is an effective tool for monetary policy in unusual situations as well.

Table 2.2 Continues
Central bank communication on three Cases

Case One: One Central Bank and its Economy	Research	Methodology	General Findings
The BOE and the UK	Reeves and Sawichi, 2007	OLS; GARCH	The publication of the Minutes of Monetary Policy Committee meetings and the Inflation Report significantly affect near-term interest rate expectations, an effect particularly visible in intraday data. The results might also reflect the different mandates of the FOMC and the MPC, with the Fed having greater freedom to interpret its objectives.
	Chortareas and Noikokyris, 2014	Market-based measure	Moreover, the impact of MPC policy decisions on equities depends on the MPC members' voting record publication, especially when the last reveals unanimity versus dissent voting.
Canadian Central Bank and Canada	Hayo and Neuenkirch, 2011	Order probit model of Taylor Rule	Communication, especially speeches and testimony by Canadian Governing Council members, provides a significant and robust explanation of Canadian target rate decisions. However, prior to the introduction of fixed announcement dates, Canadian communication contained more information on upcoming policy moves. Finally, communication by the Fed (more frequent) outperforms Canadian communication in explaining Canadian interest rate decisions.
Reserve Bank of Australia and Australia	Smales, 2012	TARCH and EGARCH	Interest rate futures react strongly to target rate announcements across the maturity spectrum, particularly in short maturity. Furthermore, an asymmetric news effect whereby volatility reacts more strongly to bad news. The December 2007 modification in policy communication has improved ability of RBA to influence expectations.

Table 2.2 Continues
Central bank communication on three cases

Case One: One Central Bank and its Economy	Research	Methodology	General Findings
The Riksbank and Sweden	Andersson <i>et al.</i> , 2006	A model for small open economy	Published inflation reports and speeches also have some impact on short rates. Speeches are found to be a more important determinant for the longer end of the term structure. The conclusion is that central bank communication is an essential part of the conduct of monetary policy.
Case Two: One Central Bank and Other Economy	Research	Methodology	General Findings
The Fed and Argentina	Hayo and Nueunkirch, 2013	GARCH	The US monetary policy and macroeconomic announcements have a significant impact. Argentine markets were more dependent on US news under the currency board as floating exchange rate absorbs spillovers. US-dollar-denominated assets react less to US news than peso-denominated assets
The Fed and Canada	Beck <i>et al.</i> , 2012	Diagonal-BEKK Models	Central bank communication significantly increases the correlation of financial markets within and across the two countries and is particularly important for the correlation of Canadian and US long-term interest rates.
The Fed and seventeen emerging economies	Hayo <i>et al.</i> , 2012	GARCH	Monetary policy actions and communication have a significant impact. Informal communication particularly with higher frequency have a larger influence on returns than do target rate surprises. During financial crisis, central bank communication played an even more pronounced role. American emerging markets react more to communication than do non-American markets.

Table 2.3 Continues
Central bank communication on three cases

Case Two: One Central Bank and Other Economy	Research	Methodology	General Findings
The Fed and the EU and Pacific	Hayo <i>et al.</i> , 2010	GARCH	The US's target rate changes and FOMC communication on European and Pacific equity market returns have a significant impact. European markets are influenced by a greater variety of communication than Pacific markets.
Case Three: Multiple Central Banks and Multiple Economies	Research	Methodology	General Findings
The central banks and the G3 economies	Fraztscher, 2006	EGARCH	Communication exhibited a significant contemporaneous effect on exchange rates and moved forward exchange rates up to 6 months in the desired direction. Communication is found to reduce exchange rate volatility and uncertainty whereas actual interventions tend to raise it. communication tends to be an effective policy tool over the medium-term.
	Fraztscher, 2008	EGARCH	G3 communication policies have constituted an effective policy tool in influencing exchange rates in the desired direction. Communication has been effective independently from the stance and direction of monetary policy and the occurrence of actual interventions. Effectiveness of communication is strongly related to degree of uncertainty and the positioning of participants in FX markets. Interventions affect exchange rates primarily through a coordination channel.

Table 2.2 Continues			
Central bank communication on three cases			
Case Three: Multiple Central Banks and Multiple Economies	Research	Methodology	General Findings
The central banks and the G3 economies	Beine <i>et al.</i> , 2009	GARCH	Appropriate speeches clarifying current intervention policy can have marginally virtuous effects on exchange rate level and volatility. This leads to the conclusion that, in general, actual interventions on the market should still be employed, if official statements are used to clarify nature and purpose of these interventions.
The Fed and the ECB, and the USA and the EU	Rosa, 2011	Event study	Monetary policy actions and statements have important but differing effects on asset prices, with unexpected communication having a much greater impact on longer-term interest rates. The ECB's and the Fed's monetary policy or news shocks successful affect domestic asset prices. The response of the American yield curve to the Fed's statements is larger than the ones of ECB because of larger policy rate cycle in the US. The Fed moves European interest rates better than the ECB to move American rates. This finding shows the predominance of dollar fixed income assets rather than to an attempt of the ECB to mimic the Fed.
Czech Republic, Hungary and Poland	Egert and Kocenda, 2012	A two-stage empirical strategy with GARCH	During the pre-crisis and crisis periods, three currencies react to macroeconomic news during periods in an intuitive manner that corresponds to exchange rate related theories. However, the responsiveness of the currencies to central bank verbal interventions becomes important only during the crisis period.

2.4.2 Methodologies Used in the Literature

In terms of methodology, theoretical research in this topic mostly focuses on transparency and communication design. Empirical research is conducted with time-series models, discrete choice models, panel data models, and non-parametric models. Or the research can focus on communication indexes. The following sections briefly discuss these aspects.

Theoretical Research

Theoretical research mostly discusses central bank design based on asymmetric information and communication signals. Some researchers have focused on the degree of information transparency. For example, Amato *et al.* (2002) propose a small island model that helps in analysing the importance of communication policy. The finding suggests that the economic effects of public information are important, however, the precise public information is a double-edged tool. James and Lawler (2010) theoretically find that greater precision of information provided to wage setters in respect of supply shocks has some, but ambiguous, welfare effects. Kool *et al.* (2011) examine the possible adverse effects of transparency in the Diamond (1985) model with a rational expectation model. Myatt and Wallace (2014) contribute the literature by researching the ideal characteristics of informative announcements in a Lucas-Phelps island economy and find that central bank may prefer the ‘averagely public’ information.

Most of the researchers support that communication is effective in some aspects, which is generally consistent with the empirical findings in the literature that communication has some economic effects on the economy and financial markets. For example, Hoerberichts *et al.* (2008) support that the improved transparency about the central bank’s forecasting procedures improves output stabilization. In the liquidity trap, communication is important for managing market expectations and it helps stabilizing expectations around the inflation target equilibrium, found by Eusepi (2010). With the guidance of Tinbergen’s classical theory of economic policy, Hallett and Acocella (2012) support the argument that communication of future policy can affect an economic platform. Monetary policy is mainly made by the monetary policy committee. Therefore, this aspect has received some attention in the literature. For example, Weber (2010)

who analyses transparency with an individualistic decision-making model and finds that transparency about the different views of members of a committee about the economic outlook is beneficial. Another study of the decision-making group is by Berk and Bierut (2011) who use a single binomial simultaneous voting model and find that communication is a relative effective way to implement the ‘knowledge pooling’ in a monetary policy committee. Since around 2005, empirical research on this topic has developed along the indicated lines.

Empirical Research

Empirical research on the topic has been emerging and has attracted a lot of attention. The commonly used methodologies in this topic are time-series and discrete choice models. Some researchers use panel data models and non-parametric analysis (e.g. Rosa, 2013).

i. Measuring Central Bank Communication

Measuring central bank communication is key to this research and is normally achieved in three ways. The first one is the most widely used approach, which quantifies central bank communication through coding. By analysing the content of communication, aspects such as monetary policy inclination (tightening or easing), attitudes towards economic outlook, hawkish or dovish words, informative and uninformative stance, and the media’s favorableness reflected by headlines of various news, are normally coded from +1 to –1 or even from +3 to –3. Or these coded indexes can be transformed to become aggregated communication indicators (e.g. Berger *et al.*, 2011), for example, to measure inclination based on the benchmark. A few researchers analyse communication with linguistic software. For example, there is also a Swiss Economic Institute communication indicator based on the ECB’s communications about price stability in press conferences that has been used by researchers (e.g. Neuenkirch, 2013a). Hansen and McMahon (2016) use linguistic software to analyse the FOMC’s communications about economic outlook and forward guidance. Iglesias *et al.* (2017) also uses linguistic software to extract words of Central Bank of Turkey, who find the communication’s ability to influence the financial markets through the term structure of the interest rates. This approach may be time-efficient, however, some interpretations may require ‘reading between the lines’.

A few studies incorporate communication into signal functions (e.g. Andersson *et al.*, 2006). Rosa uses a coded index and then makes an analysis to obtain surprise components of communication (e.g. Rosa, 2011). In general, this coded approach may have some drawbacks, mainly the subjectivity problem. Some researchers have discussed this and handled the subjectivity problem by methods such as independent coding, analysing entire statements, and assessing attitudes in media reports. Neutral codes are also hard to judge. Fratzscher (2008) suggests two approaches: dropping the neutrally coded communication, which is used by some researchers (Beine *et al.*, 2009), or focusing on deviations from the predominant policy mantra.

The following are examples of coded communications, which represent supportive attitudes in verbal intervention (Burkhard and Fischer, 2009), the Canadian economic outlook (Hayo and Neuekirch, 2011a), the ECB's communication (Ehrmann and Fratzscher, 2007; Ehrmann and Fratzscher, 2013), and the Fed's communication on four aspects (Hayo *et al.*, 2010; Hayo *et al.*, 2012; Hayo and Neuekirch, 2013b), software-based communication indexes by Born *et al.* (2012) and Born *et al.* (2014) who code communication in financial stability reports, speeches, and interviews of some emerging economies into positive or negative attitudes.

A second approach is to measure central bank communications using the data themselves. For example, the clarity and consistency of communication can be analysed directly based on data (e.g. Jansen and De Haan, 2006; Jansen, 2011). Another example is the frequency of communication per topic in one central bank, which can be used to evaluate the impact of communication (e.g. Siklos and Bohl, 2007). The favorableness index of media communication, which builds on the number of media reports around monetary policy decision days, was introduced by Berger *et al.* (2011) to research the ECB's communication and the media. Further, the dispersion of favorableness index and the content index were created when analysing the media in the Czech Republic (Bohm *et al.*, 2012).

The third approach is to analyse communication indirectly through its impact as reflected by changes in levels and volatility of asset prices; however, the intended direction of asset prices will be not extracted. A common approach is to introduce dummy variables to control meeting days, announcement of voting records, and timing of central bank communications. In the

existing papers, for example, Fratzscher (2008) uses dummy variables for before-meeting, inter-meeting, and after-meeting periods. Chortareas and Noikokyris (2014) examine the BOE with dummy variables for meeting days and voting records. The good news and bad news can be controlled in GARCH-type models to research asymmetric news impacts.

A related feature is the index of central bank transparency. Researchers mostly adopt a transparency index based on several categories, in which central bank communications are included. Then, indexes are regressed on economic determinants (e.g. Crowe and Meade, 2008; Dincer and Eichengree, 2007; Siklo, 2011), for example, using OLS or panel least square fixed effects models with dummy variables for economic characteristics (e.g., Neuenkirch, 2013b).

ii. Empirical Models

After analysing communication, most research on this topic uses empirical methods, such as time-series models, for example, GARCH-type models are frequently used. This discussion may shed light on the following aspects of the empirical research.

In what-to-communicate questions, researchers code certain communications and measure their impact, such as economic outlook, or monetary policy stances. Other researchers focus on specific communications, for example, the forward guidance of the Fed (e.g. Moessner, 2014). In addition, VAR models, such as basic VAR and structural VAR, are used to identify the impulse response of macroeconomic variables (e.g. inflation) to the shock of central bank communication. VAR models are relatively less used; however, in recent years, more papers are using VAR to analyse communication indexes. For example, Giorgio and Rossi (2012) focus on the ECB's communication with a structural VAR model, while Neuenkirch (2013) studies the role of the ECB's communication in monetary policy transmission with a basic VAR. Both of them find that elements of ECB communication (e.g. monetary policy stances or ambiguity) affect real economic variables. The research could be extended to developing economies.

In how-to-communicate questions, communication channels are compared with time-series models (e.g. Hayo *et al.*, 2012). The intermediary (i.e. the media) has been analysed with a favorableness index in panel data fixed effects models (e.g. Berger *et al.*, 2011) and OLS. The

market perception from survey data is normally used when comparing communication models with Taylor-rule models (e.g. Schmidt and Nautz, 2012).

For when-to-communicate questions, papers compare communication before and during crises (e.g. Buchul, 2013; Egert and Kocenda, 2013) in time-series models with dummy variables (e.g. Ehrmann and Fratzscher, 2007; Ehrmann and Fratzscher, 2008; Nautz and Schmidt, 2009). Some research looks into zero lower bound conditions and mostly finds further stabilizing monetary effects of communication, although different methods are used. For example, Burkhard and Fischer (2009) use non-parametric analysis and Campbell *et al.* (2012) use an estimated dynamic stochastic general equilibrium model.

For communication design, researchers mainly use theoretical methods for central bank transparency and communication (e.g. Weber, 2010; Myatt and Wallace, 2014), for example, game theoretical models and island models. Other determinants of optimal communication strategy, such as clarity, are researched by regressing readability statistics on several variables (Born *et al.*, 2012) or by using a novel four-step approach (Bulir *et al.*, 2012). Frequency and intensity have been researched by creating communication indicators or focusing on data. Consistency is measured using dispersion indexes that capture the dispersion of communication (e.g. Jansen and De Haan, 2006; Ehrmann and Fratzscher, 2013). Alternatively, to evaluate whether words match deeds, there are market-based approaches (e.g. Rosa and Verga, 2007) and GARCH-type models (e.g. Siklos and Bohl, 2008).

In terms of impact-type questions, GARCH-type models (e.g. GARCH, EGARCH, FIGARCH) have been widely used on equity markets (e.g. Hayo *et al.*, 2012), on foreign exchange markets (e.g. Fratzscher, 2008), on money and equity markets in China (Ji and Zhou, 2011), on the Fed's spillover effects (Hayo and Neuenkirch, 2011) and on integration effects (e.g. Beck *et al.*, 2012). As discussed above, there are increasing numbers of VAR models on communication effects, although mostly focused on the developed economies. Panel data models with country fixed effects have been applied to a number of economies. The analysis of communication to predict future monetary policy is generally researched with ordered probit or logit models in Taylor rule cases (e.g. Jansen and De Haan, 2009; Pincheira and Calani, 2009;

Hayo and Neuenkirch, 2010; Li, 2011; Schmidt and Nautz, 2012). Non-parametric analysis based on direction criteria is used as well (e.g. Jansen and De Haan, 2007; Ranaldo and Rossi, 2010). In terms of robustness tests, there are some standard methods, such as choosing different data periods or data intervals, using market-based measures instead of survey-based measures, and employing instrumental variables, etc.

Some researchers review findings in the literature. The papers could focus on central bank transparency. For example, an earlier work is the discussion of central bank transparency by Geraats (2002), further extended by Geraats (2006) and Geraats (2010). Issing (2005) and Huang (2007) provide an overview of central bank communication, transparency, and accountability. Ehrmann and Fratzscher (2005) discuss communication and decision-making process by committees in the ECB, the BOE, and the Fed, while De Haan *et al.* (2006) review central bank transparency and communication. Blinder (2006), Ehrmann and Fratzscher (2007), Blinder (2009), and Reis (2013) focus on monetary policy decisions by committees and propose suggestions for improved central bank design. There is a comprehensive literature review on central bank communication and monetary policy in Blinder *et al.* (2008), which has greatly benefited this thesis. Aikman *et al.* (2011) analyse macroeconomic policy-making under uncertainty. Besides general discussions, some researchers look at specific cases. De Haan (2008) places emphasis on the ECB's communications, while Neely and Rey (2010) review the Fed's announcement effects. Geraats (2010) and Knutter *et al.* (2011) focus on communication and its impact on financial stability.

2.5 Conclusion

Central bank communication and monetary policy have attracted a lot of attention in recent times. By reducing market uncertainty and bias, communication helps central banks to manage market expectations and influence financial markets, which makes it a worthwhile undertaking. In this chapter, the general research questions and findings in the literature are discussed, which suggests that there are potential areas for further research. In the extant literature, less emphasis has been placed on developing economies, therefore this study mainly evaluates the effects of central bank communication in the cases of two major developing economies.

Chapter 3

Central Bank Communication in Practice: A Review of Bank of England, The Federal Reserve, People's Bank of China and Reserve Bank of India

3.1 Introduction

In Chapter 2, questions in theoretical and empirical literature on central bank communication have been discussed. This chapter provides information regarding communication in the two developed economies of the UK and the US as well as the two emerging economies of China and India. The reason is to provide background information on central bank communication in practice. The first two central banks are the Bank of England (BOE) and the Federal Reserve System (Fed) of the US. The Fed has been analysed intensively in the literature, which provides a broad framework for central bank communication strategy and implementation that have been largely adopted by the emerging economies' central banks. The other two emerging economies' central banks are the subjects of the following empirical chapters.

The rest of the chapter is structured as follows. Section 3.2 introduces the background of central bank communication in the four countries. Section 3.3 discusses and compares the information provided by the central banks. Section 3.4 presents discussions on research questions and communication in practice. Section 3.5 concludes the chapter.

3.2 The Evolution of Central Banks

The BOE was established in 1694 and is the second-oldest central bank in the world, following the Bank of Sweden (1668). The BOE's main objectives are to maintain monetary and financial stability, as well as to support government policies. Specifically, the BOE is mandated with maintaining price stability based on the government's inflation target. The BOE was granted independence in 1997, so its decisions on monetary policy are made and carried out independently. The BOE is mainly structured and operated by committees. Among them are the Prudential Regulation Committee, the Financial Policy Committee, and the most prominent one, the Monetary Policy Committee (MPC), which consists of nine members. Five are bank staff.

These are the governor, three deputy governors, and the chief economist, plus four external members. The MPC meets eight times a year to set interest rates with the aim of achieving the government's defined inflation target, currently 2%.

The central bank of the United States is the Fed, which was created in 1913 by the Federal Reserve Act. It conducts the country's monetary policy. The structure of the Fed differs from that of BOE presented above. The Fed consists of the Federal Reserve Board, the Federal Reserve Banks and the Federal Open Market Committee (FOMC). The FOMC became part of the Fed between 1933 and 1935. Its main function is to set rates and to take necessary actions in the setting of monetary policy. It also communicates policy and rate changes and other information to the public. The FOMC has 12 members, of whom seven are members of the Board of Governors, plus the president of the Federal Reserve Bank of New York; four of the remaining members are elected on a rotational basis from 11 Reserve Bank presidents. As with the BOE's MPC, the FOMC typically meets eight times in a year.

The PBOC was founded in 1948 when the Huabei Bank, Beihai Bank, and Xibei Agriculture Bank were amalgamated. Its main aims are to promote financial stability and economic development, which are similar to the goals of other central banks. The PBOC is structured as a single body with various departments that include the Monetary Policy Department, Financial Market Departments, etc. The Monetary Policy Committee (MPC) was established in 1997 and is the main monetary policy-making body of the bank, setting monetary policy based on the macroeconomic objectives of the government. The MPC has fifteen members including the governor of the PBOC, senior officials of the governmental departments, and several experts. By contrast with the BOE and the Fed, the PBOC's MPC meets four times a year. Policy rates have a low frequency of change and can be announced at any time.

The RBI was established in 1935 in accordance with the provisions of the Reserve Bank of India Act, 1934. Its basic functions are similar to those of other central banks presented above, such as maintaining financial and price stability while keeping in mind the objective of growth. In 2016, the Reserve Bank of India Act, 1934 was amended to adopt a flexible inflation-targeting (IT) framework. The RBI is governed by the directors of the Central Board, who are

Directors of the Board for Financial Supervision and the Board for Payment and Settlement Systems. The Monetary Policy Committee (MPC) is vested with the responsibility of conducting monetary policy; its first meeting was held in 2016. The MPC has six members that include the staff of the bank and external members and it holds bi-quarterly meetings.

Overall, it can be seen that main aims of central banks and their policy-making committees are similar, although some central banks have a formally adopted inflation target as the main pillar of their monetary policy. Adoption of IT may require more information being revealed to the public about how the target will be met. The degree of independence also varies among the central banks. Some have independence in setting monetary targets and choice of policy instruments to meet the target, while others have only instrumental independence. The Fed falls into the former category, while the BOE belongs to the latter.

3.3 Background to Central Bank Communication

Central bank communication in the four economies are reviewed within three dimensions of communication transmission in practice; the senders (central banks), the intermediators (the media), and the receivers (the public and markets).

The Senders (Central Banks)

Central bank communication comprises information disclosure via formal and informal channels. The channels selected by central banks are different in terms of structure and operations; however, a common objective is to communicate monetary policy effectively. China and India are important developing economies and members of 'BRICS', therefore, lessons derived from these countries have wider implications for the rest of the emerging and developing economies. The UK and US play significant roles in global economic activities as developed economies, and their central banks have high independence and transparency.

i. Origins of Central Bank Communication

Why is central bank communication needed? As discussed above, the increasing importance

of communication results from real economic trends, mainly the increasing degree of central bank transparency, the adoption of IT regimes, and the development of financial markets. These trends have differences within each economy, particularly between developed and developing economies. Communication strategies were adopted earlier in the developed economies from the late 20th century, for example, after the BOE was granted independence in 1997. In comparison, central bank communication only becomes important in developing economies in recent years. However, efforts to improve communication have been seen from these developing economies' central banks, for example, the PBOC's communications have been increasingly noticeable on the bank's formal website. The RBI's communication strategy has also been given good consideration by its Department of Communication.

ii. Monetary Policy Objectives

Central banks develop strategies to achieve monetary policy objectives. Monetary policy institutional arrangements and implementation in each economy might differ. However, despite differences, the broad monetary policy objectives are similar. For example, in the case of the PBOC, it states that 'the principal objectives are stability of price level, full employment, economic growth, balance of international account and financial stability'. These goals can be seen in the other three central banks' objectives. Some unique objectives are largely related to monetary policy regimes. For example, stability of price levels is central to those developed economies with IT regimes. This is the situation for the BOE and the Fed, which both have a formal inflation target of about 2 percent. Notably, India has recently adopted a flexible inflation targeting framework with an upper tolerance limit of 6 per cent and a lower tolerance limit of 2 per cent. This contrasts with the case of China. Although the PBOC places a strong emphasis on maintaining a low inflation level (particularly before 2012, when inflation soared to its highest level after 2010), it does not have an explicit inflation target. Inflation in China has been relatively stable, ranging between 5 and 6 percent over these years, which is much higher than inflation in developed economies.

The IT regimes of the BOE, the Fed, and the RBI require more explanations to the markets about how the formal target will be achieved and maintained. Therefore, a need for greater

transparency and communication arises naturally. Although IT regimes may display smaller communication effects, because markets are already aware of the formal target, it has been counter-argued that because the formal target is likely to vary, there is a need for constantly updated information to be provided to the markets, for example, in the case of the BOE (e.g. Reeves and Swicki, 2007). Also, monetary policy objectives may relate to the emergence of new monetary policy approaches, such as forward guidance, which was initially adopted by central banks in developed economies. A recent demonstration that the RBI is trying to share more information is a new section on its formal website called the Mint Street Memos (MSMs), which provide brief reports and analysis on contemporary topics⁴.

iii. Monetary Policy Committee (MPC)

Monetary policy committees (MPCs) set monetary policy by changing short-term policy rates and applying other measures such as quantitative easing during financial crises. From a traditional monetary policy view, the committee sets the policy rates, conducts and manages open market operations, and also manages the required reserve ratios. These are the most important roles of MPCs in most economies, but committees in other central banks have additional roles. For example, the FOMC specifies communication as a role of its monetary policy conduct, in that ‘the Federal Reserve’s communication of its assessment of the outlook for the economy and its intentions regarding the federal funds rate became a more important policy tool’⁵. Similar directions are found for the MPC of the BOE. This might not be explicitly stated by other central banks, however, it has gradually become an integral part of central bank operations around the world. In the cases of the PBOC and RBI, both central banks communicate via formal and informal channels, notably monetary policy reports. However, the details of communications are more comprehensive in developed countries’ central banks, such as the BOE and the Fed. One reason could be that such communications are formally identified as an essential function of the committee. When the central bank considers communication as one of its roles, it is understandable that more emphasis will be placed on this aspect. The data collection shows that details of the information to be provided by central banks in developed

⁴ From the RBI: https://www.rbi.org.in/Scripts/MSM_MintStreetMemos.aspx.

⁵ From the Fed: https://www.federalreserve.gov/aboutthefed/files/pf_3.pdf.

economies are more comprehensive than such details available in emerging economies.

iv. The Structure of the MPC

The roles of the MPCs are similar, but their structure, degree of independence, and level of transparency as well as the frequency of meetings may differ. The MPC is made up of people like governors, senior officials, and experts. One issue that comes to mind is, how many people are there on the committee? A following question is, how are these members selected? Such questions relate to central bank transparency.

With respect to the number of people on the MPC, such numbers may not relate to economic development or size. For example, the MPC of the BOE has nine members and that of the RBI is six, while the MPC of the PBOC and the FOMC of the Fed have memberships greater than 10 (15 and 12, respectively). However, the compositions of these MPCs share a lot in common. Most MPC members are governors and officials of the central bank, or senior officials of key economic sectors such as finance and academia. The external members are necessary because they bring outside expertise into the MPC. As the BOE argues, the appointment of independent members is designed to ensure that the MPC benefits from the thinking and expertise of external members, which complements the internal expertise. This is similar to the MPCs of RBI and PBOC, which both have three external members in related areas, while all the members of the FOMC are governors and reserve bank presidents. A finding from analysing communication is that although independent experts vote in the MPC, information largely tends to be conveyed by governors and senior officials, for example, in the PBOC's case. Whether differences in structure of MPCs matter to the effectiveness of central bank communication is a subject that requires further research.

v. Decision-making Processes and Communication Strategy

The main function of the MPC is setting up and implementing monetary policy, which involves deliberations during periodic meetings. The traditional monetary policy strategy includes policy rate decisions and open market operations. During periodic meetings, domestic and international economic issues and supplementary material such as surveys and research

papers are considered for policy decisions. There are differences in these decision-making processes and subsequent communications among central banks. This aspect has been looked into by some researchers. For example, Ehrmann and Fratzscher (2005) conclude that the effectiveness of communication is not independent from the decision-making process.

Communication strategies refer to how information relating to monetary policy changes, such as reasons behind policies, are communicated to economic agents in an appropriate way. These MPC strategies are main areas of research in the literature.

The number of members of the respective MPCs appears to be relevant to their decision-making processes and communication strategies. For example, the PBOC's MPC votes with a common threshold of two thirds for acceptance of monetary policy changes. A higher number of members in a meeting may lead to divergent views on economic issues and optimum policy. However, if there is an important and respected figure who tends to be listened to more by other members in the MPC, the potentially differing opinions may tilt towards the dominant view. This might hold for the communication strategy after the MPC meeting. Therefore, the number of people may not be an influential element, since the style of the MPC is largely influenced by its decision-making process and communication strategy.

Decision-making processes may be unique in emerging and developing economies' central banks. For example, although the minutes of MPC meetings of the PBOC are published, there is no information about voting records and how the discussion of the meeting is carried out. The same applies to the case of the RBI before 2015. This contrasts with decision-making processes in the MPCs of developed economies, in which all the necessary details are reported and documented. As a communication strategy, the bank may form the view that a more consistent voice after MPC meetings is preferable. However, the individual views may shed light on thoughts and information. The FOMC has shown tendencies of a collegial communication strategy, which means governors taking the main communication roles, while the Fed pursues a more individualistic communication strategy, which means there is a high degree of dispersion in the individual members' words. However, communications of both the BOE and the Fed are found to have large influence on national and international markets (e.g. Rosa, 2011; Hayo *et*

al., 2012). Overall, this aspect of communication design needs more investigation, as Ehrmann and Fratzscher (2005) suggest that there may not be a single best approach to adopting decision-making processes and communication strategies.

vi. Independence and Transparency of Central Banks

Credibility of the MPC has been cited as an important factor in central bank communication. Related to this aspect is that information needs to be effectively communicated to the general public. These issues have a direct relationship with the independence and transparency of central banks, which in turn will have direct effects on the credibility of MPCs and their decisions and communications. Central banks with a high degree of independence are less controlled by the government and therefore experience less intervention. Some research shows that high central bank independence is beneficial for the economy; however, it is also understandable that different economies have their unique features. For example, the PBOC is a direct part of the government and is subject to the policy goals of the State Council. Smooth coordination of fiscal and monetary policies to attain economic goals of the government could be effective and consequently benefit the economy. However, more central bank independence holds in the cases of the central banks of major developed economies. It is generally argued that a higher degree of central bank independence results in higher transparency, with direct positive consequences arising from the central bank's communications. This is shown in the BOE and Fed as considered here, compared with the RBI and PBOC. The former pair has a higher degree of independence and the latter pair has a limited level of independence. An example here is the governor of the PBOC commenting that 'the communication deficit of the PBOC seems larger, it needs to enhance the communication system'⁶.

Central bank transparency aims to reduce asymmetric information during policy formulation and implementation. It is thus important before, during, and after monetary policy meetings. Before the meeting, notices of fixed dates for press conferences and interviews, and even the potential areas for discussion, will be revealed where central banks have high levels of

⁶ From the Financial Times: <http://www.ftchinese.com/story/001066203#adchannelID=5000> (in Chinese).

transparency. Central banks in emerging economies can change their communication strategy to improve on levels of transparency by adopting pre-announced dates for communication events or monetary policy changes. Taking the PBOC as an example, it did not provide information on fixed dates before 2013, compared with the ECB's regular communication events, such as press conferences. The introduction of this strategy after 2013 is found to have influence on the market, which is analysed in Chapter 4. During the meetings, transparency helps in revealing the tone of the MPC's discussion and the voting process. For example, after 2016, the release of the minutes containing valuable information such as voting records and examination by the MPC of RBI has attracted positive attention in the markets. The period after each meeting can also be considered as the period before the next meeting. During this interval, central bank transparency has a considerable influence on central bank communication. With high transparency, such as with the BOE and Fed, formal and informal communication is published with a shorter time lag and with more comprehensive contents. Compared with developed economies, central banks in developing economies with low levels of transparency tend to engage in poor communication, with negative effects on the markets. For example, some papers (e.g. Hayo *et al.*, 2012a) support the view that more timely and accurate communication is beneficial for the economy, as it is understandable that the markets need to receive information about the last meeting within a reasonable time; however, the publication lags of central banks differ widely. Furthermore, the data collection reveals that the content of communication is reduced and the number of communication events is fewer in the cases of the PBOC and RBI, compared with the BOE and Fed. For example, the BOE provides speeches by MPC members according to topics such as monetary policy, which reveals more transparency.

Surveys, statistics, and research about the economy are generally more available on the formal websites of central banks with higher levels of transparency, which affects research involving market expectations. In both the PBOC and the RBI, the surveys are only done quarterly or bi-quarterly, while some additional surveys that are designed to investigate issues in the real economy are available in the UK and the US. For example, to collect data and information on business investment and financial decisions, the BOE undertakes periodic surveys and receives data from the public, which increases two-way communication.

Information about the models and economic projections is also revealed to the public. However, the central banks of emerging economies have been improving in these aspects of transparency, including the PBOC and the RBI. For example, publication of minutes that contain voting records and other details by the RBI, and the importance of communication emphasized formally and informally by the PBOC, are becoming permanent features of these banks' communication strategies.

The Intermediator (the Media)

Information is transmitted by central banks and their MPCs. Before the public and markets can receive this information, it is also processed via the intermediary, the media. The media relating to financial areas closely watches the statements of central banks, and then principal information is passed to the general public with attention-catching headlines. Therefore, these media sources largely facilitate information transmission. Research on this aspect is still in its infancy and is mainly hampered by difficulty in obtaining reliable data. In existing papers, the evidence is that media expression is strongly related to the original central bank communication. For example, in the EU, the favorableness of the media is influenced by the amount of information communicated by the ECB (Berger *et al.*, 2011). Another paper by Hayo and Neuenkirch (2011a) conclude that the Bank of Canada's official communications have greater influence on the bond market, while media coverage is more relevant for the stock market.

In this information era, there are huge amounts of information processed online or via the print media; however, in each economy, several larger media sources normally receive more attention. This is the case for the four economies here, but one difference is the international coverage of central bank communication. When reading articles from influential media such as the Financial Times and the Wall Street Journal, a noticeable point is that information about developed economies seems to be more dominant over news from developing economies. It is understandable that developed economies overshadow the world economy. However, the question is, if one piece of information from a central bank is covered internationally and not just nationally, would the effects of this information differ on national and international markets? Logically, information has a larger impact if it spreads widely, however, more evidence on this

aspect is needed. In the recent literature, insights from papers analysing spillover and integration effects of communication identify international effects of communication. For example, the Fed's communication has a wider influence on international equity markets, as supported by various papers (Beck *et al.*, 2012; Hayo *et al.*, 2012). In addition to the important role of the US economy, would it be possible that the larger influence of its central bank communication is due to broadly international media coverage? Existing findings suggests that the media is important in effective central bank communication. In practice, central banks have been trying to manage their relationship with the media. For example, the PBOC has introduced periodic meetings with the media since 2013.

The Receivers (The Public and the Markets)

Central banks talk for the receivers, the public, and the markets. Using different channels, communication is received and reflected in several aspects. First, financial markets respond to communication mainly by manifesting volatility in asset prices that has direct effects on returns. One monetary policy objective is financial stability. Formal or informal communication can be used to move markets in desired directions, for example, the use of verbal interventions on foreign exchange markets (e.g. Fratzscher, 2008). Then, the receivers' responses can be documented and analysed, with results that can be used for future monetary policy. In serving this function, central bank communication plays an important role in managing market expectations. Therefore, relevant surveys and responses to communication by central banks and governmental departments are very important. In the four countries discussed here, it is found that surveys in the developed economies are more available and frequent than those in emerging economies. Surveys of the PBOC are carried out quarterly, while surveys of developed economies' central banks are more frequent, such as the monthly published surveys of the Fed.

Central banks lack information about receivers' responses to communication. As communication is intended for the receivers, there is a need for more interactive relations between the senders and receivers. Feedback from receivers should be useful for the improvement of communication, monetary policy formulation and implementation. An existing example is a section provided by the BOE called 'additional statistics requested by users', which

provides useful information requested by receivers, such as monthly consumer credit and gross lending to individuals from monetary financial institutions. Reeves and Sawicki (2007) suggest enhancement of communication by informal and formal discussions between the bank staff, MPC members, and economic agents during regional visits. In practice, these channels provide opportunities for interaction between senders and receivers.

3.4 Contents of Central Bank Communications

The contents of central bank communication have attracted attention. Various questions are discussed in Chapter 2, Literature Review. Here, these questions are briefly reviewed, focusing on the practices in the four central banks.

i. What to Communicate

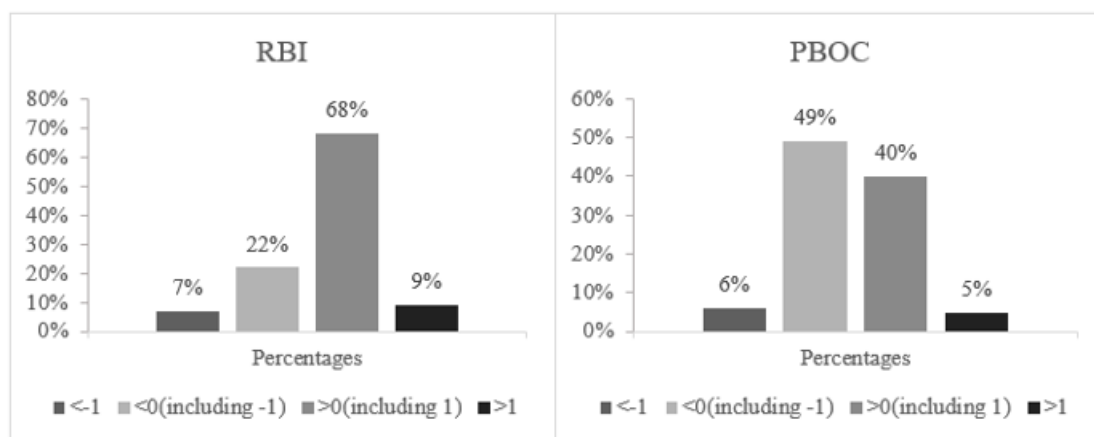
Central banks decide what kinds of information to convey, which are the ‘what-to-communicate’ questions in the research. First, the content of communication is related to events and economic developments. For example, in testimony made by the governor and officials, what-to-communicate questions naturally focus on the theme of the information to be provided. Second, in formal communications that have regular topics, what-to-communicate questions tend to be predetermined, a difference from informal communication. For example, the PBOC’s monetary policy reports normally consist of five sections with topics such as money supply, the economic outlook, and future monetary policy stances. In this case, the markets are prepared to receive the information as the reports are published. In these two approaches relating to content, it is found that the common content is similar across the banks. In the four central banks, the topics normally include the economic outlook, such as inflation expectations, monetary policy actions to deal with areas such as financial stability, and monetary policy inclination.

However, differences among these central banks are found. The first one is the use of forward guidance, which has become popular in recent years. This new unconventional monetary policy tool talks about potential paths of future policy rates, thereby helping central banks influence market expectations even without actual monetary policy action. In other words, such communication is not just ‘cheap talk’, but is based on central bank credibility. Adoption

of forward guidance comes partially as a response to unusual situations such as the zero lower bound rates found in some economies after the financial crisis. It is found that this unconventional monetary policy has been intensively used by the BOE and the ECB. The RBI also specifically includes a section on forward guidance in its formal reports. Although the PBOC gives signals on monetary policy stances, there is no formal forward guidance yet. It is generally found that forward guidance has effects on markets. For example, Moessne (2014) finds that the FOMC's forward guidance increases levels of the US equity market and reduces volatility in the US bond market. However, this is an area that requires further investigation, using real cases of more central banks.

Another aspect of what-to-communicate is verbal intervention on foreign exchange markets. Besides actual intervention, central banks communicate their views and possible actions for stability of exchange rates, but the effect of this may depend on levels of central bank independence and transparency. This strategy is mostly used by the central banks of developed economies, while some developing economies' central banks such as the PBOC appear to use fewer verbal interventions and are also less open. Some empirical evidence supports the effectiveness of verbal interventions (e.g. Fratzscher, 2008; Rosa, 2011), but more research is required to shed light on its importance and the mechanism through which this communication impacts on market behaviour. Last, tendencies in communication are also found to be different among central banks. For example, the PBOC's communication about monetary policy stance tends to be more expansionary. The following figures compare communication indexes that serve as proxies for monetary policy stances of the PBOC and the RBI. These communication indexes are created based on the narrative approach discussed in the literature and are used in the following empirical research. Index values above 0 indicate a tightening inclination, while those below 0 show an expansionary monetary policy inclination (MPI). The details are discussed in the empirical chapters. Here is Figure 3.1 about the distribution of the MPI indexes of RBI and PBOC.

Figure 3.1: Distribution of the MPI indexes of the RBI and the PBOC



The above figures show clear differences of the same topic between the two central banks. From 2010 to 2014, the RBI tends to signal a generally tightening monetary policy inclination, reflected by the highest bar (68%) in Figure 3.1 (a), while the PBOC mostly communicated with an easing monetary policy inclination, shown by the highest bar (49%) in Figure 3.2 (b). This might be also influenced by the economic conditions in China and India during that period, when China was faced with shrinking GDP growth, while the RBI mainly dealt with inflation. Besides MPI index shown above, central banks tend to have their own preferences on topics about economic outlook, for example, a tendency to convey positive outlook in some central banks. This is shown more in the third empirical chapter about figures of PBOC and RBI's communication indexes.

ii. How-to-Communicate

After deciding the content of communication, central banks choose channels to transmit information. There are two options, which are formal and informal channels. The formal channels are normally various reports that have a predetermined element and publication lag, such as the minutes of monetary policy meetings, monetary policy reports, and financial stability reports. As discussed above, the aspects of communication in these reports are largely expected, therefore they represent more regularity and stability. Informal communication such as speeches and interviews are made by members of MPCs or a representative from a collegial perspective; this information is communicated in more vivid and less predetermined forms, which provides more flexibility. However, such communication also contains the risk that an

individual perspective may diverge from the group point of view.

The features of communication channels, therefore, present an important question in deciding how to choose between formal and informal channels. In the samples here, a closer look shows that most communication occurs through informal channels, in particular through speeches in which governors take the main responsibility. Although formal communication is generally less used by central banks, the mixture between the two channels appears to vary among central banks. For example, the PBOC uses more formal communication, while a more balanced combination of communication channels is found in the RBI. This indicates different tendencies of channel use and communication style by central banks.

Table 3.1: Types of channels and formal surveys of the central banks

Numbers	Formal Channels	Common Example	Informal Channels	Common Example	Formal Surveys	Common Example
BOE	10+	Inflation Report	4	Conference	4+	Inflation Attitudes Survey
Fed	8	FOMC Statement	4	Testimony	4+	Survey of Consumer Finances
RBI	8	Monetary policy report	4	Speech	4	Survey of professional forecast
PBOC	6	Financial Stability report	4	Interview	3	Survey of Urban Household

Source: Formal websites of the four central banks; Common channels includes information about economic outlook or monetary policy stances. Numbers of surveys are approximately accounted.

The above table, Table 3.1, provides information about communication channels and formal surveys of the central banks. It shows that compared with the RBI and PBOC, BOE and the Fed have more formal channels and formal surveys.

iii. When-to-Communicate

Having determined content and channels of communication, the next question is when to release information. When-to-communicate questions are mainly about publication lags and

purdah periods. The former matters for formal communication that controls days specified for information disclosure, whereas the latter focuses on informal communication, mainly speeches before and after policy meetings. Compared with other questions, this aspect has received less attention in the literature. However, the scanty evidence available, such as in Ehrmann and Fratzscher (2009), suggests that financial markets are very sensitive to communication, particularly before and after policy meetings. This means that the markets are waiting for information. Common sense assumes that the timelier the information is, the more useful it is to the markets. This is because the quicker the markets receive the anticipated information, the larger is the reduction of information asymmetry between central banks and markets. An early example is that before October 1998, the BOE published reports with a six-week lag, but a lag of only two weeks was introduced from 1998 after the bank's independence. This is supposed to provide quicker information and keep markets up to date with developments.

iv. Communication Environment and its Effect

Central bank communication sometimes helps in dealing with unusual situations. Two situations are mainly discussed here, the 2007 financial crisis and the zero lower bound condition, which are real-time issues. First, central bank communication can move markets in desired directions by shaping expectations, so it has been used to promote financial stability and inform the markets of its macro prudential policy. This has been increasing in importance in both developed and developing economies after the financial crisis. In practice, the primary channel is the annual or bi-annual financial stability report (e.g. the annual FSR of the PBOC, the bi-annual FSR of the RBI). The structure and elements of this report are different from other formal communications, because it contains details about potential reforms and changes of policies specifically about financial stability, although less information is included about economic outlook and monetary policy stances. In addition to this report, there are also irregular informal communications about this issue. In the four central banks covered, communication about financial stability is more dominant in the BOE and the Fed compared with the PBOC and the RBI. One reason could be that the former pair was more affected by the financial crisis, considering the origin of the problems. Some findings in the literature support the effectiveness

of communication in the financial crisis in providing a calming effect on the markets, such as the Fed's communication on the US market (Hayo *et al.*, 2012b).

Second, central bank communication becomes important at the zero lower bound. Due to financial crisis and quantitative easing (QE) programmes in some developed economies, interest rates were cut to a low level. In such situations, further expansionary stances and management of market expectations are helped by unconventional monetary policy such as forward guidance. The BOE, the Fed, and other central banks tend to believe in the effectiveness of forward guidance. This has some support from the empirical literature (e.g. Buerkhard and Fischer, 2009; Moessne, 2015; Coenen *et al.*, 2017). In comparison, forward guidance is largely absent in developing countries. One reason for this is perhaps that these economies' policy rates have not approached the zero lower bound. However, a clear path of future policy rates would be helpful in shaping market expectations, irrespective of whether the economy is developed or emerging. For example, the PBOC changes policy rates irregularly and with low frequency, but there is a good attempt to convey information about its future policy stance. The RBI, on the other hand, has explicitly incorporated forward guidance occasionally in some formal reports, and although the content may not always focus on the path of interest rates, it provides valuable information about future monetary policy stances.

There are other unusual situations that can heighten uncertainty in an economy. Two recent examples are the Brexit and the ending of QE programmes. On the morning that the news of Brexit came out, the British pound depreciated hugely. The governor of the BOE, Mr Mark Carney, made a speech that provided reassurance about exchange rate stability. This had positive effects on the markets, as volatility subsided. The second example is the announcement of exiting QE. An article published on July 19, 2017 in the Financial Times commented about a suggestion made by ECB chief Mr Mario Draghi in late June at the ECB's annual forum⁷. The statement that 'reflationary' forces had replaced deflationary tendencies was originally intended to provide reassurance that the economic outlook was on track. However, this led investors to believe that the bank was about to tighten its policy and exit the QE programme. The article

⁷ From the Financial Times: <https://www.ft.com/content/28c00070-6b16-11e7-b9c7-15af748b60d0>.

referred to a precedent for this, the 2013 ‘taper tantrum’, when the Fed suggested that it would be winding down its QE and both dollar and Treasury yields soared. These events suggest that in certain situations, communication has potential effects in both directions on markets if communication is not properly conveyed. In Chapter 4, the dispersed communication of the PBOC was found to increase market volatility.

3.5 Conclusion and Potential Areas of Improvement

This chapter discusses central bank communication as practiced by central banks in both developed and emerging economies, the former represented by the BOE and the Fed and the latter by the PBOC and the RBI. The aim is to take a closer look at central bank communication in practice, from the perspective of these central banks’ operations. The above discussion shows that communication is becoming essential for effective monetary policy implementation.

Several questions have been briefly discussed, using examples from the four central banks. It can be concluded that, first, central bank independence, and in particular transparency, have direct implications for the effectiveness of central bank communication. The transparency index shows that the developing economies have lower levels of central bank transparency (e.g. Dincer and Eichengreen, 2014). In contrast, central banks in developed economies have higher levels of transparency, which tend to have positive effects on communication. Second, on what-to-communicate questions, there is a need for the inclusion of more comprehensive and consistent information on monetary policy stances in developing economies. In terms of the receivers of these communication, economic surveys and timely feedback could be more helpful, because they provide beneficial information regarding monetary policy decisions and implementation. Third, central bank communication is useful in unusual situations. In response to crises, central banks of these countries have adopted coordinated information dissemination as an additional tool of monetary policy. This includes the forward guidance policy of the BOE. Uncertainties around Brexit create another extraordinary circumstance in which the BOE deployed communication as a means of calming down the markets. The forward guidance policy could be introduced and improved by developing economies’ central banks.

Chapter 4

An Empirical Analysis of Chinese Financial Markets Responses to the People's Bank of China's Policy Communication

4.1 Introduction

Central banks formulate monetary policy, thereby directly influencing financial markets in the short term. An unconventional tool of monetary policy that is growing in importance is central bank communication. Central banks' transparency was not treated with great importance until recently, and monetary policymaking was largely conducted with secrecy. Since the 1990s, there has been a clear trend with central banks enhancing transparency when they communicate their policy formulations and implementation plans to economic agents (Geraats, 2000). Accordingly, procedural and policy implementation have been handled with greater transparency. Together with the increasing demand for transparency, central banks are providing information such as rationales behind policy decisions, economic forecasts, and monetary policy inclinations to the public.

Central bank communication is the provision of information by central banks to the public on policy issues through formal and informal channels, such as written reports, press conferences and speeches (De Haan *et al.*, 2007). An important role of communication is to manage market expectations, which matter for financial markets and the economy (Blinder, 1998). Well-communicated information makes markets more efficient and lowers volatility (Kahn, 2007), and therefore helps central banks achieve monetary policy objectives. This is because credible communication reduces information asymmetry by signalling these banks' policies, economic outlooks, etc.

The effectiveness of communication has been discussed in Chapter 2, which concludes that communication has effects on financial markets. For example, some papers investigate the contents of communication, which focuses on aspects such as economic outlook (e.g. Rosa, 2011; Hayo *et al.*, 2012; Campbell *et al.*, 2012). Another aspect is the study of communication

channels, which is mainly concerned with the effect of communication strategies (e.g. De Haan, 2008; Berger *et al.*, 2011). The issue of ‘how-to-communicate’ can be analysed in terms of using formal versus informal communication. Although most of the research focuses on formal communications, such as minutes and quarterly inflation reports (Reeves and Swicki, 2007), financial stability reports (Born *et al.*, 2012), the ECB’s press conference (e.g. Conrad and Lamla, 2010; Berger *et al.*, 2011; Hussain, 2011), there is no consensus on which is more effective (e.g., Ehrmann and Fratzscher, 2007; Hayo and Neuenkirch, 2011). The existing findings are mixed. For example, Reeves and Swicki (2007) report that the BOE’s speeches have less effect on the markets relative to the bank’s minutes and inflation reports. Hayo *et al.* (2010) find evidence that speeches have larger impact, while infrequent report and testimonies have less effect on the EU and Pacific markets.

Chapter 2, Literature Review, shows that research on central bank communication mainly focuses on developed economies and their central banks, such as the ECB and the Fed. However, as argued by Neuenkirch (2011) and Knutter *et al.* (2011), effective central bank communication is equally fundamental for developing and emerging economies, which constitute substantial global output. This is a main gap found in extant literature on this topic. Therefore, the main aim of this thesis is to analyse effects of communication on financial markets in emerging economies, which are shown in the three empirical chapters. Chapter 4 and Chapter 5 look into central bank communication in China as part of the emerging economies and ‘BRICS’. Another important economy and close neighbour of China, India, is analysed as a focus in Chapter 6.

The aim of this chapter is to analyse the effects of central bank communication on financial markets. It is found that the previous studies on PBOC’s communication use less comprehensive communication indexes. Besides, the analysis of PBOC’s communication strategies was overlooked in the literature. Therefore, the main contributions of this chapter, which is also mentioned in Introduction, are presented here. First, it analyses the credibility of the PBOC which was less covered in the extant literature. Second, the chapter uses more comprehensive communication indexes that better reflect communication’s effects. Third, the creation of a

communication index on world economic outlook to examine ‘what-to-communicate’ questions. Fourth, the effects of communication on foreign exchange markets are extended compared with previous literature on the PBOC. Finally, the three PBOC’s communication strategies are tested for effectiveness on the interbank money market. The main findings of the chapter are: (i) the PBOC has been found to possess credibility – its words matched its deeds; (ii) the PBOC is found to influence the three financial markets in China (i.e. interbank money market, equity market, and foreign exchange market); (iii) informal communication shows a larger effect in general, particularly for monetary policy stances; (iv) three communication strategies of the PBOC found during data collection (e.g., the same-day communication) influence on the money market in China, particularly on reducing its volatility.

The remainder of this chapter is organized as follows. Section 4.2 discusses data and construction of communication indexes. Section 4.3 presents methodologies. Section 4.4 considers the credibility of the PBOC. Section 4.5 presents the estimated results. Section 4.6 concludes and discusses policy implications.

4.2 Data and Communication Index Construction

The focus is on three financial markets. These are the Chinese interbank money market, which is supposed to be directly influenced by the PBOC; the Chinese equity market, which is a hot issue in China; and the foreign exchange markets, focusing on five currencies: US dollar, British pound, euro, Hong Kong dollar, and Japanese yen. Shanghai Interbank Offer Rates (SHIBOR), the most liberalized and important money market rates in China, are used as proxies for money market performance⁸.

The aim is to see whether the three markets are affected by the PBOC’s communication. Given that the equity market is not directly influenced by the PBOC, the effect of communication is interesting to find out. Among several stock exchanges (e.g. Shanghai Stock Exchange and Hong Kong Stock Exchange), Shanghai Stock Exchange is the premier stock exchange in mainland China. It is closely watched nationwide and contains larger size

⁸ Data from SHIBOR’s website: <http://www.shibor.org/shibor/web/DataService.jsp>.

enterprises, while Shenzhen Stock Exchange lists more medium and small size firms. Furthermore, Shenzhen Stock Exchange follows the performance and fluctuations of the Shanghai Stock Exchange. Therefore, the Shanghai Composite Index (SSE) is used as a proxy for the Chinese stock market⁹. This index is a capitalization-weighted index from November 19, 1990 and is the leading stock exchange index of mainland China. Similar with other economies, the foreign exchange market¹⁰ plays a key role in China; however, there is little research about this market and communications of the PBOC, therefore it is meaningful to look at this aspect. The daily data including communication indexes cover a five-year period from 04/01/2010 to 31/12/2014, over which the PBOC's communications increased noticeably compared with previous years.

The communication index is the main interest of this topic, central bank communication. In Chapter 2, the literature review chapter, three ways on how communication indexes are constructed are discussed. For clarity, here are some discussion about communication indexes in this thesis. 1). Where to get communication data? Communication data used in the three empirical chapters are from formal websites of PBOC and Reserve Bank of India (RBI). 2) How to get communication indexes? It could be said that two ways are used in this general topic. The first approach is by researchers who read communication and the other is by computer software that capture certain words. Most of the studies in the literature, particularly the papers about PBOC (e.g., Ji and Zhou, 2011), used the former approach. In terms of the PBOC, it is found that the official language sometimes tends to be obscure, for example, changes of repo rates are rarely mentioned. This could be the case for other central banks. Then, researchers usually prefer reading between the lines, to code communication indexes. In this study, nearly all formal and informal communication data are read and then coded for indexes. This is also a contribution talked earlier that the reading process brought some ideas to this study. For example, the PBOC talks about the global economic outlook, then, this aspect of information was coded for a new communication index. 3). How to reduce subjectivity? A drawback for human computed index is subjectivity, also discussed in some literature. In this thesis, first, the

⁹ Data from Shanghai Stock Exchange: <http://www.sse.com.cn/market/sseindex/overview>.

¹⁰ Data from State Administration of Foreign Exchange: http://www.safe.gov.cn/wps/portal/sy/tjsj_hljzj_inquire.

original communication data from the PBOC's website were read twice. Each time the communication indexes were recoded, then, the research checked for the consistency of communication indexes. Second, this chapter uses relatively high frequency of data, the daily data, to focus on the impact of communication. Third, the communication indexes about PBOC and RBI have some co-movement with economic indicators such as inflation and repo in the economies, shown from this chapter to Chapter 6. Fourth, in Chapter 5 about PBOC and Chapter 6 about RBI and PBOC, three types of aggregated communication indexes are tried to reduce subjectivity. Lastly, with these communication indexes, there are some consistent findings with the literature in each empirical chapter.

4). What aspects of communication are analysed? In the case of PBOC, the previous studies normally focus on monetary policy inclination, very few papers analyse the communication about domestic economic outlook that used by some studies on developed economies' central banks. During the data collection, it is found that PBOC talks about world economic outlook, which is a case for other central banks. However, the relevant communication index is rarely used not just in the case of PBOC. More studies could use this aspect of communication as a new index. In this chapter on financial market, three communication indexes are used. In the next chapter, the communication about money supply is added, in addition to domestic economic outlook and inflation.

5). What is the frequency and time interval of communication data? The data is generally from 01/01/2009 to 31/12/2015. This chapter uses daily data from 04/01/2010 to 31/12/2014 from Chinese financial markets, while Chapter 5 uses quarterly data about China from Q1/2009 to Q4/2015 and Chapter 6 uses monthly data from 01/2010 to 12/2015 based on the macro economy in China and India. The similarly time interval is convenient for general findings. Another reason is that there are very few data about communication before 2009 on the PBOC's website, which might be a reason that some studies on PBOC only code formal communication or monetary policy inclination.

Here is an example. More details are provided in Appendix.

Example: In the PBOC's monetary policy report of on November 5, 2013, it emphasised that 'in the near future, the economy would make progress while maintaining stability, but the economy still faces a lot of risks and challenges. The foundation of the price level is still

unstable. Because of relative sensitivity of demand sides, we should continue to guide and to manage the inflation expectation'¹¹. The information mainly focuses on inflation, therefore MPI (monetary policy inclination) index is coded as +1 indicating that the PBOC would place emphasis on the potentially rising inflation to make it change from current 'unstable' situation to a stable one.

Communication indexes capture communication regarding the domestic economic outlook, the world economic outlook, and monetary policy inclination. Considering the content of communication, economic outlook is about future macroeconomic conditions that have shown effects on financial markets in developed economies (e.g. Rosa, 2011; Hayo *et al.*, 2012b). However, while economic outlook in the literature normally focuses on the domestic economy, it is found that central banks also convey views about the world economy. In the case of the PBOC, therefore, the extension to communication of the world economic outlook is of interest and is examined in this chapter. This is in line with a study about the PBOC's communication index over the same period (Lin and Zhao, 2015), which argues that the world economic outlook should be included in communication indexes. In terms of communication, formal communication includes the minutes of meetings, monetary policy reports, international financial market reports, and financial stability reports. Informal communication is normally interviews, testimonies, conferences, and speeches of central bankers.

The study uses the narrative approach discussed above, where a coded index is based on the tone, intensity, and previous communication attitudes. Overall, from January 2010 to December 2014, there are 217 overall domestic economic outlook indexes (the central bank predicts whether the domestic economic trend will be positive or negative), 144 overall world economic indexes (the central bank predicts whether world economic trends will be positive or negative) and 207 overall monetary policy inclination indexes (the central bank signals whether monetary policy will be easing or tightening up), respectively.

¹¹ From the PBOC's website:
<http://www.pbc.gov.cn/zhengcehuobisi/125207/125227/125957/125991/2907288/index.html> (in Chinese).

Here is the descriptive statistics table of the variables.

Table 4.1: Descriptive statistics

<i>Series</i>	<i>Mean</i>	<i>Std. Dev</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Obs.</i>
SHIBOR from overnight to 1Y					
O/N	2.77	1.09	9.58	1.03	1247
1W	3.45	1.22	9.07	1.36	1247
2W	3.78	1.32	9.06	1.41	1247
1M	4.23	1.34	9.70	1.74	1247
3M	4.27	1.14	6.46	1.83	1247
6M	4.19	1.00	5.52	1.91	1247
9M	4.25	0.96	5.25	2.06	1247
1Y	4.34	0.93	5.26	2.25	1247
Shanghai Stock Exchange Composite Index (SSE)					
Ln (SSE)	7.79	0.14	8.10	7.58	1182
the exchange rates					
US Dollar	6.38	0.23	6.83	6.09	1164
Pound	10.13	0.38	11.19	9.16	1164
Euro	8.50	0.51	9.92	7.46	1164
HK Dollar	0.82	0.04	0.88	0.01	1164
Yen	0.07	0.01	0.08	0.05	1164
the overall communication indexes					
DEO	0.12	0.39	2.50	-1.50	1247
WEO	0.00	0.30	2.00	-2.00	1247
MPI	-0.02	0.37	2.50	-2.00	1247

Table 5.1 provides some information about the data. Then, the following parts analyse each communication indexes, the main interests of this study.

i. Communication on Domestic Economic Outlook (DEO)

The domestic economic outlook, DEO, is coded from -2 to $+2$ according to its expressed degree of likelihood. For example, if the central bank predicts that the domestic economic trend is very likely to be positive, then its communication will be coded as $+2$. In this case, most indexes are in the interval from -1 to $+1$. These can be summarized as the following.

$$DEO = \begin{cases} > 0 & \text{positive domestic economic outlook} \\ < 0 & \text{negative domestic economic outlook} \end{cases} \quad (4.1)$$

where positive domestic outlook refers to the PBOC’s prediction that domestic economy will rise, and a negative index means that the bank predicts the trend fall.

Figure 4.1: Overall DEO communication index

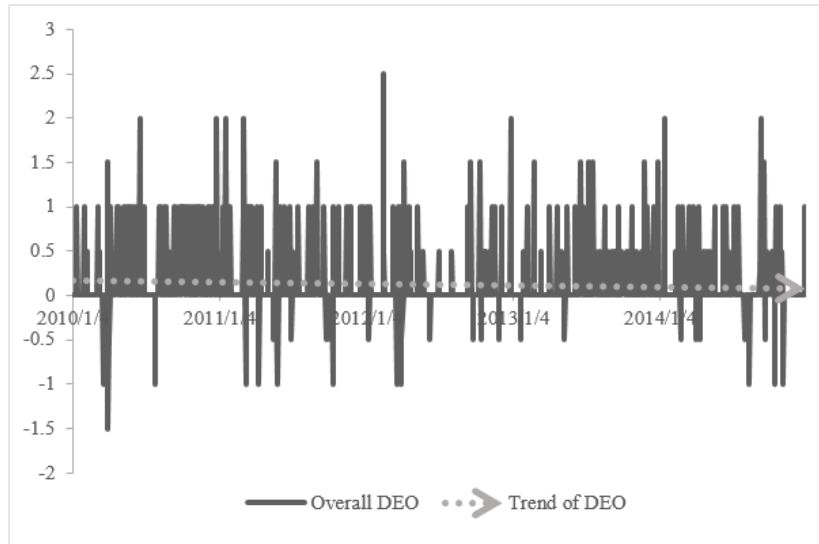


Figure 4.1 illustrates that the DEO slowly decreases, which is shown by the dashed line representing the trend. This is consistent with changes in China’s economic conditions in recent years, mainly because of the transformation of domestic economic structures, looming real estate market bubbles, and the worldwide financial crisis.

Figure 4.2: Distribution of overall DEO communication indexes

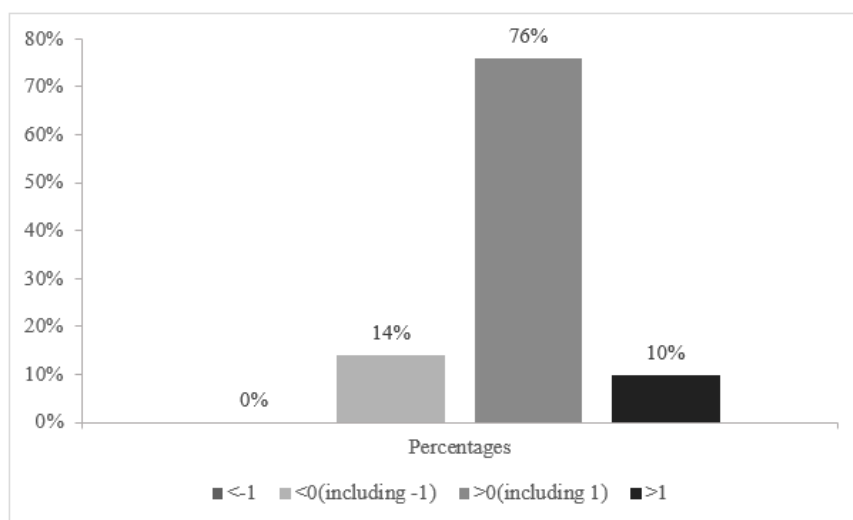


Figure 4.2 shows that Chinese central bankers and executive government officials tend to

communicate with a positive attitude when it comes to the domestic economic outlook. In the data collection and reading of communication of central banks, a rather positive tone about domestic economic outlook is usually conveyed.

ii. Communication on World Economic Outlook (WEO)

The PBOC also communicates its views about the world economic outlook, in line with other central banks. This element was overlooked in the literature, however, the PBOC’s efforts about this communication were noticed in the data collection. Therefore, this idea leads to the question of how this information impacts on Chinese financial markets. The world economic outlook index (WEO) is given as follows:

$$WEO = \begin{cases} > 0 & \text{positive world economic outlook} \\ < 0 & \text{negative world economic outlook} \end{cases} \quad (4.2)$$

where a positive index refers to the view that world economic trends will rise, while a negative index means that the PBOC presents a view that the trend will fall.

Figure 4.3: Overall WEO communication indexes

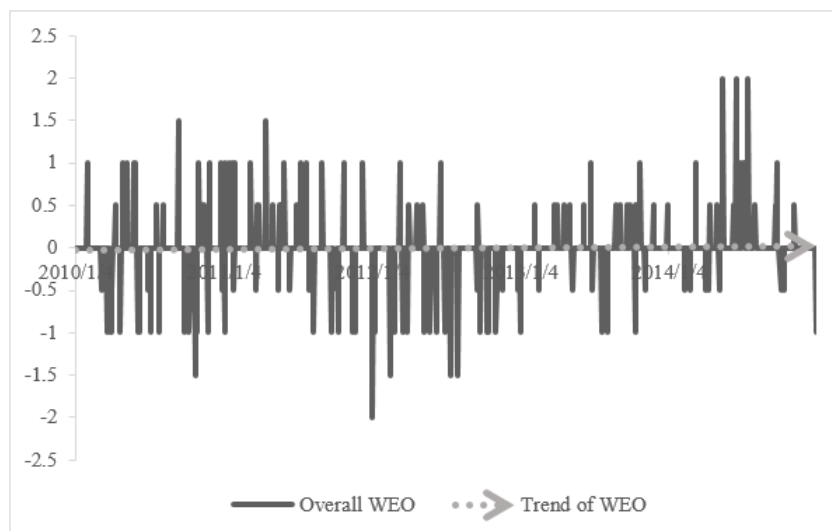
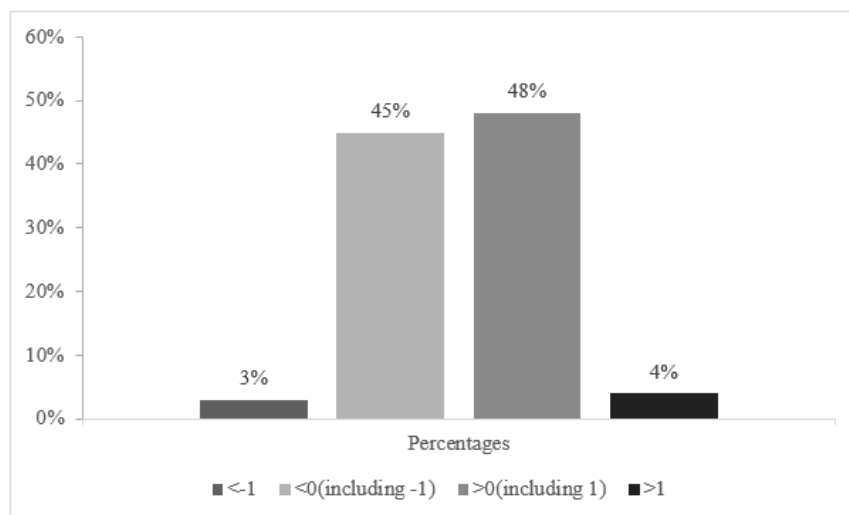


Figure 4.3 shows that there is a very gradual, but steadily increasing positive tendency in the PBOC’s communications about the world economic outlook, which corresponds with real world economic performance. The worldwide subprime crisis receded from around 2012 and the figure indicates that this is the period when the overall trend starts to become positive,

although very marginally. Bars with positive values become more frequent, especially after 2014, compared with previous years.

Figure 4.4: Distribution of WEO communication indexes



Compared with percentages of domestic economic outlook indexes in Figure 4.3, Figure 4.4 shows that the Chinese central bank’s communication about the world economic outlook is more conservative. This means that the PBOC tends to talk with less positive attitudes about the world economy than it shows towards information about the domestic economic outlook. The negative and positive communications share nearly the same percentage, 45% and 48%, respectively. These are points of difference with the analysis in Chapter 6 of the RBI.

iii. Communication on Monetary Policy Inclination (MPI)

This index is based on the PBOC’s inclination of monetary policy: tightening or easing signs. For example, if the governor communicates that a high inflation rate needs to be tackled, the communication is coded as +2. The monetary policy inclination is coded as follows, similar to the DEO and WEO indexes.

$$MPI = \begin{cases} > 0 & \text{tightening monetary policy inclination} \\ < 0 & \text{easing monetary policy inclination} \end{cases} \quad (4.3)$$

Here are figures about the MPI index.

Figure 4.5: Overall MPI communication indexes

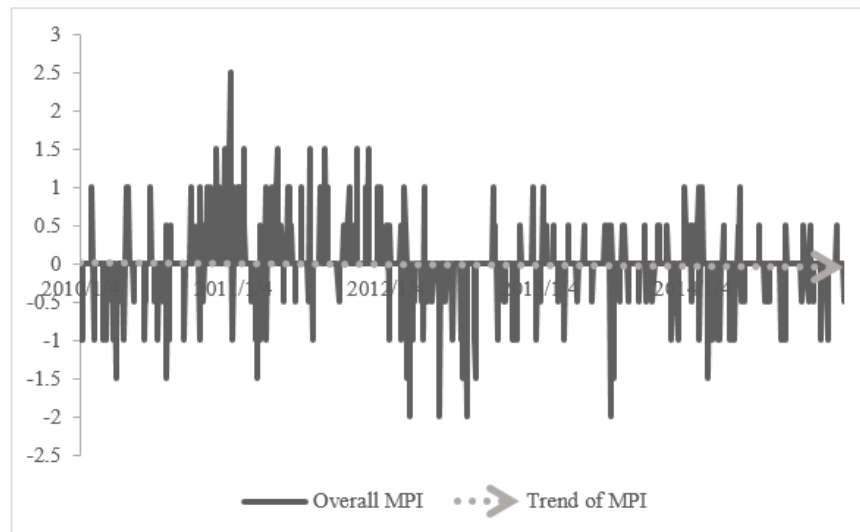
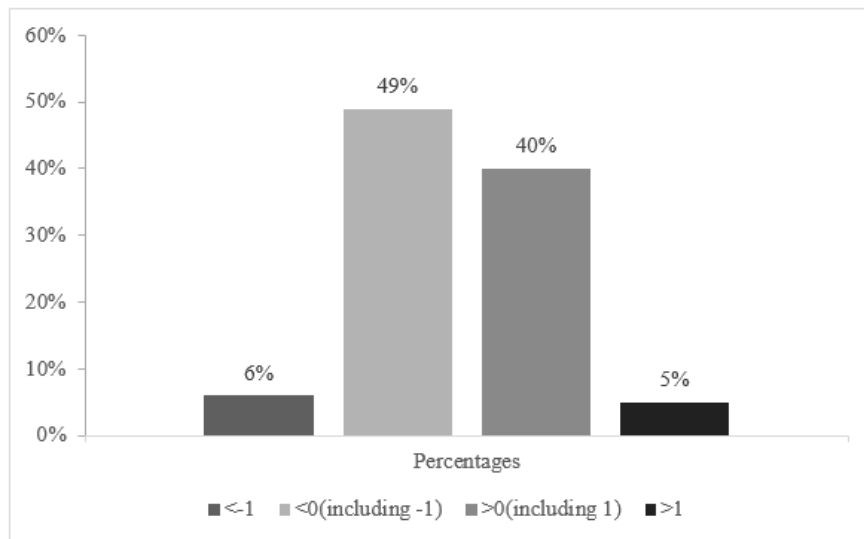


Figure 4.6: Distribution of overall MPI communication indexes



Since January 2011, the PBOC has moved from a slightly easier monetary policy to a prudent monetary stance. There are more positive (tightening) inclinations in 2011 than in 2010, because of the emphasis on dealing with rising inflation from mid-2012, which is shown in Figure 4.5. However, the direction started to change, for example, an easing monetary policy since 2012 is found. Mainly because of concerns about downward economic pressure, the prudent monetary policy shifted towards a slightly easing stance. This is captured in Figure 4.6,

where easing monetary policy inclination indications contribute to more than half of communication on monetary policy inclination (55%).

4.3 Methodologies

The methodology is presented at first to discuss about methods for coding communication indexes. Then, Section 4.3 presents some analysis of the communication indexes.

In line with the relevant papers analysing communication's ability to move markets, such as Ehrmann and Fratzscher (2007), Hayo *et al.*, (2012) and Buchel (2013), EGARCH models are used. This is mainly because, first, the EGARCH models would capture skewness and kurtosis, and second, they are relatively convenient to use and fit communication indexes on financial markets. The mean equation is represented as:

$$r_t = a_0 + a_1 r_{t-1} + \beta_i \sum_i CI_t^i + \gamma Z_t + \varepsilon_t \quad (4.4)$$

where r_t is the SHIBOR rate, the domestic equity market, and the Renminbi's exchange rates with five currencies (i.e., US dollar, British Pound, Euro, Hong Kong dollar, Japanese Yen). CI_t^i denotes the three communication indexes that discussed in the following section and Z_t is the vector of control variables including the announcement of macroeconomics news (e.g., CPI, GDP). The variance of the model is:

$$\log(\sigma_t) = \omega + a_5 \log(\sigma_{t-1}^2) + a_6 \left[\frac{|\mu_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] + a_7 \frac{|\mu_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \lambda_i \sum_i Comdays_t^i + \gamma ZD_t^h \quad (4.5)$$

where $Comdays_t^i$ are days of communication events and ZD_t^h are control variables for macroeconomic announcement.

The SHIBOR, the SSE, and the exchange rates are subjected to unit root tests using the ADF, PP, and KPSS methods. The results are reported in Table 4.2.

Table 4.2: Unit root test

SHIBOR from overnight to 9-month						
	ADF		PP		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
O/N	-7.55***		-6.87***		0.86 ###	0.02
1W	-6.74***		-6.67***		1.07 ###	0.02
2W	-6.04***		-5.57***		1.14 ###	0.02
1M	-4.88***		-4.15***		1.07 ###	0.02
3M	-2.18	-11.81***	-2.15	-17.76***	1.38 ###	0.15
6M	-2.39	-9.92***	-2.38	-22.59***	1.68 ###	0.62
9M	-2.38	-7.72***	-2.50	-17.75***	1.84 ###	0.73
Shanghai Stock Exchange (SSE) Composite Index						
Ln(SSE)	ADF		PP		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
	-1.56	-33.8***	-1.57	-33.8***	2.86 ###	0.61
the exchange rates						
	ADF		PP		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
US Dollar	-2.04	-32.2***	-2.00	-32.2***	4.11 ###	0.45
Pound	-2.59*	-36.8***	-2.60*	-36.8***	1.72 ###	0.06
Euro	-2.04	-36.0***	-2.01	-35.9***	2.63 ###	0.08
HK Dollar	-2.51	-3.49***	-27.4***		0.50	
Yen	0.68	-34.8***	0.68	-34.9***	3.51 ###	0.57
the overall communication indexes						
	ADF		PP		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
DEO	-36.15***		-36.24***		0.73##	0.08
WEO	-33.52***		-34.03***		0.43#	0.16
MPI	-32.00***		-33.57***		0.39#	0.07

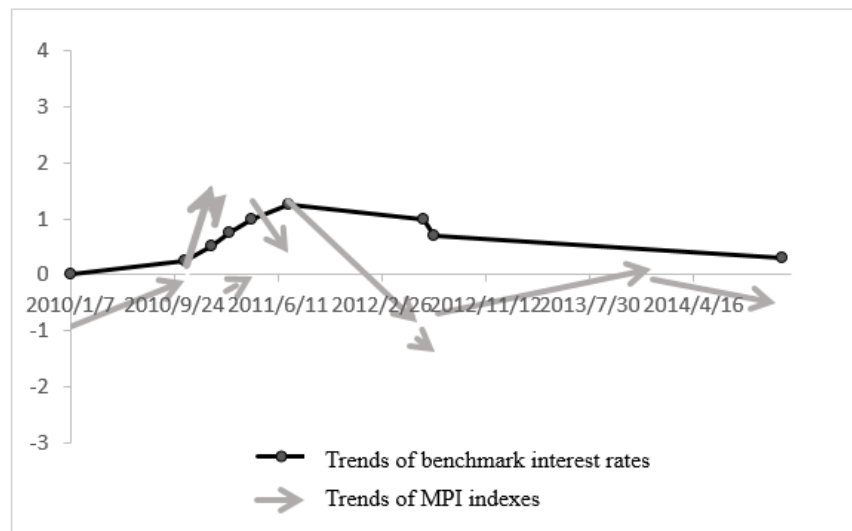
Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively; the ###, ## and # indicate insignificant at the 99%, 95% and 90% levels, respectively.

4.4 Central Bank Credibility: Words Versus Deeds

It is important to compare what the central bank does with what it says. If a central bank does not do what it has conveyed to the economic agents, this will undermine its credibility and market confidence. In contrast, high central bank credibility can command market confidence and, therefore, put the bank in a better position to manage market expectations. It is difficult to match the central banks' words with their deeds exactly; however, central banks' communications should at least partly match their actions. In other words, the sign of the correlation between communication and action should be positive (Berger *et al.*, 2011). The PBOC relies on the benchmark interest rates, the reserve requirement ratio (RRR), and open market operations as its main monetary policy tools to influence the financial markets. However, it does not regularly change either its benchmark interest rates or reserve requirement ratios (altogether there were 23 irregular changes from January 2010 to December 2014). A theoretical

paper about the PBOC’s credibility argues that it is important to match the bank’s monetary policy actions with its communication (Lu and Hu, 2009). Here, the overall communication index of monetary policy inclination (MPI), which has a direct relation with monetary policy, and the PBOC’s actions are compared. The comparison is mainly conducted in each of the policy-changing intervals to look at the correspondence between words and deeds.

Figure 4.7: Trend comparison of interest rates and MPI index



The first approach is a trend comparison between benchmark interest rates (average of benchmark interest deposit and lending rates) and the communication index of monetary policy inclination, which is reported in Figure 4.7. The trends are seen generally to move together. However, in the last period from mid of 2012, it is not clear that communication positively correlates with action. One of the reasons might be that over a long part of this period, there were no benchmark rate changes. Computing the trend after January 2014, a positive correlation between words and deeds of the PBOC is apparent. However, it might be that communication tends to ‘prepare’ the market for the action to follow in a short time.

Figure 4.8: Trend comparison of RRR and MPI index

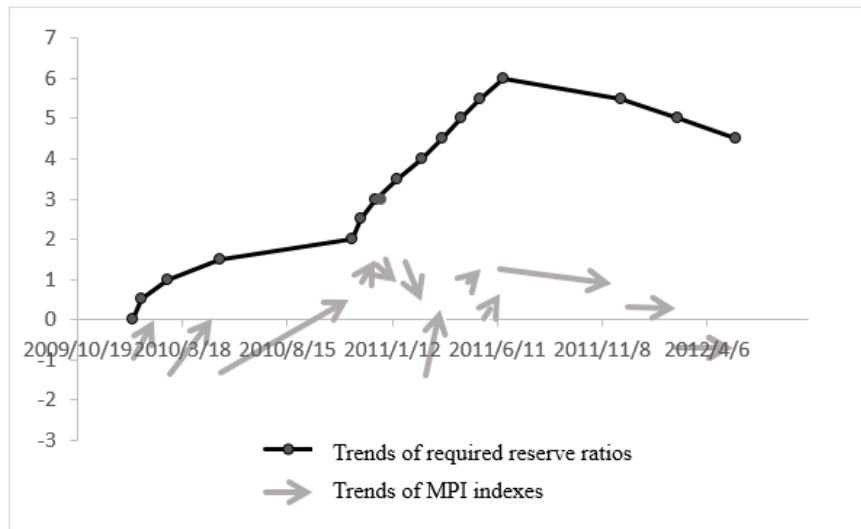


Figure 4.8 shows the RRR and the MPI index. In general, the communication index trend and changes of RRR tend to move together. The next figure shows the open market operation, which focuses on the total amount of repurchases and reverse repurchases every half year.

Figure 4.9: Trend comparison of open market operations and MPI index

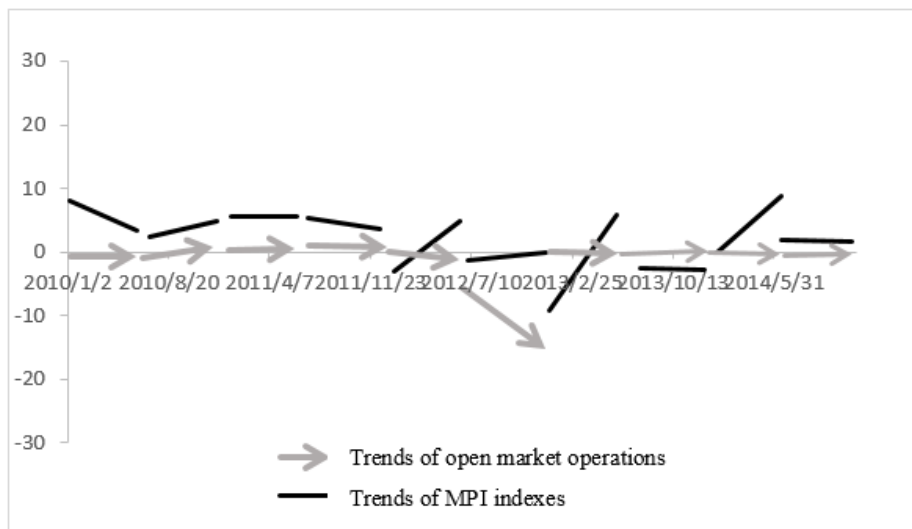
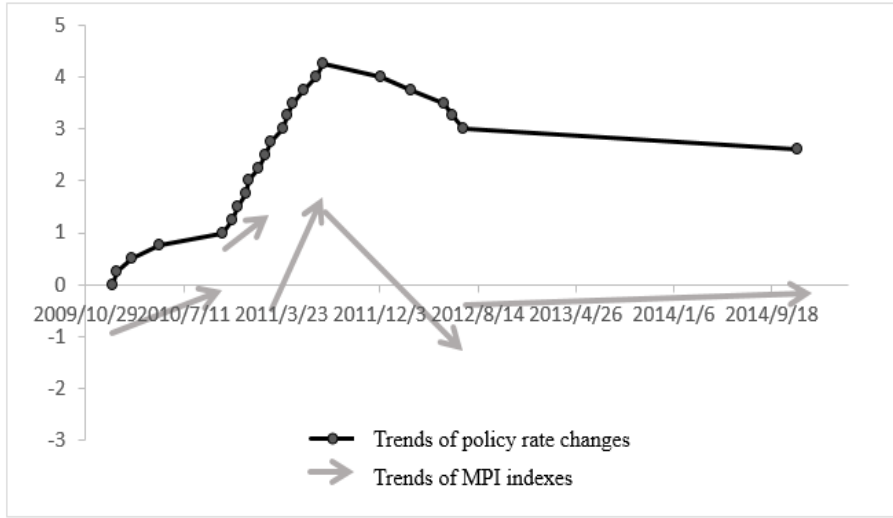


Figure 4.9 shows that, over most of the period, the two trends move in the same direction; however, they diverge in the last two years. Finally, trends of overall communication indexes and changes of the two policy rates altogether were compared in Figure 4.10. In general, communication indexes move with policy rates.

Figure 4.10: Trend comparison of policy rate changes (benchmark rates plus RRR) and MPI index



Four apparent intervals (i.e. two increasing trends and two decreasing trends) are shown in Figure 4.10. Here, a basic OLS is used to have a brief look at whether the changes of policy action are positively correlated with the adaptive communication changes. The independent variable are the accumulative changes of benchmark interest rates and reserve requirement ratios, based on the policy rate changes along the timeline. The explanatory variables are the accumulative changes of the communication index in each policy-changing interval. The above figure, Figure 4.10, shows that, in general, there are two increasing trends and two decreasing trends of the policy rate changes. Trend comparison shows that most of the trends of communication index and the trends of policy rates seem to move together. However, the last trend is almost half of the total five-year interval. Due to this special case of a long interval without policy rate changes, the analysis concentrates on the first three trends. Then, the three trends are represented as three dummy variables (i.e. D_i where $i = 1,2,3$) for the first three intervals. The estimated model is:

$$\Delta r_t = \alpha + \beta \Delta CI_t + D_i + \varepsilon_t \quad (4.6)$$

where r_t is time adjusted policy rates, CI_t is the communication index and D_i represents the three dummies for the three trends explained above.

Table 4.3: Results for the three intervals

	$D_{interval1}$	$D_{interval2}$	$D_{interval3}$
Value	0.192	0.175	0.157
(Standard Error)	(0.009)	(0.005)	(0.007)

The estimated results are reported in Table 4.3, which shows that the basic OLS with simple variables returns some findings about monetary policy changes and communication, where a positive value in each time interval is found. Furthermore, the values are decreasing. Reasons for this could be that the open market operations have more power in the ‘words and deeds’ analysis, and it could also be that central bank credibility has changed or that the communication index is not complete enough to capture the entire correlation. In general, based on the above trend comparison and the OLS analysis, the results show that the words of the PBOC seem, at least partly, to match its deeds.

4.5 Estimated Results

This section reports the results of the PBOC’s communication on three financial markets of China, communication channels, and communication strategies of the PBOC. In the variance equation of the EGARCH, the volatility is expected to be reduced by various communication indexes, or the volatility would increase in response to PBOC’s information. In the mean equation of the EGARCH, there are two signs of each communication index. To look at whether PBOC’s communication influences on the market proxies in the desired direction, the expected signs of the coefficients are shown in Table 4.4.

Table 4.4: Expected signs of the coefficients on the mean equation

	SHIBOR (the money market)	SSE (the equity market)	the exchange rates (the appreciation of domestic currency reduces the exchange rates in direct quotations)
DEO	+	+	-
WEO	+	+	-
MPI	+	-	-

The positive economic outlook and tightening monetary policy inclination are expected to increase the SHIBOR. Similarly, positive economic outlook boosts stock market while tightening monetary policy dampens stock market. For the foreign exchange market in direct quotations used by the PBOC, the appreciation of RMB reduces the exchange rates. Therefore, positive economic outlook appreciates domestic currency, while tightening monetary policy increases interest rates and appreciates domestic currency.

4.5.1 The PBOC's Communication on the Three Financial Markets

As discussed above, EGARCH are estimated. Results containing at least one significant coefficient in either mean or variance are reported in this paper. In addition, where some periods of one-year SHIBOR show no changes at all, overnight SHIBOR (O/N) to nine-month SHIBOR ($\Delta 9M$) are mainly estimated.

Table 4.5: Effects of the communication indexes on SHIBOR

	O/N	1W	2W	1M	Δ3M	Δ6M	Δ9M
Domestic Economic Outlook	-0.0160** (0.2123**)	0.0244** (0.1219***)		0.0011 (0.3010***)	0.0011*** (0.5578***)	0.0002*** (0.8018***)	-0.0002 (0.7681***)
World Economic Outlook	0.0384*** (0.1155**)	0.0083 (0.1741***)	0.0071 (0.0685***)	-0.0009 (0.2612***)	-0.0009** (-0.2451***)	-0.0004*** (-0.7997***)	-0.0004 (-0.6390***)
Monetary Policy Inclination	0.0386*** (0.6204***)	0.0139* (0.2998***)	0.0406** (0.2151**)	0.0043 (0.3554***)	0.0016*** (0.0425)	0.0005*** (0.3327***)	0.0005*** (0.5112***)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

Table 4.5 shows that the positive DEO, WEO and tightening MPI communication indexes generally have positive effects on the mean of the SHIBOR series, which is consistent with the signals of these communication. However, the communication index on world economic outlook decreases some of the SHIBOR series, from 3-month to 9-month SHIBOR. Both mean and variance of the communication index on monetary policy inclination increase. All the three indexes show more effect on the mean of short-term SHIBOR, some decreasing effects are found. However, the volatility shows an increasing effect in response to the three indexes. This is consistent with the previous literature about the PBOC (e.g., Ji and Song, 2012; Wang and Liu, 2016; Zhou and Hu, 2016). The new index about world economic outlook has some various effect on SHIBOR, which increase mean and variance in the short term but decrease the both on the longer time. The MPI index has larger influence in the short-term SHIBOR. This is consistent with the findings Ji and Song (2012), and Wu and Pan (2014) on this market about effects of MPI index. In this case, the introduced communication about the world economic outlook has some comparable effects with the other indexes.

In terms of the equity market, it is assumed that the PBOC has fewer effects on it, however, it is interesting to see whether the communication of the PBOC affects the market over these years. The results are presented in Table 4.6.

Table 4.6: Effects of the communication indexes on SSE

	Mean	Change of Volatility
Domestic Economic Outlook	0.0006	0.0368
World Economic Outlook	-0.0021**	-0.0641**
Monetary Policy Inclination	-0.0010	-0.0920***

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

It can be seen from Table 4.6 that, in general, communication of the PBOC does have some effects on the Chinese stock market; however, the results seem not be effective, compared with the evidence in the interbank money market. First, in terms of the impact, communication about domestic economic outlook increases stock returns (0.0006), while other indexes decrease stock returns (-0.0021 and -0.0010). For stock volatility, the communication index of domestic economic outlook increases volatility, while the counterparties reduce volatility. The monetary policy inclination shows the largest impact (-0.092) on reducing volatility. Wang and Liu (2016) also has similar findings about the MPI on this market.

The effect of communication index on this stock market is less compared with the interbank money market, a finding consistent with literature (e.g., Ji and Song, 2012; Wu and Pan, 2014). As discussed, the Chinese stock market is less influenced by the PBOC in practice and it contains a wider range of investors compared with the interbank money market. The evidence suggests that communication on monetary policy inclination does indeed calm the market the most. Overall, the equity market has some responses to the communication, supporting some previous findings (e.g. Ji and Song, 2012; Zhang and Hu, 2013; Sun and Liu, 2016) on this market. The final interests are the yuan's exchange rates for five currencies where direct quotations are used, an extension to studies of Ji and Song (2012) and Wang and Liu (2016) on yuan's exchange rate with Euro. The communication world economic outlook is assumed to has some effects on the markets.

Table 4.7: Effects of the communication indexes on exchange rates

	US Dollar	British Pound	Euro	Hong Kong Dollar	Japanese Yen
Domestic Economic Outlook	-0.0004* (0.4149***)	0.0022 (0.0567***)	0.0051* (-0.0378**)	-0.0003*** (-1.2343***)	
World Economic Outlook	0.0008** (-0.0943**)	-0.0100** (0.0186)	-0.0056 (0.0491***)	0.0002*** (-0.7840***)	
Monetary Policy Inclination	-0.0002 (-0.0765**)	0.0039 (-0.0189*)		-0.0005*** (1.2369)	0.0001 (0.0398*)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

In general, the three communication indexes and macroeconomic announcements have some significant influence on the foreign exchange markets, but less compared with the previous two markets which is consistent with work of Ji and Song (2012) and Wang and Liu (2016). In the first place, the results seem to be varied. For communication on the domestic economic outlook, the signs of the coefficient are different. Then, the indexes about the world economic outlook has comparable performance compared with the other two indexes, particularly on Hong Kong dollar where the volatility was reduced largely to the PBOC's communication about economic outlook. The monetary policy inclination still has the largest effect on influencing volatility in the currencies. Second, from a larger perspective, the results show that the Hong Kong dollar is more significantly affected by the PBOC's communication, especially in the reduction of market volatility. This is understandable from the relation between mainland China and Hong Kong. The US dollar, the British pound and the euro show responses to the PBOC's communication, while the Japanese yen performs less in the first model.

The level and variance of exchange rates are found to be smaller compared to the findings in similar topics in the literature (e.g., Fratzscher, 2008; Beine *et al.*, 2009). This could be the nature of the yuan's exchange rates with major currencies, because some fluctuations in these exchange rates are generally small, for example, the Hong Kong dollar. And it is also very likely that the communication of the PBOC still needs more improvement, compared with the central banks with more communication such as the ECB. As discussed in Chapter 3 regarding

communication in practice, the PBOC makes fewer verbal interventions on foreign exchange markets than central banks in developed economies.

4.5.2 Formal versus Informal Communication

Given that the above findings suggest that the PBOC's communication has some effects on the three markets, it will be meaningful to examine the PBOC's communication in more detail. One of the most important aspects suggested by the literature is the communication channel. For example, it is worthwhile to assess the varied effects of formal and informal communication, a look at a 'how-to-communicate' question. According to communication data (i.e. formal or informal), three overall communication indexes are transformed to six communication indexes (e.g. formal monetary policy implication and informal monetary policy implication). The results in Table 4.8 are consistent with those reported in Table 4.5.

Table 4.8: Effects of communication channels on SHIBOR

	O/N	1W	2W	1M	Δ6M	Δ9M
Formal Domestic	0.0083 (0.2654***)			0.0070 (0.2962***)		
Informal Domestic	0.0229*** (-0.0446*)	0.0204 (0.1497***)	0.0239*** (0.0400***)	0.0008 (0.1962***)	0.0004 (0.3848***)	
Formal World	0.004 (-0.6199***)	-0.0349 (0.2889***)	0.0004 (-0.1457***)	0.0001 (0.1925***)	0.0005 (-0.5921***)	0.0001*** (-1.6787***)
Informal World	-0.0218*** (0.4133***)	0.0349* (0.2889***)	0.0010 (-0.0416**)	0.0012 (0.1619***)	0.0004 (-0.2815***)	
Formal Monetary		0.0011 (0.2121***)	0.0078 (-0.0419**)		0.0021*** (-0.3529***)	-0.0002*** (1.2778***)
Informal Monetary	-0.0036 (0.393***)	0.0177* (0.2769***)		0.0036 (0.3256***)	0.0022*** (0.3375)	

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

The results show that both communication indexes about domestic economic outlook increase the mean and volatility of SHIBOR. The formal world economic outlook performs better than the informal one on reducing volatility, a main reason could be most of communication about world economy is found in the formal communication of PBOC. Both

communication channels of monetary policy inclination have comparable effects. In general, the informal communication has slightly better effects on influencing the market, which shares similar findings with some studies on the PBOC (e.g., Ji and Song, 2012). The findings about communication channels are mixed in the literature, it may depend the features of central bank and the economy. For example, in a case about the Fed, Hayo *et al.* (2010) found that informal communication has a larger effect on the EU and Pacific markets.

Similarly, the SSE equity composite index and the five exchange rates are analysed in the same process. Here is Table 4.9 for the SSE index and communication indexes.

Table 4.9: Effects of communication channels on Shanghai Stock Exchange Index

	Mean	Change of Volatility
Formal Domestic	0.0004	-0.2353***
Informal Domestic		
Formal World	-0.0023*	0.0150
Informal World	0.0007	0.2061***
Formal Monetary		
Informal Monetary	-0.0028**	-0.0137

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

A first glance shows that informal communication affects the SSE slightly better than does formal communication. This corresponds to the findings in the interbank money market, which suggest that for the fast-changing equity market in China, investors tend to watch informal communication closely considering its flexibility. Furthermore, the informal communication about monetary policy inclination affects the market more on mean level while the formal communication about domestic economic outlook calm the market most. Evidence in Tables 4.8 and 4.9 indicate that informal communication tends to receive slightly more effective responses, which is consistent with the findings of other studies on the PBOC’s communication channels (e.g. Ji and Song, 2012; Wu and Pan, 2014). Exchange rates are then analysed with regard to the communication channels shown in the next table.

Table 4.10: Effects of communication channels on exchange rates

	US Dollar	British Pound	Euro	Hong Kong Dollar	Japanese Yen
Formal Domestic	0.0001 (-0.2147*)		0.0043 (-0.1435***)	-0.0002*** (-2.1889***)	
Informal Domestic		0.0020 (0.0925***)		-0.0001*** (-1.7665***)	
Formal World	-0.0002* (0.2351*)			-0.0001*** (-0.8662***)	
Informal World	0.0003** (-0.1307)	-0.0170*** (0.0856***)	-0.0091 (0.0762**)	0.0001 (-1.2039***)	
Formal Monetary	0.0005*** (-0.1273)	0.0031 (0.0891**)	0.0024 (0.0938***)	-0.0002*** (4.1319***)	
Informal Monetary		0.0030 (-0.0506***)			

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

The results of formal and informal PBOC communication on foreign exchange markets are shown in the above table. Similar to the estimation of overall communication indexes and exchange rates, the results are varied. First, both communication channels about the domestic economic outlook increase the level and reduce the volatility of the exchange rates. For the world economic outlook, both formal and informal communication receives more significant responses than the other variables. In general, the formal communication still has larger effects than the informal channels. Similar with the previous analysis, the Hong Kong dollar is strongly affected by the PBOC's communication, mostly on reduction of volatility. This is also similar in some respects with findings in literature, as discussed in Chapter 2. Berger *et al.* (2009) show that in terms of the ECB's monetary policy inclination, communications of London-based institutions have a better forecasting ability than those of other regions. Hayo *et al.* (2013) analyse the Fed and seventeen emerging economies and show that, in terms of communication effect on equity markets, American emerging markets react more to communication than non-American markets. Although Hayo *et al.* (2013) focus on equity markets, the hint from these findings together with the evidence from Hong Kong dollar in this section suggest that geography tends to be a factor influencing communication effects.

4.5.3 Communication Strategies of the PBOC

From above analysis, it appears that communication of the PBOC has some significant effects on the three financial markets investigated. Furthermore, comparison between communication channels shows the potential importance of channel choice in communication strategies. Therefore, the following section takes a further look at the communication strategies of the PBOC. Given that the interbank money market is supposed to be the most responsive one to the monetary policy of the PBOC, and has shown some larger responses to the PBOC's communication, the analysis focuses on this market.

i. The Governor's Communication

The above findings show that informal communication has a larger effect on the money market; the next question is, which is the most important informal communication? When processing communication data of the PBOC, it is noticed that the governor's communication accounted for a large share of the total communication events (28%), which is also likely to be the case in some other central banks. Based on this percentage, the governor's communication tends to be an important component of informal communication. Furthermore, the governor's communication can be categorized into two groups: speeches (43 events) and general communication (50 events). Some researchers (e.g. Siklos and Bohl, 2005; Hayo and Neuenkirch, 2010; Ji and Zhou, 2011) place emphasis on the governor's overall speeches, however, it is possible to extend this analysis.

Three overall communication indexes were aggregated to get an overall communication index. Then, the governor's communication was analysed to see whether it has significant effects, using dummy variables with the EGARCH model:

$$r_t = a_0 + a_1 r_{t-1} + \beta_1 OverallCI_t + \beta_2 Governor'sCI_t + \gamma Z_t + \epsilon_t \quad (4.7)$$

$$\log(\sigma_t) = \omega + a_5 \log(\sigma_{t-1}^2) + a_6 \left[\frac{|\mu_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] + a_7 \frac{|\mu_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \lambda_1 OCD + \lambda_2 GCD + \gamma ZD_t^h \quad (4.8)$$

where the *OverallCI* is the overall communication index, *Governor'sCI* is the governor's communication index, *OCD* are the days of overall communication and *GCD* are the days of governor's communication.

Table 4.11: Effects of the governor's communication

	O/N	1W	2W	1M	Δ3M
Governor's	-0.0059	0.0333*	0.0097	0.0277***	0.0024***
Overall C	(-0.5624***)	(0.0608)	(-0.0844***)	(0.1494***)	(-1.1952***)
	Δ6M	Δ9M	Δ1Y		
	0.0006	0.0001	0.0004***		
	(-1.4315***)	(-0.4708***)	(-0.2894***)		

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

Table 4.11 shows that the governor's overall communication has significant effects on SHIBOR, mostly decreasing market volatility over the long term. Then, dummy variables were used to see whether the governor's general communication and speeches have different effects.

Table 4.12: Effects of the governor's communications

	O/N	1W	2W	1M	Δ3M	Δ6M	Δ9M	Δ1Y
Governor's	-0.0601***	0.0385	-0.0070	0.0403***	-0.0012***	-0.00001		
Other C	(0.9731***)	(0.2666***)	(0.146***)	(0.2712***)	(-0.0853)	(-1.148***)		
Governor's	0.0206***	0.0286	0.010	0.0259***	0.0030***	0.0009***	0.00001	0.0012***
Speeches	(-0.7196***)	(-0.1614**)	(-0.281***)	(0.0942***)	(0.9128***)	(-1.161***)	(-1.545***)	(-0.5699***)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

Table 4.12 reports that the governor's other communication increases the mean and variance of SHIBOR, while the governor's speeches increase the mean of SHIBOR while largely reducing its volatility. This may indicate that speeches by the governor have some impact on the Chinese money markets, mainly in reducing volatility.

ii. Fixed Testimony Strategy

Three specific communication strategies of the PBOC are analysed, which are fixed-date testimony, high-frequency communication of senior officials, and same-day communication. In

the data collection, some apparent communication strategies were noticed and it is interesting to see whether they are generally effective. The first one is the fixed testimony strategy. The PBOC has put increasing efforts into its communication in recent years. The bank mostly communicates irregularly, however, its unique strategy with four fixed-date press conferences each year was introduced from January 2013. The fixed dates of communications could attract more attention, because the public is likely to anticipate and prepare for this communication. The press conferences of the ECB provide a similar example. The announcement effects of this strategy are analysed with the help of dummy variables in the model.

Table 4.13: Estimation of the fixed-date testimony strategy

	O/N	1W	2W	Δ3M
Fixed	-0.0676***	0.0047	-0.0927**	-0.0004
Testimony	(-0.1082***)	(0.0046**)	(-0.5328***)	(-1.7687***)
	Δ6M	Δ9M	Δ1Y	
	0.00008	0.00001	0.00001	
	(-0.5031***)	(-1.3193*)	(-3.3075***)	

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

The evidence in Table 4.13 shows that most of the mean and volatility values are negative, which seems counterintuitive, because the conjecture is that communication indexes or announcement effects should positively influence the levels of SHIBOR. Another thought about this is the following. The fixed testimony strategy started in January 2013, when the PBOC had already changed towards an easing monetary policy; thus, the negative effects shown here could be because the PBOC signalled the easing inclination and the market correctly assimilated these signals. Based on this idea, the results on the mean level could be desirable. In terms of volatility, the strategy mostly reduces the volatility of the SHIBOR series, and the long-term volatility seems to be more influenced. As discussed above, the markets may prepare for these testimonies and once the communiqués are received, they help in shaping long-term expectations, because these official fixed-date events normally talk about the monetary policy goals in the next term. Generally, this newly introduced fixed-date testimony strategy displays some effective abilities

to influence the Chinese money market, particularly on reducing volatility.

iii. Strategy of High-Frequency Senior Officials' Communication

In the first five months of 2011, information about previous macroeconomic performance was frequently communicated, especially the path and emphasis of future policy. Each communication event by senior officials provided rather comprehensive information, which happened only once during those five years. The effect of this communication strategy, or of these unique communication events, is of interest. Therefore, the content it contains is different from the economic outlook or monetary policy inclination information and needs to be examined separately. The conjecture here is that this information will create volatility due to the relatively extensive information it contains, similar to of the argument of the paper about the UK by Reeves and Sawicki (2007).

Table 4.14: Estimation for high-frequency senior officials' communication

	O/N	1W	1M	Δ3M
High-Frequency Strategy	-0.3143*** (-0.3722**)	-0.2484* (0.2531**)	-0.0911*** (-0.0330)	-0.0237*** (0.4180***)
	Δ6M	Δ9M	Δ1Y	
	0.0035*** (0.3937**)	0.0056*** (1.0376***)	0.0035*** (0.9058***)	

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

Table 4.14 reports that in the short term, the high-frequency communication strategy reduces the mean of SHIBOR. However, it seems to show increasing effects on volatility in the longer term. In the short run, this communication appears to have less effect. As discussed above, the nature of these communications contains rather comprehensive path details and the focus of future work, which is unique compared with other communication; this hypothesis is supported by the finding that it creates news and volatility in the market.

iv. Same-Day Communication Strategy (Consistency or Dispersion)

Central bank communication sometimes hits markets on the same day, whether on purpose or not. What will be the effects of this same-day communication? Will this have a strengthening effect on the markets? This assumes that communication signals can be duplicated or triplicated to the markets, thereby increasing the communication effect. Based on these ideas, three overall communication indexes and those communications that hit the market on the same day are of primary interest. To conduct this analysis, 48 days with same-day communication were further categorized into two variables, the same-day communication on domestic and world economic outlook together (EC), and the same-day communication on monetary policy inclination (MPI). Then, the days (five days) that contain both economic outlook and monetary policy inclination were picked for an interaction slope dummy variable. This was used when both types of same-day communication hit the market together, for example, to create a double same-day effect. Two other dummy variables were proxies for effects of each type of same-day communication (i.e. EC or MPI). The mean equation of EGARCH (1,1) to analyse this takes the following:

$$r_t = a_0 + a_1 r_{t-1} + \beta_1 CI_t * SD_D + \beta_2 SD_{EC} + \beta_3 SD_{MPI} + \gamma Z_t + \epsilon_t \quad (4.9)$$

where SD_D is the double effect, SD_{EC} is the same-day communication about overall economic outlook, and SD_{MPI} is the same-day communication about monetary policy inclination.

Table 4.15: Estimation for same-day communication

	O/N	1W	2W	1M
Double Effect	-0.131***	0.1959***	-0.0610**	-0.0143
EC	-0.155*** (-0.1255)		0.056*** (0.185***)	-0.0416*** (1.1332***)
MPI	-0.1033 (-0.3526**)	0.0436 (-0.3354***)		-0.006 (0.4656***)
	$\Delta 3M$	$\Delta 6M$	$\Delta 9M$	$\Delta 1Y$
Double Effect	-0.007***	-0.0004	0.0018***	-0.00001
EC		0.0019*** (1.6815**)	-0.00003 (-0.312***)	-0.00006 (-1.4752***)
MPI		-0.001*** (-2.216***)	-0.0004 (-1.558***)	0.00002 (-0.9983***)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The first line of each group of outputs is the mean level while the second line in brackets show the change of volatility estimated by the EGARCH.

Table 4.15 reports results and shows that the coefficient of the double-effect variable is negative. Same-day communication about overall economic outlook and monetary policy inclination is found with more negative values, although the two variables mostly significantly reduce market volatility particularly in the long run (-2.28 and -5.25). However, the strengthening effects have not been clearly found. This leads to some more thoughts. A closer look at the data reveals dispersed communications on the same day, which raises the question as to whether the such divergent communication inhibited the supposedly strengthening effects. This is generally consistent with the literature (e.g. Berger *et al.*, 2011; Ehrmann and Fratzscher, 2013). For example, Giorgio and Rossi (2012) find that the ambiguity of ECB members' speeches increases some volatility of market rates. Emphasis is here placed on the mean value of coefficients for a brief look.

Table 4.16: Estimated dispersion effect

Mean Variance	2W	1M	Δ6M	Δ9M
Without Dispersion	0.0695***	0.0135	0.0010***	-0.0003
With Dispersion	-0.1615***	-0.0955*	-0.002***	-0.0012***
Dispersion Effect	-0.2310	-0.1090	-0.0035	-0.0009

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 4.16 reports coefficients with at least one significant value. The same-day effects without dispersion results are shown to be mostly positive. From the ‘Dispersion Effects’ row, the evidence suggests that dispersed communication has negative effects on the mean of the market price. The model was then estimated again without dispersion, and was compared with the one with dispersion.

To facilitate comparison, the responses of SHIBOR to these communication indexes (i.e. EC and MPI) with and without dispersion are presented in Table 4.17, which focuses on change of volatility. The marked numbers indicate that dispersion effects increase volatility of SHIBOR.

Table 4.17: Same-day communication with and without dispersion (change of volatility)

	O/N	1W	2W	1M	Δ3M	Δ6M	Δ9M	Δ1Y
EC with Dispersion	0.535***	-0.207**	-0.129***	0.751***	-0.544***	-0.936***	-0.252***	-0.123***
EC without Dispersion	0.334***	-0.667***	-0.525***	1.088***	-1.004***	3.123***	-1.553***	-3.024***
Dispersion Effects	0.201	0.460	0.396	-0.337	0.460	-4.059	1.301	2.901
	O/N	1W	2W	1M	Δ3M	Δ6M	Δ9M	Δ1Y
MP with Dispersion	0.378***		0.227***		0.690***	-0.798***	-0.734***	-1.115***
MP without Dispersion	-0.030		0.054		0.428***	0.344***	0.037	-1.618***
Dispersion Effects	0.408		0.173		0.262	-1.142	-0.771	0.503

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. The marked numbers show that the dispersed communication increases volatility of SHIBOR.

For same-day communication about the economic outlook, the dispersion effects mostly increased volatility. Similar results are shown for same-day communication about monetary policy inclination. These findings show that the dispersed communication tends to increase

market volatility in this case of Chinese interbank money market.

For robustness test, some researchers use GARCH in the literature (e.g., Frazzeshcher, 2008; Beine *et al.*, 2009; Hayo *et al.*, 2012), then the method was tried on the three markets and the strategies, which mostly yield similar findings. And similar results are found when the market indexes are regressed directly on the communication indexes.

4.6 Conclusion

The increasing importance of central bank communication makes it a worthwhile research interest. A main role of central bank communication is to move the markets, the effect on financial markets: (1) to improve market efficiency and (2) to decrease market volatility (Blinder *et al.*, 2008). This topic has attracted considerable attention, but mostly in developed economies. Developing economies have become important, however, the effectiveness of central bank communication in these economies has been overlooked. This paper attempts to fill the gap by looking at PBOC's communication on three financial markets in China. In terms of the contributions, first, it is the analysis of PBOC's credibility which had not been covered in the literature. Second, compared with the extant literature on case of PBOC, this study codes the communication indexes from a more comprehensive data set. Third, for the motivation during data collection and the importance of global financial stability, a new communication index about world economic outlook was constructed. Fourth, the comparison between formal and informal channels in terms of the three communication indexes contributes the literature. Furthermore, the three communication strategies of the PBOC during 2010 to 2014 were found during the data collection, and were the main interests for the 'how-to-communicate' questions.

The main The results show that the PBOC's words appear to match its deeds. In addition, its communication has significant effects on the three markets. For the supposedly most responsive interbank money market, communication about monetary policy inclination is more influential. This is also found in the equity market. The findings from foreign exchange markets are varied, but the larger response of Hong Kong dollar supports the view that geography influences communication effects. In terms of communication channels, a similar finding is

about informal communication, which suggests policymakers and markets could pay more attention to informal communication, such as speeches. An example is that the governor's speeches influence significantly on the money market. For the foreign exchange markets, the formal communication has more impact on the five exchange rates. The three communication strategies of PBOC have some effects reflected by evidences in the money market, such as reducing market volatility. Finally, dispersed communication, in particular those that affect the market on the same day, should be treated with care when communicating to the markets.

Chapter 5

Is Peoples Bank of China's Communication Useful in Predicting the Country's Monetary Policy Stance? An Analysis based on Taylor-Rule

5.1 Introduction

The evidence presented in Chapter 4 suggests that central bank communication has effects on the Chinese financial markets by impacting on the mean and volatility of asset prices. The evidence is consistent with other studies on central bank communication discussed in Chapter 2, the literature review. For example, Brand *et al.* (2010) analyse the policy decisions of the European Central Bank (ECB) and find that the ECB's communication affects the European money market. Rosa (2011) documents that surprise components of communication have a large effect on the US equity indexes and Hayo *et al.* (2012) discover similar significant effects of informal communication. Central communication's effects on price volatility are found to be prominent by Hussain (2011), who reports that the ECB's press conference has a clear impact on the volatility of European indexes. Similarly, statements are found to explain volatility of equity returns on the Federal Open Market Committee's (FOMC)'s meeting days (Kurov, 2012). Furthermore, the FOMC's policy rate guidance reduces volatility of equity returns in the US (Moessner, 2014). Overall, central bank communication tends to make markets more efficient and to reduce market volatility.

Chapter 4 studies the PBOC's communication for the period between 2010 and 2014, to examine its effects on the Chinese financial markets based on the performance of the most liberalized money market rates, Shanghai Interbank Offer Rates (SHIBOR), equity markets, and foreign exchange markets. With three overall communication indexes (e.g. domestic economic outlook index) and six communication indexes (e.g. formal monetary policy inclination index), evidence suggests that the PBOC's communication impacts on the levels and volatility of these market rates. The findings indicate that the communication, particularly about monetary policy inclination, has effects on reducing market volatility.

This chapter looks at another important role of central bank communication in the short and medium term, that is to improve predictability of monetary policy stance. This also relates to management of market expectations. Central bank communication is argued to reduce expectation bias, thereby increasing the predictability of future monetary policy (e.g. Fillipozi, 2009; Hayford and Malliaris, 2012; Neuenkirch, 2013). For example, Hayo and Neuenkirch (2010) find that in the case of the Fed, communication about policy rate changes explain and improve predictability of repo changes. Ehrmann *et al.* (2012) discover that there is a sizeable effect of communication on inflation objectives in some developed economies. In general, central bank communication is found to be significant on inflation expectations (e.g., Eijffinger and Geraats, 2004; Amstad and Fischer, 2009; Pincheira and Calani, 2009; Jansen and De Haan, 2009; Schmidt and Nautz, 2012; Moessner, 2014).

In terms of the predictability of central bank communication, some papers focus on the factors influencing predictability, for example, geography (e.g. Berger *et al.*, 2009; Hayo and Neuenkirch, 2013), and others look into diversity of communication (e.g. Ehrmann and Fraztscher, 2013). Taylor-rule models are a popular and useful tool for examining interest rate determinations. The Taylor rule has been used in analysing central bank communication, with contradictory results reported by the relevant papers. Heinemann and Ullrich (2007), Rosa and Verga (2007) argue that the communication model does not outperform the Taylor rule model. However, some studies such as the one by Sturm and De Haan (2011) find that when interbank rates are incorporated in the Taylor rule model, communication indicators are significant, similar to those of Li (2011).

The aim of this chapter is to use a Taylor rule model to analyse central bank communication in China. The existing literature tends to focus on predictability of central bank communication in developed economies, more cases of developing economies are needed. Besides, very few studies examined the PBOC's communication and its predictability on the PBOC's monetary policy stance. Therefore, the aim of this chapter is to contribute more evidences to the literature. First, compared with Li (2011)'s analysis, this work examines the effects of not just the PBOC's monetary policy report, a complete set of formal and informal communications is included for

better communication indexes. The communication indexes used in Chapter 4 are extended for the data of 2009 and 2015. Second, during data collection, it is found that PBOC indeed talked about its money supply. Therefore, following the literature (e.g., Jansen and De Haan, 2009), a new communication index about money supply is of interest in this chapter. Third, the PBOC's communication channels are compared for their predictability of repo rates, which continues the study of the 'how-to-communicate' questions. Using ordered probit models with data from 2009 to 2015, first, the main findings suggest that the communication signals, particularly the signals about inflation, have predictability power of future policy rates. Second, it is found that predictability of PBOC's communication has improved, when combined with a forward-looking element. Third, communication channels matter for predictability and informal communication has a larger effect, which is consistent with the general findings in previous Chapter 4 about the financial markets of China. Finally, communication about money supply has small, but not significant, predictability power.

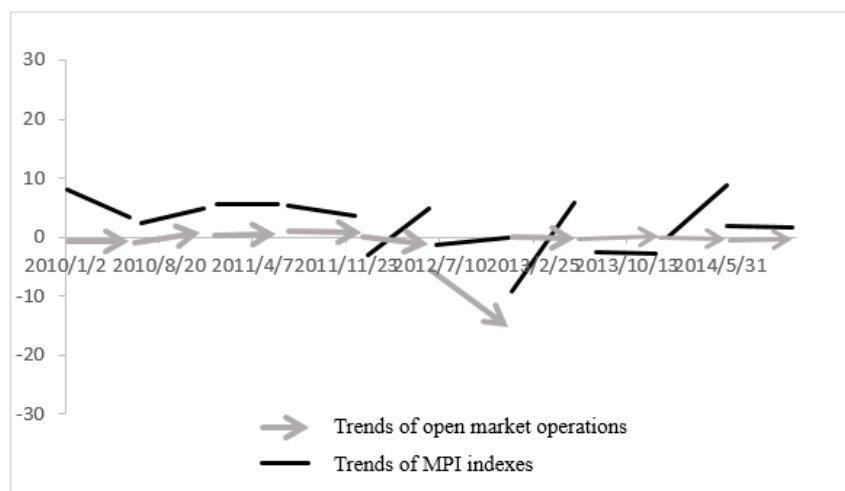
The rest of the chapter is organized as follows. Section 5.2 discusses the data and methodology. Section 5.3 discusses the findings, while Section 5.4 concludes the chapter.

5.2 Data and methodology

Chapter 4¹² briefly analyses the PBOC's credibility in terms of its words and action. The following Figure 5.1 compares trends between the overall monetary policy inclination index and the open market operation (the average of each six-month period) from 2010 to 2014.

¹² See p.77.

Figure 5.1: Trend comparison of PBOC's open market operations and its MPI index



The above figure illustrates that the trends of MPI indexes and of PBOC's open market operations from 2010 to 2014 tend to move together, although some trends, such as those during the period between 2012 to 2013, have divergence. Communication itself could be considered as a monetary policy tool, because it tends to accompany with actual actions from the PBOC, as discussed in Chapter 4. This also means that the communication about certain aspects, particularly about monetary policy inflation, could be used as signals to guide market expectations and to provide information about the PBOC's possible monetary policy actions.

Some features of the PBOC (e.g. changes of repo rates, independence) have been discussed in Chapter 3, central bank communication in practice. A feature related to this chapter is that PBOC communicates its view about the money supply in China, mostly by formal communication (e.g., monetary policy reports). This is an interesting point that this work intends to explore, following the literature on developed economies' cases, such as the work of Jansen and De Haan (2009) on the earlier years of European Monetary Union (EMU).

Following narrative approach, the chapter transforms qualitative communication data into indexes by a coding system, shown as the following indexes.

DEO	$\begin{cases} > 0 \\ < 0 \end{cases}$	The economy is overheating, policy rate would increase The economy runs too slow, policy rate would decrease
INF	$\begin{cases} > 0 \\ < 0 \end{cases}$	The inflation is too high, policy rate would increase The inflation is too low, policy rate would decrease
M2	$\begin{cases} > 0 \\ < 0 \end{cases}$	The increasing rate of M2 is too fast, policy rate would increase The increasing rate of M2 is too slow, policy rate would decrease

More specifically, for the domestic economic outlook, when the PBOC shows that the current economic situation is overheating and it is likely that a cut in policy rate will be made in the near future to slow down the economy, then the index takes the value of +1. Conversely, when the PBOC perceives that the economy is under pressure, therefore communicating its view about enhancing economic development in the future, the index is assigned -1 to reflect its moderate inclination to reduce the policy rate. Finally, a 0 index represents the signal that the PBOC will maintain its present policy rate. Besides, the 0 index may come from the aggregation of communication indexes in a policy rate-changing interval, for example, two consecutive indexes are -1 and 1. Then, similarly for the other two indexes, these are summarized as the following, where *DEO* denotes the domestic economic outlook, *INF* represents the inflation and *M2* is the money supply. The subjectivity of the communication indexes has been discussed in Chapter 4¹³.

Here is an example. More details about communication of the PBOC are shown in Appendix.

Example: In an interview with the PBOC's official on October 16, 2013, the official answered a question about the money supply¹⁴. He said 'the money supply is a little short among banks, with more communication and explanation, we would gradually guide policy rates to keep the money supply at a sufficient level in the next period'. The money supply was relatively low at that time, then, the communication index M2 would be coded as -1 to show an inclination for an easing monetary policy.

¹³ See p.68.

¹⁴ From the PBOC: <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2900378/index.html> (in Chinese).

5.2.1 The Relevant Variables

The Taylor rule model used in this chapter employs expectation data in addition to normal explanatory variables (i.e. GDP gap, inflation gap) in the Taylor rule. The expectation data of formal surveys conducted by the PBOC and the statistical department of China (i.e. the entrepreneurs' confidence indexes, the indexes about expectation of future income, the macroeconomic confidence indexes, and the indexes about future price level) are used in this analysis. The dataset covers from 2009 to 2015 with macroeconomic variables, the forward-looking macroeconomic variables, and communication indexes.

i. Real macroeconomic variables

Repo rates¹⁵

The PBOC defines the repo rate as the benchmark interest rate for loans, which has a direct influence on the Chinese economy, such as the real estate market, which needs a lot of loans to support it. A probit model was used to analyse changes of repo rates. It is found that most of the repo rate changes were of the same size (i.e. 0.25%), therefore, the range from was allowed to be between -1 and $+1$. For example, the policy rate was raised by 0.25% on December 5, 2011, therefore, this change was coded as $+1$.

Gross domestic product (GDP) gap

The real GDP was generated by deflating the nominal GDP using the consumer price index¹⁶. Seasonal effects were addressed by X-11 method¹⁷. Finally, the Hodrick-Prescott (HP) filtering method was employed to obtain the potential GDP was used to obtain the GDP gap.

Inflation gap

The changes of the quarterly consumer price index (CPI) have been used as a proxy for the

¹⁵ Data from the PBOC: <http://www.pbc.gov.cn/zhengcehuobisi/125207/125213/125440/index.html>.

¹⁶ Data from National Bureau of Statistics of China: <http://data.stats.gov.cn/>.

¹⁷ The X-11 method is based on an iterative principle of estimation; this estimation being done at each step with moving averages. The method is designed for the seasonal adjustment of monthly and quarterly series.

inflation. The first difference of these CPI values yields the inflation gap.

ii. Forward-looking macroeconomic variables

Forward-looking macroeconomic data from three formal surveys conducted by the PBOC and the statistical department of China are used in this chapter¹⁸. Starting from the last century, these surveys have been the most formal and important survey of the Chinese economy. The seasonal surveys target three groups in China: the urban residents, the entrepreneurs, and the bank's executives, with the aim of collating information on how these groups perceive the state of the economy. These surveys essentially cover issues such as, the residents' satisfaction with their current income, the entrepreneurs' feelings about current economic conditions, and the bank executives' opinions on the performance of the current monetary policy. Although the surveys seem to place more emphasis on the current and past economy, there are still several questions focusing on future expectations. Four variables are used to proxy for the expectation of GDP gap and expectation of inflation gap.

Expectation of GDP gap

Since the expected potential GDP is not easily obtainable, in this work, three indexes on domestic economic outlook are computed, based on the survey data. Then, in order to generate the expected potential GDP, the three indexes are given equal weights and the difference obtained is used as a proxy for the expectation of GDP gap.

Expectation of Inflation Gap

For the expected inflation, because it is only reflected in the surveys of urban residents, the urban residents' predictions of likely price movements in the next season are used. The PBOC usually communicates the increase or decrease of this survey data, then, the difference was taken to be a proxy for the expected inflation gap.

¹⁸ Data from the PBOC: <http://www.pbc.gov.cn/diaochatongjisi/116219/116319/index.html>.

iii. Communication indexes

This analysis incorporates three communication indexes (i.e. communication about the domestic economic look, inflation, and money supply). Another contribution of the chapter is to look into the channels of central bank communication in China, not only relying on monetary policy reports as analysed by the previous study (Li, 2011). The reason behind this is mainly because the informal communication (e.g. governor's speeches) is likely to impact in a different way to formal communication (e.g. monetary policy reports). The evidence presented in Chapter 4 shows that the informal communication of the PBOC affects the country's interbank money market. It is, therefore, necessary to look into the effects of aspects of communication and communication channels. These are explored using the communication indexes.

Chapter 4 uses the daily data, however, this chapter uses the quarterly data. Therefore, the daily communication indexes are aggregated for quarterly communication indexes. Two methods are used in this chapter to reduce the subjectivity of aggregating communication indexes. The first method by Heinemann and Ullrich (2007) is mainly used, while second one is for robustness test. Next chapter also uses two aggregated communication indexes, which helps to look at whether different ways for aggregating original communication have similar results. This indicator focuses on the frequency of words and the inclination as follows:

$$WI_t = \sum_{i=1}^t \frac{\text{numberofObs}(X_{i,t}) - \text{meanofObs}_t(X_i)}{\text{stdv}(X_i)} * \text{sign}(X_i) * \text{weight}(X_i) \quad (5.1)$$

Where WI is the aggregated MPI index, t is the event window which is a month here, $\text{numberofObs}(X_{i,t})$ is the number of communication event (e.g., monetary policy report) in the month, $\text{meanofObs}_t(X_i)$ is the mean value of all the communication index, $\text{stdv}(X_i)$ is the standard deviation of all the communication indexes, $\text{sign}(X_i)$ is from the three communication indexes that focus on the domestic economic outlook, the inflation, and the money supply, $\text{weight}(X_i)$ is used as 1 in this case. The second one is the simple aggregation of communication indexes:

$$\text{Aggregated communication index} = \frac{\sum \text{Value of Indexes}}{\text{Number of Indexes}} \quad (5.2)$$

where the index divides the sum of index values by the total number of indexes in each time interval, to account for seasonal effects. This composite index also reflects the overall direction and size of these communication indexes. Similar with Chapter 4, for comparison between communication channels, the three overall communication indexes, and six sub-communication indexes based on communication channels are used in later sections.

Here is the descriptive statistics table of the variables.

Table 5.1: Descriptive statistics

<i>Series</i>	<i>Mean</i>	<i>Std. Dev</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Obs.</i>
Repo	0	0.5547	1	-1	28
GDP gap	-0.0002	0.0076	0.0089	-0.2116	28
Inflation gap	0.0041	0.0166	0.5635	-0.0253	28
GDP gap ^{Expected}	0.0121	0.0941	0.2288	-0.1499	28
Inflation gap ^{Expected}	0.0036	0.0513	0.11	-0.094	28
Signals ^{GDP}	-0.2191	0.8327	1.4967	-1.6455	28
Signals ^{Inflation}	0.2580	0.8874	3.9513	-0.8969	28
Signals ^{M2}	-0.1870	0.8510	1.4908	-2.0770	28

Table 5.1 gives information about the variables used in the models. Then, here is Figure 5.2 about repo changes of the PBOC and the three communication indexes.

Figure 5.2: Repo changes and the three communication indexes of the PBOC from 2009 to 2015

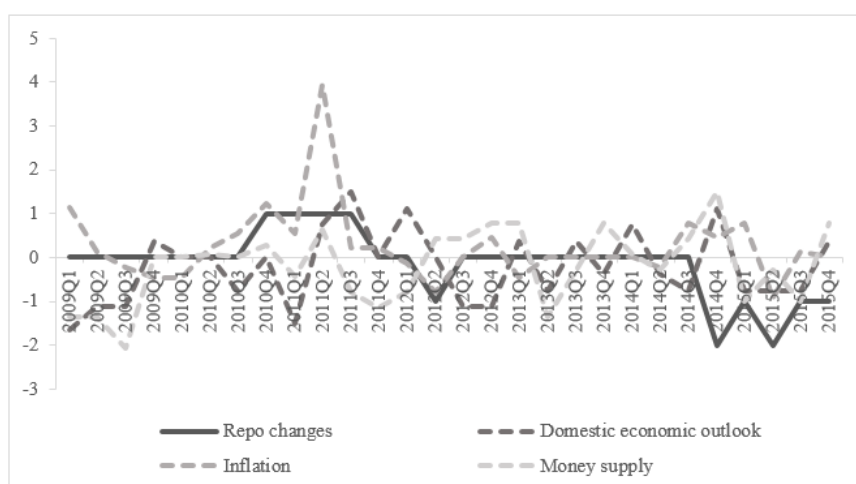


Figure 5.2 shows that most of the overall communication indexes move in the same direction with the repo, for example, three communication indexes started to rise before the second quarter in 2010, when the repo was tightened for inflation. However, some have different patterns. Then, the following analysis may yield further finding about the figures.

5.2.2 Methodologies

The basic Taylor rule model can be represented as follows:

$$R_t = r^* + \pi + \alpha(\pi_t - \pi^*) + \beta(y_t - y^*) \quad (5.3)$$

where the R_t is the central bank policy rates implied by the Taylor rule, r^* is the neutral real policy interest rate, π is the current inflation rate, π^* is the central bank's target inflation rate and y^* is the target output. The target inflation rate π^* is not clearly stated by the PBOC, then following the suggestion by Jansen and De Haan (2009) and Li (2011), the difference of equation (5.3) was taken to avoid the estimation of π^* , shown in equation (5.4).

$$\Delta R_t = (a + 1)\Delta\pi_t + \beta\Delta y_t \quad (5.4)$$

where the $\Delta\pi_t$ is the inflation gap, the Δy_t is the GDP gap.

As discussed above, it is found that the PBOC's communicates its view about money supply, however not much as the communication about economic outlook or inflation. It still sends signals to the markets, particularly with the irregular repo changes of PBOC. Then, based on this idea, this chapter follows the literature (e.g, Jansen and De Hann, 2009; Berger *et al.*, 2011). For example, Jansen and De Haan (2009) uses the communication indexes to capture the information about the possibility of repo changes, which is supposed to be comparable with the information obtained by the macroeconomic variables such as inflation and GDP. In this approach, the above Equation 5.4 about macroeconomic variables, can be represented as an alternative version with communication indexes:

$$\Delta R_t = \beta_1 \text{Signal}^{\Delta \pi_t} + \beta_2 \text{Signal}^{\Delta y_t} + \beta_3 \text{Signal}^{\Delta M^2_t} \quad (5.5)$$

where the three signals are the three communication indexes of interests in this analysis, which are discussed in Section 5.2¹⁹ about communication indexes.

Then, in the left-hand sides of Equation 5.4 and 5.5, the ΔR_t^* is considered as the appropriate change of policy rate that cannot be observed, two threshold values τ_1 and τ_2 are used and determined by the estimation. ΔR_t is -1 indicates the rates cut, 0 means the rates remain, and 1 represents the rates rise.

$$\begin{aligned} \Delta R_t &= -1, \text{ if } \Delta R_t^* \leq \tau_1; \\ \Delta R_t &= 0, \text{ if } \tau_1 < \Delta R_t^* \leq \tau_2 ; \\ \Delta R_t &= 1, \text{ if } \Delta R_t^* > \tau_2 \end{aligned} \quad (5.6)$$

Then, assuming error term is under normal distribution, the probabilities are represented as:

$$\begin{aligned} \Pr[\Delta R(t) = -1 | Z(t)] &= \Phi(\tau_1 - Z(t)' \beta) \\ \Pr[\Delta R(t) = 0 | Z(t)] &= \Phi(\tau_2 - Z(t)' \beta) - \Phi(\tau_1 - Z(t)' \beta) \\ \Pr[\Delta R(t) = 1 | Z(t)] &= 1 - \Phi(\tau_2 - Z(t)' \beta) \end{aligned} \quad (5.7)$$

where Φ is the cumulative standard normal distribution and $Z(t)$ is a vector that represent the explanatory variables (e.g., communication indexes). Considering these as ordered values, the ordered probit model is adopted with the maximum likelihood method. The two threshold values are estimated with the explanatory variables.

Here is unit root test that uses ADF, PP, and KPSS, the results are in Table 5.2.

¹⁹ See p.101.

Table 5.2: Unit root test

	ADF		PP		KPSS	
	Level	1st Diff	Level	1st Diff	Level	1st Diff
Repo	-2.20	-8.05***	-2.24	-7.77***	0.40#	0.08
GDP gap	-3.84***		-3.87***		0.16	
Inflation gap	-4.56***		-5.51***		0.33	
GDP gap ^{Expected}	-3.61***		-4.17***		0.44	
Inflation gap ^{Expected}	-5.94***		-6.06***		0.24	
Signals ^{GDP}	-5.08***		-5.11***		0.14	
Signals ^{Inflation}	-4.43***		-4.48***		0.14	
Signals ^{M2}	-4.21***		-4.13***		0.33	

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively; the ###, ## and # indicate insignificance at the 1%, 5% and 10% levels, respectively.

5.3 Estimated Results

There are three groups of variables; the macroeconomic variables, the forward-looking variables and communication indexes. Therefore, the estimation was based on these three groups plus an extra group for combine forward-looking variables and the communication indexes. The estimation results are reported in Table 5.3 with a line for element of M2. The analysis here focuses the goodness of fit Pseudo- R^2 , the size, the ‘corrected’ signs, and the significant levels of coefficients.

Table 5.3: Estimation for the models including communication about M2

	(1) Macro	2) Forward-looking	(3) Communication (with M2)		(4) Forward-looking and Communication (with M2)	
(1) Real						
$\Delta\pi_t$	3.5921					
Δy_t	6.6408					
(2) Survey						
$\Delta\pi_t^{Expected}$		7.4427*			5.1324	(5.5254)
$\Delta y_t^{Expected}$		-2.8429			-3.0467	(-3.1331)
(3) Coms						
$Signal^{\Delta\pi_t}$			0.4580*	(0.4887*)	0.4790*	(0.5243*)
$Signal^{\Delta y_t}$			-0.5313*	(-0.4756)	-0.5672*	(-0.5016)
$Signal^{\Delta M2_t}$				(-0.1954)		(-0.2445)
Pseudo- R^2	0.01	0.08	0.10	(0.11)	0.16	(0.17)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

In testing the goodness fit of these four models, the pseudo- R^2 increases range from 0.01 (model 1) to 0.17 (model 4), where models 3 and 4 represent the models with communication signals. The levels of significance of the variables in models 3 and 4 are greater than those of models 1 and 2. Communication models with M2 slightly increases the fitness. These findings have similarity with the work of Jansen and De Haan (2009) on the earlier years of EMU, which shows that, macroeconomic data have the lowest pseudo- R^2 and the fitness improves up to model 4. Li's (2011) study has similar findings in the case of the PBOC. A reason might be the irregular repo changes of the PBOC. However, this could suggest that the combination of communication models with the forward-looking element could have some predictability of repo changes.

Here is Table 5.4 for the expected signs of the coefficients, which facilitates the discussion about Table 5.5.

Table 5.4: Expected signs of the coefficients in the models

	(1) Rates cut	(2) Rates unchanged	(3) Rates rise
Coefficients about inflation gap	-	0	+
Coefficients about GDP gap	-	0	+
Coefficients about money supply	-	0	+

Then, Table 5.4 shows the estimated marginal effects of the four models, according to the three scenarios (i.e., rates cut, rates unchanged, and rates rise).

Table 5.5: Estimated marginal effects of the models

	(1) Rates cut (with M2)	(2) Rates unchanged (with M2)	(3) Rates rise (with M2)
Model (1) $\Delta \pi_t$	-0.8101	0.1514	0.6587
Δy_t	-1.4977	0.2799	1.2178
Model (2) $\Delta \pi_t^{Expected}$	-1.7143*	0.4509	1.2635*
$\Delta y_t^{Expected}$	-0.5742	0.1510	0.4232
Model (3) $Signal^{\Delta \pi_t}$	-0.0885* (-0.0934*)	0.0015 (0.0009)	0.0808 (0.0926*)
$Signal^{\Delta y_t}$	0.1026* (0.0909**)	-0.0022 (-0.0008)	-0.1152* (-0.0901)
$Signal^{\Delta M^2_t}$	(0.0373)	(-0.0003)	(-0.037)
Model (4) $\Delta \pi_t^{Expected}$	-0.8990 (-0.9263)	0.0449 (0.0470)	0.7663 (0.8793)
$\Delta y_t^{Expected}$	0.5337 (0.5219)	-0.0266 (-0.0265)	-0.4866 (-0.4954)
$Signal^{\Delta \pi_t}$	-0.0839* (-0.087*)	0.0042 (0.0045)	0.0744 (0.0834*)
$Signal^{\Delta y_t}$	0.0994* (0.0841)	0.0050 (-0.043)	-0.1067* (-0.0798)
$Signal^{\Delta M^2_t}$	(0.0410)	(-0.021)	(-0.0389)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 5.5 reports the marginal effects of these variables, which helps in analysing the predictive power of the variables. The results have been categorized into three groups according

to whether rates are cut, rates remain steady, or rates rise. It is expected that if the central bank perceives that the inflation is too high, it will tighten up monetary policy by raising the policy rate. The signs of coefficients are then expected to be positive related to three cases for correct direction of predictability. Starting from the estimation vertically, first, for the probability of maintaining the current rate, the models do not seem to fit well, considering the significance level of the variables. This could be because there were not many policy rate changes made by the PBOC in these years. A similar finding is shown in the cases of Jansen and De Haan (2009) and Li (2011), in that the marginal effects of forward-looking models and communication models tend to be better. This is somewhat consistent with some of the literature, for examples, Siklos and Bohl (2007)'s study on the Bundesbank, Pincheira and Calani (2009)'s study on Chile, Hayo and Neuenkirch (2010) on the case of the Fed, Strum and De Haan (2011)'s investigation into the ECB, and Ehrmann and Fratzscher (2013)'s study on the Fed, that use of communication signals with the Taylor rule has some predictability.

For the probability of a rates cut, the communication signals fit the model better than real and forward-looking macroeconomic data in this case of PBOC, based on the significant variables from models 1 to 4. The 'correct' sign should be -1 according to the Taylor rule, most of variables match this sign, however, only communication index based on inflation has this predictive power. In terms of values, model 1 and 2 representing the Taylor rule with macroeconomic and forward-looking variables have larger predictive power than the other models. This suggests that the expectation data have some role in predicting the policy rate changes. From models 3 and 4, it is can be seen that the forward-looking element increases performance of communication signals, plus returning larger pseudo- R^2 in these models. In terms of the probability of a rate rise, similar results are found. In consideration of the magnitude, the communication signals seem to be less powerful, but the predictive power of these signals is also slightly enhanced with the help of forward-looking variables.

From a horizontal perspective, for all four models, the evidence suggests that the predictive ability is largest in the case of rate cuts, followed by rates rising and rates remaining steady. The information on the inflation gap is more useful in model 2 with forward-looking data than in

the case of model 1. Similarly, communication signals with an inflation gap tend to show larger effects than other aspects of communication. Jansen and De Haan finds that variables concerning inflation have a larger effect, while Li (2009) shows that the GDP gap has a larger effect. The M2 element in the models generally has a less significant influence on the policy changes, compared with the other two information elements. However, it slightly improves the predictability of the variables related to inflation, inflation expectation and communication index based on inflation. A previous finding is reported by Berger *et al.* (2011), in that the ECB's statements on the money analysis in its earlier years tended to have less effect on its monetary policy action. However, the M2 still plays some role in the estimations.

Overall, three findings could be shown from Tables 5.3 and 5.5. The first is that communication signals, which are the focus of this work, have predictive power for policy rate changes. Second, when the forward-looking element was incorporated into the Taylor rule, the performance of these variables is enhanced, as evident in the results of model 4. Third, it seems that the case of policy inertia has not been well predicted by the models. The reason could be due to the irregular changes of policy rates of the PBOC during the period covered. Central bank communication can only be useful if the information is transmitted effectively. Therefore, the 'how to communicate' question is analysed here based on formal or informal channels.

Table 5.6: Marginal effects of formal and informal communication indexes

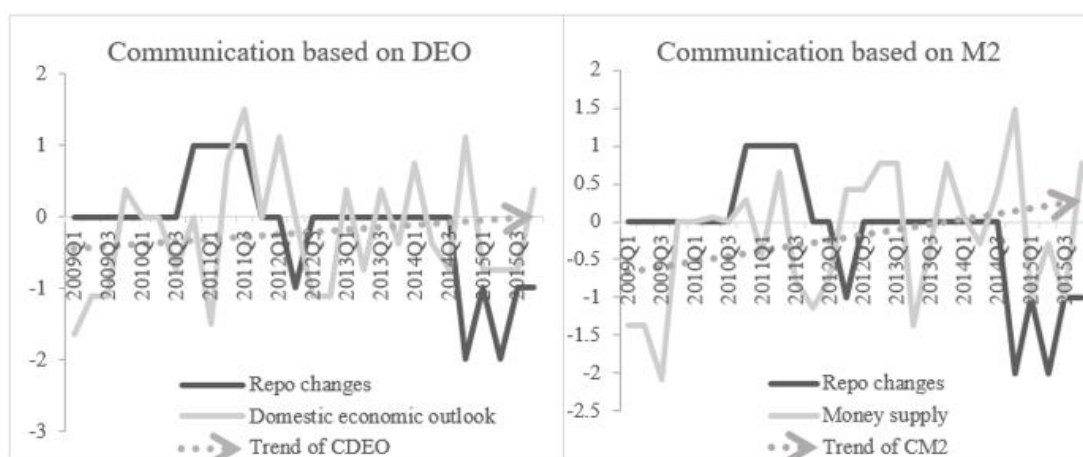
	(1) Rates cut (with M2)	(2) Rates unchanged (with M2)	(3) Rates rise (with M2)
<i>Formal Signal</i> ^{$\Delta\pi_t$}	0.0153 (0.0263)	-0.0001 (-0.0001)	-0.0152 (-0.0263)
<i>Informal Signal</i> ^{$\Delta\pi_t$}	-0.1173* (-0.1225*)	0.0008 (0.0002)	0.1165* (0.1223*)
<i>Formal Signal</i> ^{Δy_t}	0.0782 (0.0937)	-0.0005 (-0.0001)	-0.0776 (-0.0935)
<i>Informal Signal</i> ^{Δy_t}	0.1371 (0.1189)	-0.0008 (-0.0002)	-0.1362* (-0.118*)
<i>Formal Signal</i> ^{$\Delta M2_t$}	(-0.0255)	(0.0001)	(0.0254)
<i>Informal Signal</i> ^{$\Delta M2_t$}	(0.0329)	(-0.0001)	(-0.3273)

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 5.6 reports the marginal effects of communication indexes based on different channels. A brief look at the table reveals the difference between formal and informal communication, especially for the size of the marginal effect. First, for predicting policy inertia, it shows less

predictive power and insignificant results. Second, informal communication generally has larger effects than informal communication. The informal communication about inflation has the correct sign, while the signs of communication indexes based domestic economic outlook and money supply are not well. In the literature, some researchers found the effects of informal communication on predictability of policy rates. For example, Hayo and Neuenkirch (2010) found that in the case of the Fed, the speeches by members of the Board of Governors and regional presidents have more significant effects than the formal reports that are less frequent. The previous Figure 5.2²⁰ show some different movements among the indexes. Here, trends of communication indexes are compared in Figure 5.3 and Figure 5.4.

Figure 5.3: Trends of the communication indexes based on domestic economic outlook and M2

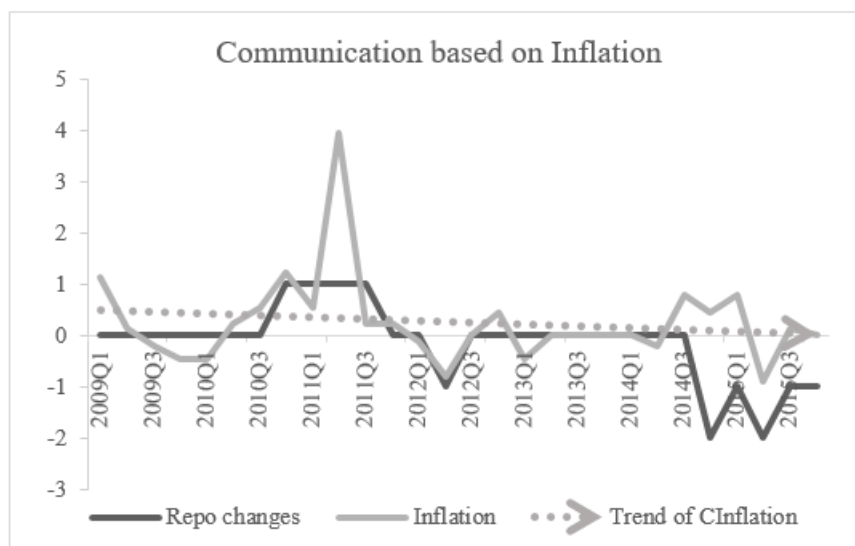


Both trends increase, while the repos were decreasing. In Chapter 4 about financial markets and daily data from 2010 to 2014, the trend of DEO is slightly increasing, however, the pattern changed when 2009 and 2015 are considered in this case. This may relate to preferences of different central banks discussed earlier in Chapter 3 and is also shown in the next chapter. For example, the PBOC tends to talk more positively about domestic economic outlook, one of the reasons could be the slowing economic growth needs more pump from the words. The similar thing is the above trend in communication based on M2. The money supply of China slowed down from 2012-2015, however, it still increased at a moderate rate. One of the reason is the

²⁰ This refers to Figure 5.2 in p.105.

relation with real estate market and money supply. This indicate that communication about these aspects may be less effective when predicting the short-term repo changes in the case of PBOC.

Figure 5.4: Trend of the communication based on inflation



The trend of communication based on inflation was decreasing, which means that the when inflation was low, the PBOC tends to reduce repo for more economic growth. The governor of PBOC, Mr Zhou, once said in an IMF conference about central banking reform on June 24, 2016 that ‘the inflation targeting regime is enviable, because it is easy to measure and to communicate’²¹. This somehow explains the findings here, which indicates that the inflation is a real issue in China and the PBOC’s words about it are meaningful for predicting repo changes. Another communication was by the deputy governor, Mr Yi (who is also the new governor of the PBOC), in a public speech on October, 27, 2015 that ‘the CPI, GDP deflator and the PPI are relatively low, therefore, we changed the policy rate to boost the economic growth’²². Although the PBOC does not have a formal inflation target, in recent years, its policy has some focus on stabilizing the price level in China. The importance of communication about inflation is consistent with some literature about the predictability and central bank communication, such as Jansen and De Haan (2009) and Li (2011). In terms of M2, the original qualitative data indicate that most of discussion is in formal communication, mostly in the monetary policy

²¹ From Xinhua News: http://www.xinhuanet.com/fortune/2016-06/27/c_129091664.htm.

²² From the PBOC: <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2969929/index.html>.

reports. The result is consistent with this finding, as the formal communication about M2 has a correct sign with the repo. This also indicates that formal communication could contain more elements of M2. Overall, these findings suggest that different communication channels matter.

An interest that has been discussed above is the PBOC’s communication about money supply. It is interesting to see whether the communication predicts policy changes. The original Taylor rule was augmented with the M2 variable as in Jansen and De Haan (2009). Accordingly, the fitness of the model for communication models and element of M2 are shown in Table 5.7.

Table 5.7: Comparison between the communication models with and without M2

	(1) Communication		(2) Formal and Informal Com		(3) Forward-looking and communication	
	Original com	With M2	Original com	With M2	Original com	With M2
Pseudo- R^2	0.08	0.11	0.15	0.16	0.16	0.17

Note: ‘Incorrected’ signs only include the marginal effects for rates cut and rates rise.

It can be seen that the pseudo- R^2 values in the four models are slightly better with the element of M2. The above Table 5.5 and Table 5.6 about marginal effects also show that with communication about M2, marginal effects of the original forward-looking or communication models tend to increase, particularly on aspect of inflation. Overall, the inclusion of the M2 variable contributed slightly to the improvement of the model.

For robustness tests, another communication index that discussed in data section was briefly tried on communication models, the policy rate changes were extended from -2 to $+2$, and the models were analysed with lags of policy rate changes following the literature (e.g. Hayo and Neuenkirch, 2010). The main findings are similar.

5.4 Conclusion

Central bank communication has become increasingly important in monetary policy formulation and implementation. The main issues being addressed are those of asymmetric information and the presence of imperfect monetary policy. As most of the existing literature

concentrates on developed countries, this chapter extends the work in Chapter 4 by analysing the effects of PBOC's communication in implementing monetary policy using the Taylor rule. The models use variables representing real macroeconomic information, forward-looking surveys, and the communication signals. The extant literature normally focuses on the importance of developed economies' central bank communication and its predictability for monetary policy stances, this chapter contributes to the literature by providing more evidences about the case of China as a developing economy. Compared with the previous literature about the PBCO on this topic, this study considers all the communication data from 2009 to 2015 for better communication indexes. Also, motivated by the importance and PBOC's communication about money supply, a new index about money supply was created for analysis. With the comprehensive dataset about PBOC's communication, the effects of communication channels have been estimated to extend the analysis in Chapter 4 about financial markets in China.

The main findings are: i) The Taylor rule with communication signals shows that communication has predictive power with regard to future policy rate changes. The performance of the model was improved with the addition of forward-looking variables in the model. Information obtained from formal surveys of the PBOC was used in the analysis, which indicate they have some effects in predicting future policy changes. ii) Communication channels matter for predicting policy changes; informal communication yields larger predictive power than formal communication. iii) Money supply (M2) changes have some role in predicting policy changes. In terms of implications for investors and regulators, the larger predictive power of informal communication is important. Meanwhile, investors could pay more attention to PBOC's communication about inflation for predicting monetary policy inclination. Regulators, on the other hand, may further improve this unconventional monetary policy tool in enhancing market expectations.

Chapter 6

Central Bank Communication in the Emerging Economies: A Comparative Analysis of China and India

6.1 Introduction

Chapter 4 and Chapter 5 have evaluated the PBOC's communications in terms of its ability to impact on the financial markets and its ability to manage the market expectations. Another function of central bank communication is to influence the economy, as it is used as an unconventional monetary policy that complements the conventional ones such as interest rate setting. As discussed in Chapter 2 and Chapter 3, the importance of this study is its focus on emerging markets, which have been overlooked in the extant literature. This chapter compares effects of central bank communications in China and India. India is also a fast-growing economy and part of the BRICS (i.e. Brazil, Russia, India, China and South Africa). The central bank of India, the Reserve Bank of India (RBI), plays an increasingly important role in its economy and the whole world. Compared with its close neighbour's central bank, the PBOC, the RBI has a longer history. The similarity, however, is that both the RBI and the PBOC have been recording rising profiles in the in the world economy.

It is generally accepted in the literature that central bank communication could be a powerful monetary policy tool. This is the case in developed economies (e.g., the US, the UK and the EU) where communication plays critical role in monetary policy implementation. In recent years, there has been a rising trend of emerging economies' central banks recognise potential benefits of central bank communication. However, as noted above little research focuses on such economies, including India. In the literature, most papers used GARCH-type models, discrete choice models (e.g., ordered probit) and non-parametric methods, however, Vector Autoregressive (VAR) models that use impulse responses are not common in the area. Papers that use VAR models to examine the effects of developed economies' central bank communication include Giorgio and Rossi (2012) and Neuenkirch (2013) both on European Central Bank (ECB), and Hansen and McMahon (2016). Hansen and McMahon (2016) analyse

the effect of information on economic conditions and monetary policy inclinations of the Federal Open Market Committee in influencing the US economy. In terms of the developing economies, some studies with VAR have been done on cases of Nigeria (Chuku, 2009), Latin America (Mondino, 2012), China (e.g., Wang, 2012), Thailand (Sethaparmote and Luangaram, 2016) and Turkey (Iglesias *et al.*, 2017), which document findings about effectiveness of communication as an unconventional monetary policy on influencing the economy.

Because of the gaps discussed above, such as the minority study group of developing economies and the less use of the VAR, the aim of this chapter is to compare the role of central bank communication as unconventional monetary policy tool in RBI and PBOC. These are the main contributions of this chapter. First, existing papers normally focus on one central bank's communication and its influence on the economy. Comparison of two central banks' communication for common findings of communication effects, particularly in cases of developing economies, was overlooked in the extant literature. Second, the use of VAR on cases of developing economies adds more evidences to the communication literature in terms of the minority study group. Third, compared to the previous studies on PBOC's communication by Wang (2012) on inflation expectation, Zhang and Hu (2013) on industrial index and inflation, and Shi *et al.* (2015) on inflation, this study compares role of repos and communication, and further looks at whether communication improves monetary policy transmission mechanism.

With monthly data from 2010 to 2015 and impulse response functions, repos and communication indexes about monetary policy inclination are analysed separately, after which the combined version of two monetary policy tools are analysed. Similar with Chapter 4 and Chapter 5, there is a comparison of communication channels. The main finding is that central bank communication acts in monetary policy transmission mechanism, and it mainly influences on inflation expectations in China and India. In terms of communication channels, informal communication of RBI and PBOC is found to be more effective on inflation expectations.

This chapter is structured as follows. Section 6.2 reviews data and methodologies. Section 6.3 discusses the findings of the estimated results while Section 6.4 concludes the chapter.

6.2 Data and Methodologies

6.2.1 Communication Indexes and Other Variables

This chapter adopts the approach in Chapter 4 by extracting information based on narrative approach. This is done in order to quantify qualitative communication by the central banks. Therefore, communication indexes capture signs or the degree of emphasis reflected in communications on domestic economic outlook, world economic outlook and monetary policy inclination. Three indexes are summarized in equation (6.1).

$$Index_{DEO,WEO,MPI} \begin{cases} > 0 & \text{positive economic outlook or tightening MP inclinations} \\ < 0 & \text{negative economic outlook or easing MP inclinations} \end{cases} \quad (6.1)$$

where the *DEO* is the domestic economic outlook, *WEO* is the world economic outlook and *MPI* is the monetary policy inclination. Here is an example of RBI's communication indexes.

Example 1: In the Quarter Review of Macroeconomic and Monetary Developments (the Monetary Policy Report) on Apr 19, 2010²³, it includes that 'The output growth of the Indian economy has started to consolidate around the trend after a sharp recovery and the headline inflation also shows signs of peaking off. Going forward, various forward-looking surveys conducted in the recent period suggest strong y-o-y growth'. This shows that the RBI has a positive domestic economic outlook, then the information was coded as +1 to reflect this view.

Communication on monetary policy inclination is used, because this communication is assumed to be more related to monetary policy than other communication indexes. Monetary policy inclination is important for good market expectation. The MPI indexes are transformed into monthly data to fit with other macroeconomic variables, such as monthly inflation. Communication indicator is an important element on this topic. Normally, single approach to code communication indicator is used in a study. Here, to see whether different communication indicators behave differently for a robust test, two types of communication indicators are employed. First, the MPI indexes are transformed based on the method by Jansen and De Haan

²³ From the RBI:
<https://www.rbi.org.in/Scripts/AnnualPublications.aspx?head=Macroeconomic+and+Monetary+Developments>.

(2009) which are represented as:

$$MPI(t) = \sum_{d=1}^t (n_d^+ - n_d^-) * \left(\frac{NT^{avg}}{N_t^* T_t} \right) \quad (6.2)$$

where the *MPI* is the transformed MPI index, t is the number of days in the event window which is monthly data here, d is the number of days, n_d^+ is the number of days with tightening monetary policy inclination, n_d^- is the number of days with easing monetary policy inclination.

Then, with the multiplier $\frac{NT^{avg}}{N_t^* T_t}$, the equation results a balanced monthly MPI indexes.

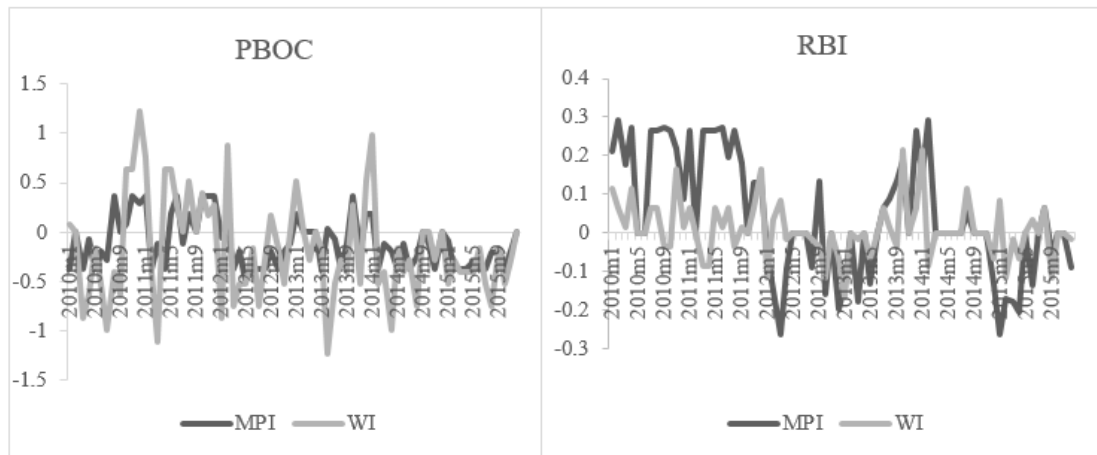
Secondly, it is the communication indicator (wording indicator, WI) by Heinemann and Ullrich (2007) that has also been used in Chapter 5, which is given as:

$$WI_t = \sum_{i=1}^t \frac{\text{numberofObs}(X_{i,t}) - \text{meanofObs}_t(X_i)}{\text{stdv}(X_i)} * \text{sign}(X_i) * \text{weight}(X_i) \quad (6.3)$$

where *WI* is the aggregated MPI index, t is the event window which is a month here, $\text{numberofObs}(X_{i,t})$ is the number of communication event (e.g., monetary policy report) in the month, $\text{meanofObs}_t(X_i)$ is the mean value of all the communication index, $\text{stdv}(X_i)$ is the standard deviation of all the communication indexes, $\text{sign}(X_i)$ signals the inclination of future monetary policy stances, $\text{weight}(X_i)$ is used as 1 in this case.

The two indicators have similarity, for example, the use of sign of communication. However, the two indexes are generally consistent, as it can be seen in the following figures about MPI indexes and WI indexes of PBOC and RBI. This show that different approach of aggregated communication indicator tends to consistent.

Figure 6.1: MPI index and WI index of PBOC and RBI from 2010 to 2015



Another thing to note is that central bank communication events in the two developing economies are generally fewer compared to the ones in the developed economies (e.g., the EU or the UK). Therefore, monthly MPI indexes used here are likely to be less effective.

6.2.2 Other Variables

In addition to the communication indexes, there are other variables included in the model. The variables included in the VAR are monthly macroeconomic variables; industrial production index (IP), a proxy for economic indicator; year-to-year inflation (changes in CPI); changes in repo rates and inflation expectations.

It is good to mention that the two economies have unique features, for example, the better development of financial markets in India, the reliance on export in China. There are also similarities, for example, the location in Asia, important roles as ‘BRICS’ members, large population and the increasing importance of central banks’ role in the economies.

i. Industrial Production Index (IP)

The industrial production (IP) indexes of China²⁴ and India²⁵ are used. However, the base year for the countries are different. For uniformity, 2010 is used as the base year for both indexes.

²⁴ Data from State Bureau of Statistics of China: <http://data.stats.gov.cn>.

²⁵ Data from the RBI: <https://dbie.rbi.org.in/DBIE/dbie.rbi?site=home>.

The indexes were used to compute year-to-year changes. Both countries had recorded economic growth around 2011-2012, then China's economy slows down from 2012 onwards while India maintains the upward trend.

ii. Inflation

CPI indexes of China²⁶ and India²⁷ are used to obtain measure for inflation, which is the rate of growth of the indexes. Then, Chinese and Indian monthly inflation rates are incorporated into the model. Similar to IP indexes, the CPI also have used different years as the base. The base year was change to 2010 for consistency. The evolution of inflation in China and India is different. India had experienced periods of high inflation from 2010 to 2014, while China's inflation peaked around 2012.

iii. Repo

The repo rate is the main policy rate that central bank use in influencing activities in the money markets. It is one of the most important policy tool in both China and India. However, the frequency of repo changes differs in the two countries. In India, the RBI²⁸ announces changes or otherwise of the repo monthly, while the PBOC²⁹ changes its repo randomly with no formal commitment on the frequency. Figure 6.2 shows the developments of repos in the countries. India has higher repo rate than China, the patterns appears to be similar. Both repos picked up from 2010 to 2012, probably to deal with inflation, which was rising during the period. From after 2012, the trend exhibits a tendency towards an easing monetary policy.

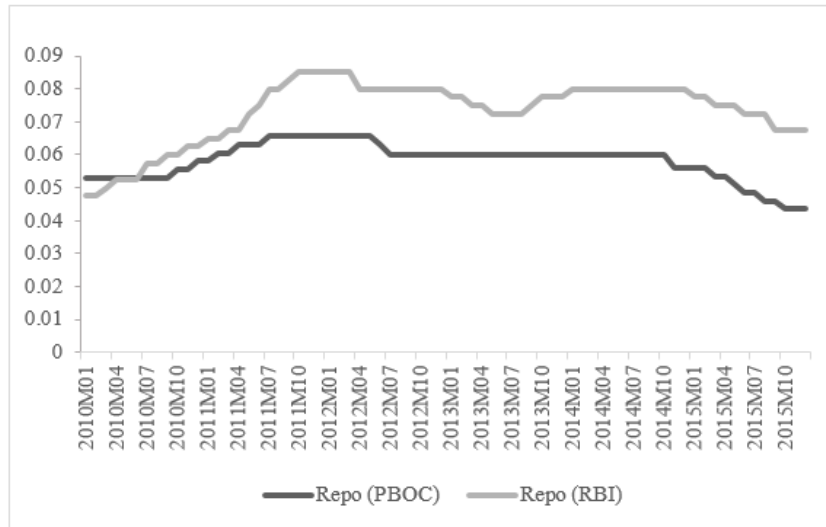
²⁶ Data from State Bureau of Statistics of China: <http://data.stats.gov.cn>.

²⁷ Data from Labour Bureau, Government of India: http://labourbureau.gov.in/LBO_indtab.pdf.

²⁸ From the RBI: <https://www.rbi.org.in/home.aspx>.

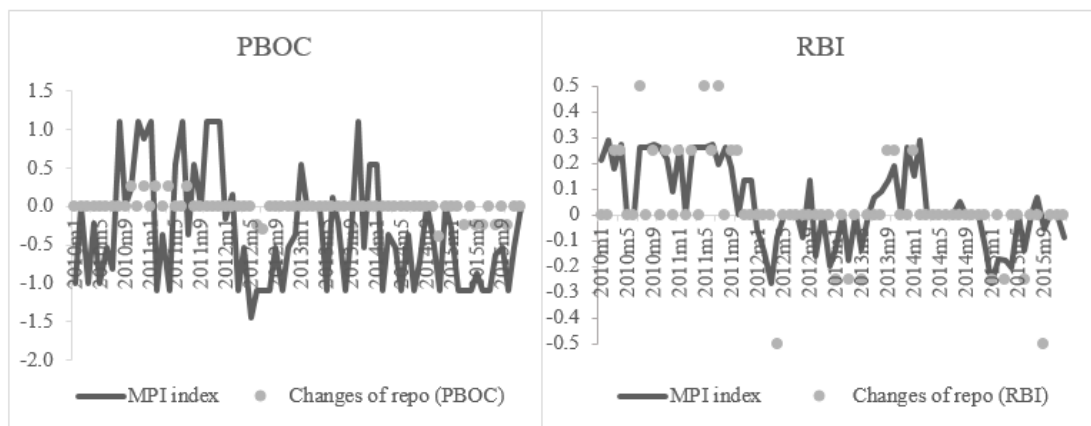
²⁹ From the PBOC: <http://www.pbc.gov.cn/zhengcehuobisi/125207/125213/125440/125835/index.html>.

Figure 6.2: Repo rates of PBOC and RBI from 2010 to 2015



Communication is considered as a complementary monetary policy tool. Then, the MPI indexes and changes of repo of PBOC and RBI are displayed in Figure 6.3 for a brief look.

Figure 6.3: MPI index and changes of repo rates of PBOC and RBI



Both figures in Figure 6.3 show that the MPI indexes tend to move with the repo changes. However, there are some differences. The PBOC's MPI index moves more volatile, but sometimes may not actually indicates the rate changes, which is influenced by the nature of repo changes of central banks discussed above. In the PBOC, the repo changes are infrequent while the communication index is more volatile. The RBI's MPI index is more correlated with the repo changes. An assumption is that when repo changes relatively regularly, the communication is used consistently as in the case of RBI, however, when there were no actual

repo changes, the bank may use communication as a tool to complement the traditional monetary policy as in the case of PBOC.

iv. Inflation Expectation

One of the important economic indicators is inflation expectation, which are changes in expected inflation based on survey data. Expected inflation of the PBOC was used in Chapter 5³⁰, which is also adopted in this chapter. The RBI publishes market expectations, including expected future inflation in quarterly publications, the Survey of Professional Forecasters, Consumer Confidence Survey and Inflation Expectations Survey of Households³¹. The variable on future inflation expectations have been incorporated into the model.

Figure 6.4: Inflation expectations and direction of CPI changes in China from 2010 to 2015

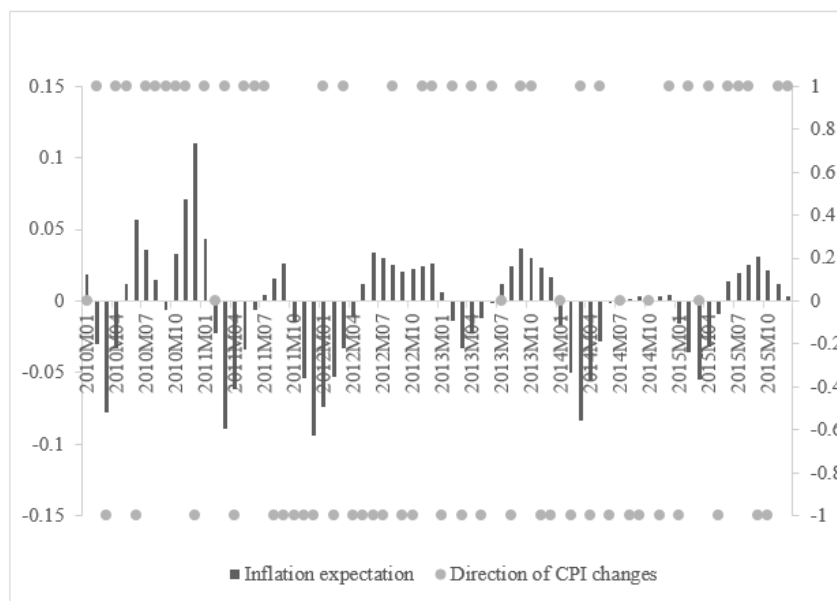


Figure 6.4 presents the monthly inflation expectations in China as opposed to the quarterly one presented in Chapter 5. It shows that the increase or decrease of CPI generally move with the inflation expectations in the same direction. Then, the inflation expectation and CPI changes in India are shown in Figure 6.5.

³⁰ Data from the PBOC: <http://www.pbc.gov.cn/diaochatongjisi/116219/index.html>.

³¹ From the RBI's publications: <https://www.rbi.org.in>.

Figure 6.5: Inflation expectations and CPI changes in India from 2010 to 2015

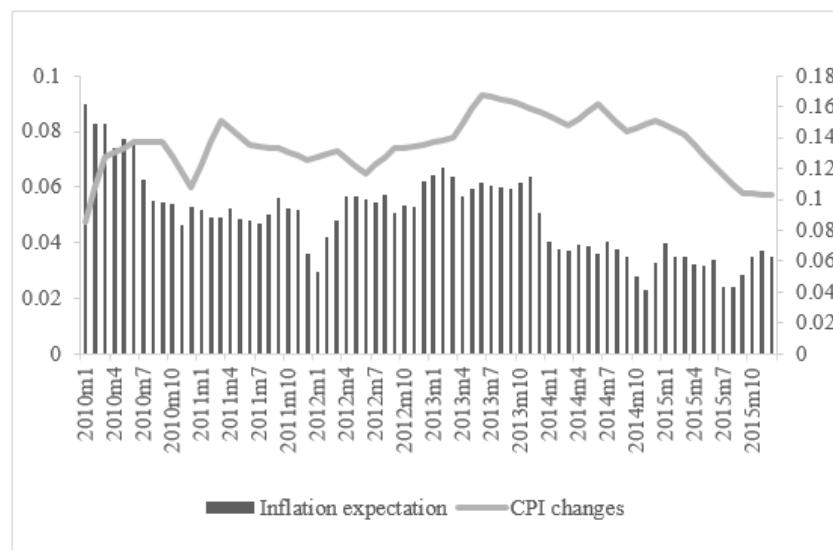


Figure 6.5 shows that inflation expectation and CPI changes tend to move in the same direction. In general, the above Figure 6.5 and Figure 6.6 shows some relationship between CPI and the inflation expectation in the two economies.

Here is a descriptive statistics table of the variables in the VAR.

Table 6.1: Descriptive Statistics

<i>Series</i>	<i>Mean</i>	<i>Std. Dev</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Obs.</i>
Case of India and RBI					
IP	1.0662	0.0590	1.2580	0.9621	72
Inflation	-0.0012	0.0090	0.0214	-0.0261	72
Inflation ^{Exp}	7.3299	0.9704	8.5000	4.7500	72
Repo	0.0464	0.1535	0.2919	-0.2637	72
MPI Index	0.0001	0.0035	0.0117	-0.0053	72
Case of China and PBOC					
IP	1.2113	0.0673	1.3940	1.0860	72
Inflation	0.0000	0.0048	0.0118	-0.0124	72
Inflation ^{Exp}	5.8083	0.5688	6.5600	4.3500	72
Repo	-0.1107	0.2499	0.3708	-0.4944	72
MPI Index	-0.0003	0.0038	0.0110	-0.0094	72

Table 6.1 gives some information about the variables in the cases of RBI and PBOC.

6.2.3 Methodologies

The VAR model is adopted for the study following the literature, for example, Neuenkirch (2013) who uses VAR to analyse stances of future monetary policy of ECB utilising the Swiss Economic Institute's Monetary Policy Communicator³², and finds that the indicator affects the inflation (expectations) similar to that of policy rate changes. Furthermore, communication is found to work in the transmission of monetary policy to output. In the case of PBOC, for example, Wang (2012) uses VAR and finds some effect of the PBOC's communication on inflation expectation from 2003 to 2010. Besides the basic VAR, some papers employ other types of VAR, for examples, the structural VAR (e.g., Giorgio and Rossi, 2012) on the case of ECB, Zhang and Hu (2013) on stock market, industrial index and inflation of China, the Hansen and McMahon (2016) on the case of FOMC. This chapter employs the SVAR following the approach in the literature (e.g., Chuku, 2009; Mohanty and Mondino, 2012; Neuenkirch, 2013).

Multi-variate VAR helps to analyse effects of monetary policy on the real economy by imposing some restrictions. Considering a multi-variate VAR with y_t as a vector of explanatory variables, as the model can be represented as follows:

$$A_0 y_t = A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_k y_{t-k} + u_t \quad (6.4)$$

where y_t are endogenous variables with k time lags from 0, and u_t is the vector of impulse response that the $(u_t) = 0$ and $E(u_t u_t') = I$. If both sides of above equation are multiplied by A_0^{-1} , it becomes the following:

$$A_0^{-1} A_0 y_t = A_0^{-1} A_1 y_{t-1} + A_0^{-1} A_2 y_{t-2} + \dots + A_0^{-1} A_k y_{t-k} + A_0^{-1} u_t \quad (6.5)$$

For simplicity, it can be represented as the following equation:

$$y_t = B_1 y_{t-1} + B_2 y_{t-2} + \dots + B_k y_{t-k} + \varepsilon_t \quad (6.6)$$

where $B_i = A_0^{-1} A_i$, and $\varepsilon_t = A_0^{-1} u_t$ that is the primary interest of the analysis. This residual $\varepsilon_t = A_0^{-1} u_t$ is the AB model proposed by Amisano and Giannini (1997). Then, the

³² The similar discussion is covered in Chapter 2, Literature Review.

model can be useful for analysing relationships between the innovations of the residuals. The residual matrix requires further restrictions for identification. The restrictions of SVAR are mainly derived from theoretical models, economic rationing and expertise knowledge,

The restrictions are determined based on economic theory. One popular way of imposing restrictions to achieve the identification above is by assuming that the main macroeconomic variables (i.e., GDP) would respond to policy variables (i.e., monetary policy) only with some lags. In this chapter, five variables are included in the VAR: the industrial production index (IP), inflation, repo as traditional monetary policy tool, and the communication index about monetary policy inclination that relates strongly to monetary policy, and inflation expectations.

The variables are therefore, ordered as follows; economic output is ordered first. Since it is sluggish, it would respond to all lagged shocks and only contemporaneously to its own shocks. Secondly, the inflation is ordered second as it responds to other lagged shocks, and contemporaneously to the shocks of output and inflation. The rationale is that inflation responds to the economic conditions, however, it takes time to be influenced by the new monetary policy, then, monetary policy variable is ordered next. Therefore, these variables respond to all lags of other shocks and the shock of macroeconomic variables. The assumption is that the policy makers respond to the real economy in a short time, however, responses to factors such as inflation expectation take some time, considering the literature in which some researchers (e.g., Hayo and Neuenkirch, 2013; Ehrmann and Fraztscher, 2013) argued that central bank communication is capable of managing market expectations. The rationale is that all other variables would have some long-lasting effect on market expectations, and would respond to lags of all other variables. Due to instability of expectations, it can also respond to all market and policy information rather quickly. Then, the restrictions would convert ε_t as follows:

$$\begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ A_{21} & 1 & 0 & 0 & 0 \\ A_{31} & A_{32} & 1 & 0 & 0 \\ A_{41} & A_{42} & A_{43} & 1 & 0 \\ A_{51} & A_{52} & A_{53} & A_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \\ u_{5t} \end{bmatrix} \quad (6.7)$$

where the economic output, ε_{1t} , responds to the lagged shocks of all other variables and

respond to its own shock contemporaneously. Therefore, the model is fully identified.

6.2.4 Unit Root Tests

Unit root tests to check for the stationarity of the series have been carried out using the Augmented Dicky-Fuller (ADF), the Phillips-Perron (PP) and the KPSS. The results reported in Table 6.2 shows that the variables are of different level of integration on levels, but stationary on first difference.

Table 6.2: Unit root tests

Case of India and RBI						
	ADF		PP		KPSS	
	Level	1 st Diff	Level	1 st Diff	Level	1 st Diff
IP	-2.99*	-11.67***	-2.87*	-11.9***	0.66##	0.05
Inflation	-7.11***		-7.05*		0.19	
Inflation ^{Exp}	-2.16	-3.83***	-2.80*	-4.96***	0.24	
Repo	-2.60*	-3.49***	-2.72*	-7.60***	-0.43	
MPI Index	-2.58**	-14.5***	-3.97***		-0.60	
Case of China and PBOC						
	ADF		PP		KPSS	
	Level	1 st Diff	Level	1 st Diff	Level	1 st Diff
IP	-2.30	-8.87**	-5.74***	-15.7***	0.74#	0.18
Inflation	-10.8***		-10.4***		0.26	
Inflation ^{Exp}	-3.45**	-3.34**	-2.92**	-7.08***	0.04	
Repo	-2.10	-3.03**	-1.48	-4.95**	-0.23	
MPI Index	-3.52***	-14.3***	-6.00***		0.34	

Note: the ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively; the ###, ## and # indicate insignificance at the 1%, 5% and 10% levels, respectively.

6.3 Comparison of Communication Indexes and Estimated Results

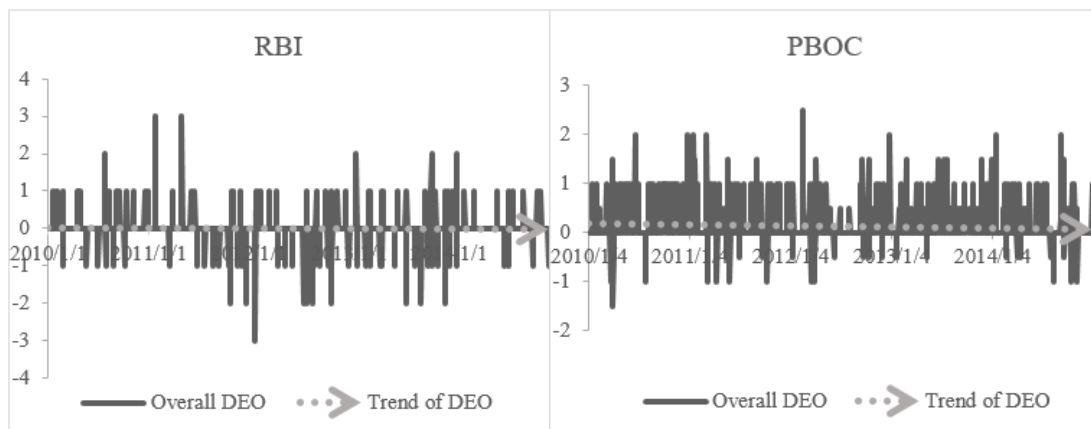
This section analyses communication indexes of both central banks. Communication indexes are main interests in this research, the previous two chapters have a look at communication of PBOC, here, the India is put in the first place. The monthly MPI index is used in the model, however, comparison of other communication indexes may be useful for the look of central bank preferences.

6.3.1 Communication Indexes of RBI and PBOC

First, it is the communication index about domestic economic outlook. Figure 6.6 represent communication indexes for the RBI and the PBOC, respectively. The trend of the overall RBI's

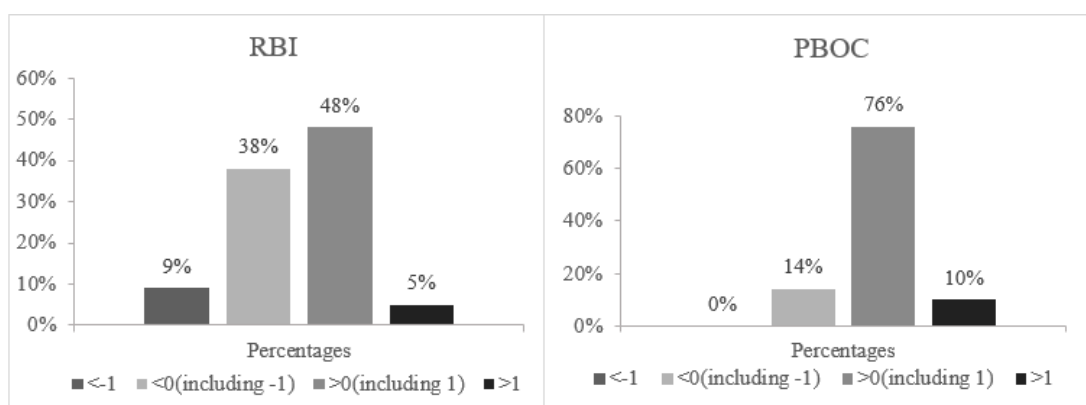
domestic economic outlook index is around 0 but slightly decreasing after 2012. The PBOC's DEO index shows a slightly downward trend as well, although the slope is more negative than the ones for the RBI. This shows that both central banks hold a slightly negative view about the domestic economic outlook from 2012 onwards.

Figure 6.6: DEO indexes of RBI and PBOC



In terms of the RBI, it is clear from Figure 6.6 that the bank mostly conveyed a positive view about domestic economic outlook, which accounts for 53% with 5% highly likely positive domestic economic outlook. Then, the distribution of DEO indexes for the RBI and the PBOC are shown in Figure 6.7.

Figure 6.7: Distribution of DEO indexes of RBI and PBOC



Compared with Figure 6.6, for example, although the PBOC gradually changes the domestic economic outlook, it still tends to talk positively. It is noted that the indexes are sometimes out of the range between -1 and +1, mainly because two or more communication events occurred

in the same day. This leads to an aggregation of indexes (e.g., two communications indicating a positive domestic economic outlook). The DEO index has 47% negative values.

Figure 6.8: WEO indexes of RBI and PBOC

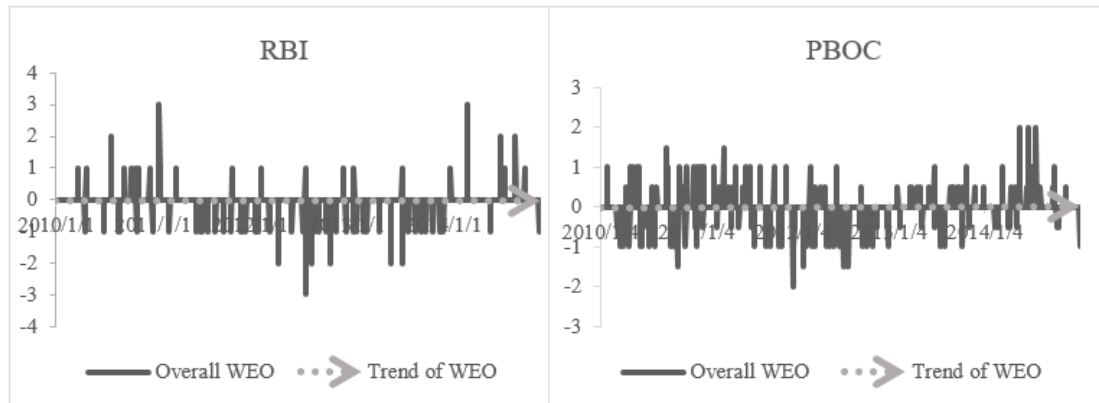
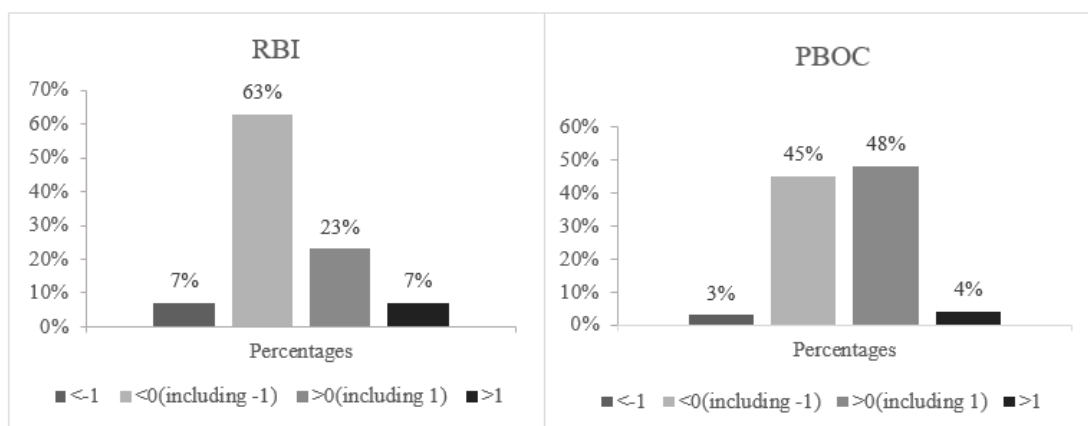


Figure 6.8 is about world economic outlook index of the two banks, where the RBI’s WEO index shows a slightly downward trend but basically around the horizontal line. Interestingly, the similar trend is also shown in the WEO index of the PBOC. The followings are the comparison between the chart graphs.

Figure 6.9: Distribution of WEO indexes of RBI and PBOC



For the RBI, most of the WEO communication indexes are conservative (70%) while the PBOC’s WEO indexes have a relative balance between the positive (52%) and negative value (48%). This seems to show that the PBOC tends to communicate positively about world economic outlook than the RBI, which is also found in the DEO indexes. However, it could be

reason that the economic growth of China was facing problem, then PBOC talk more positively to calm the markets. The last communication index is about monetary policy inclination (MPI).

Figure 6.10: MPI indexes of RBI and PBOC

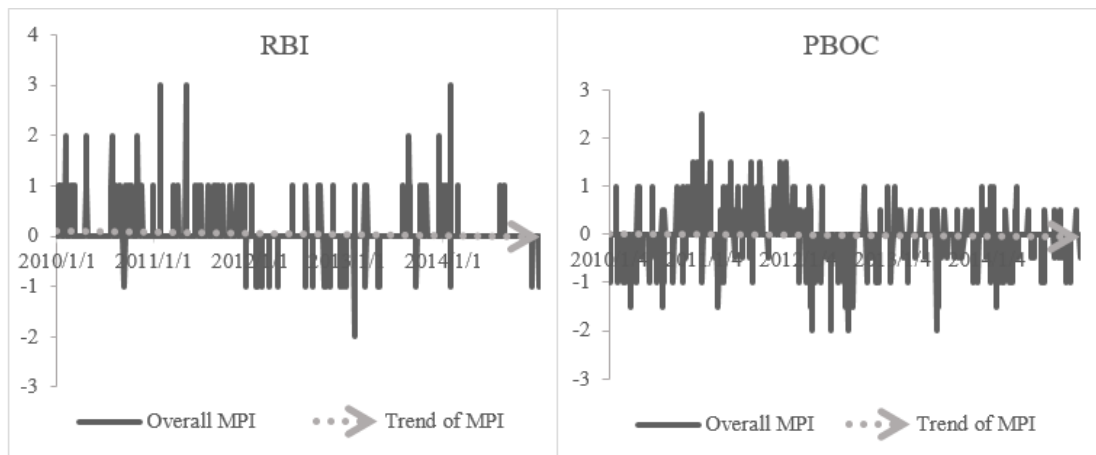
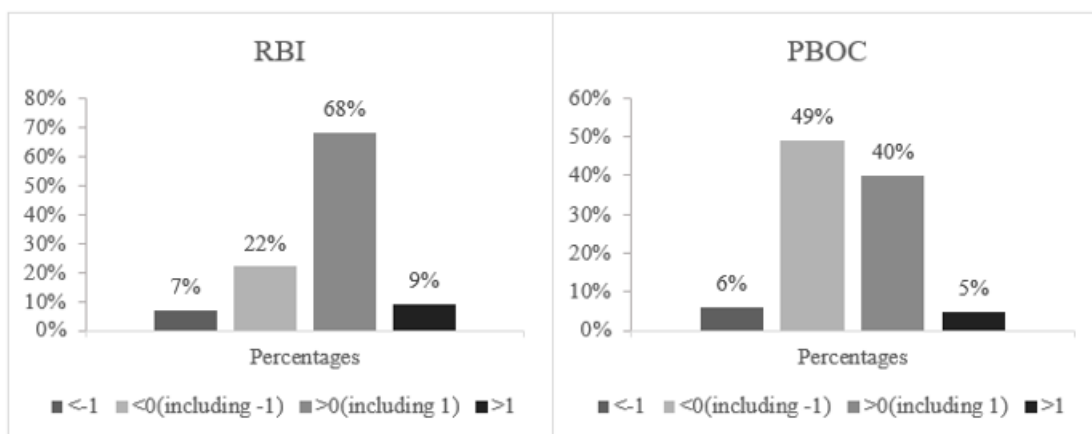


Figure 6.10 illustrates the monetary policy inclination index and its trend in RBI and PBOC. Both indexes show that there is a slightly downward trend, starting noticeably around 2012. Furthermore, it can be seen that the turning point was around late 2011 and start of 2012, similar with Figure 6.7 and Figure 8 when the economic outlook started to recover. Next figure is the comparison between chart graphs of MPI indexes.

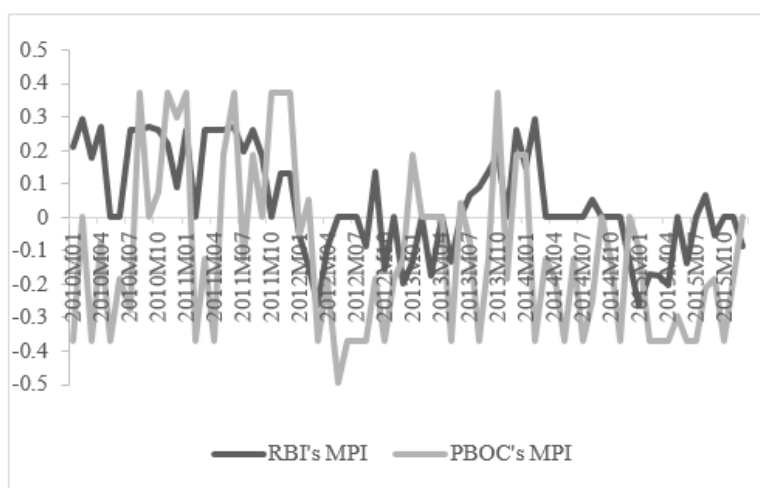
Figure 6.11: Distribution of MPI indexes of RBI and PBOC



Similar with the charts about WEO indexes, the chart graphs in Figure 6.11 appear different. In terms of RBI, the MPI indexes with value larger than 0 accounts for the majority (77%) while

in the PBOC, the MPI indexes with value smaller than 0 accounts for the majority (55%). Furthermore, the PBOC's MPI indexes have a relative balance between positive and negative value. The reason behind this could be the target of monetary policy in each central bank. The RBI spent a lot of efforts on dealing with inflation from 2010 to 2014, and kept inflation as a key target even when the RBI stated that it would change the monetary policy stances towards economic growth. While in the PBOC, the inflation was a severe problem before 2012. After 2012, the sluggish economic growth was the main concern of the PBOC, which results more easing monetary policy after 2012.

Figure 6.12: Monthly MPI indexes of RBI and PBOC



Here is Figure 6.12 of the monthly MPI index in both central banks. An interesting point is that there are some similarities about the movement of MPI indexes. China faced a severe problem of inflation before 2012 and India had the similar issue with its inflation at that time. These are reflected by the tightening MPI indexes showed above. After that, China and India both changed their directions towards an easing monetary policy to deal with sluggish economic growth. These have been shown by the latter part of the above figure where MPI indexes are generally lower after 2012.

Overall, the comparison between the three communication indexes of the RBI and the PBOC draws some conclusion. Firstly, it is the trends of three communication indexes of both central banks have some similar patterns. Second, there are some differences between the WEO

and MPI indexes when it comes to the chart graphs, although the value of both central banks' DEO indexes shows the similarity.

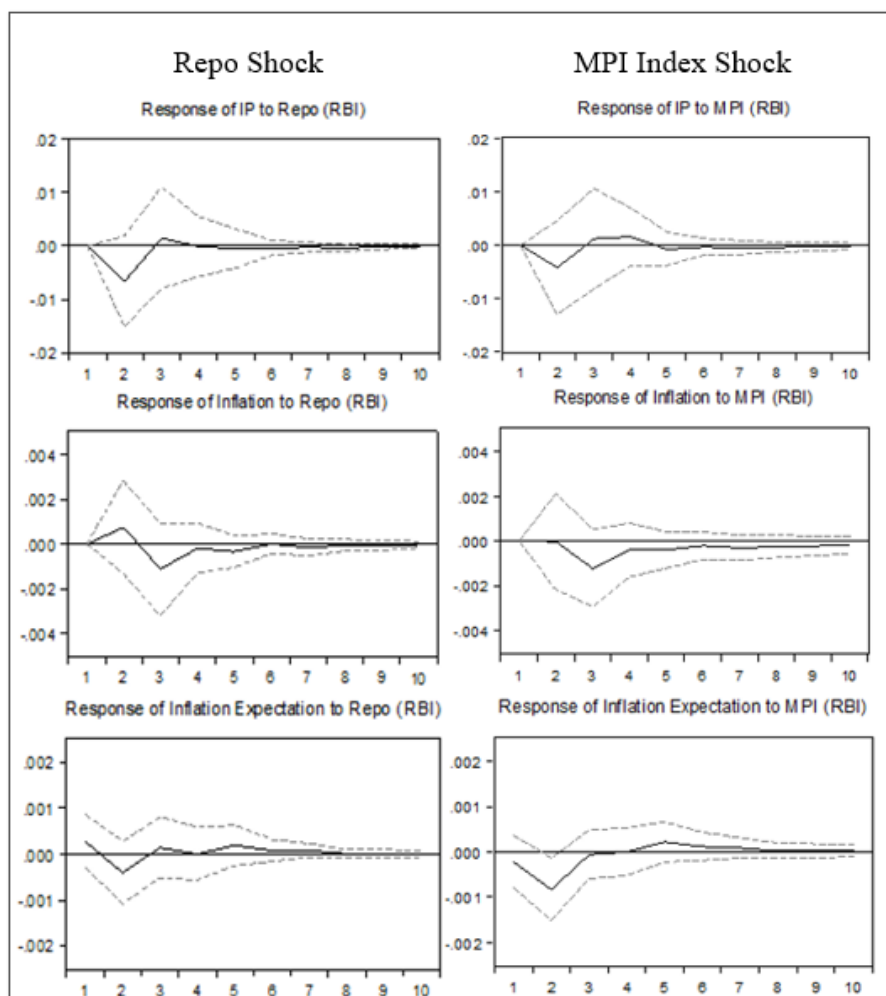
6.3.2 Estimated Results

First, the impulse responses of the case of the RBI and India are shown. Then, the similar steps are implemented on the case of the PBOC and China. Final, there are some comparisons between these two cases. In each case, traditional monetary policy and central bank communication are analysed and compared, the two 'single' versions. Then, policy rates and communication indexes are analysed together (the 'combined' version) to look into communication as a complementary tool to monetary policy actions in the transmission mechanism. The order is chosen based on information criteria (e.g., LR test statistic, Akaike information criterion) and two lags are used here. The analysis generally shows some interesting pattern of impulse responses, although some are not apparent and insignificant, which is similar with some patterns and findings of PBOC (e.g., Wang, 2012; Zhang and Hu, 2013) and Sethaparmote and Luangaram (2016) on Thailand. This might indicate that developing economies' central bank communication still need more focus, for example, the number of communication events are fewer compared with the ones in the developed economies' central banks (e.g., the Fed) discussed in Chapter 3 about communication in practice.

i. The Case of the RBI

Here are the impulses responses of the RBI and case of India. First, two 'single' versions, the repo and communication are analysed separately. Here are figures with repo in the left and communication in the right.

Figure 6.13: Responses to structural one standard deviation shock to repo and MPI of RBI

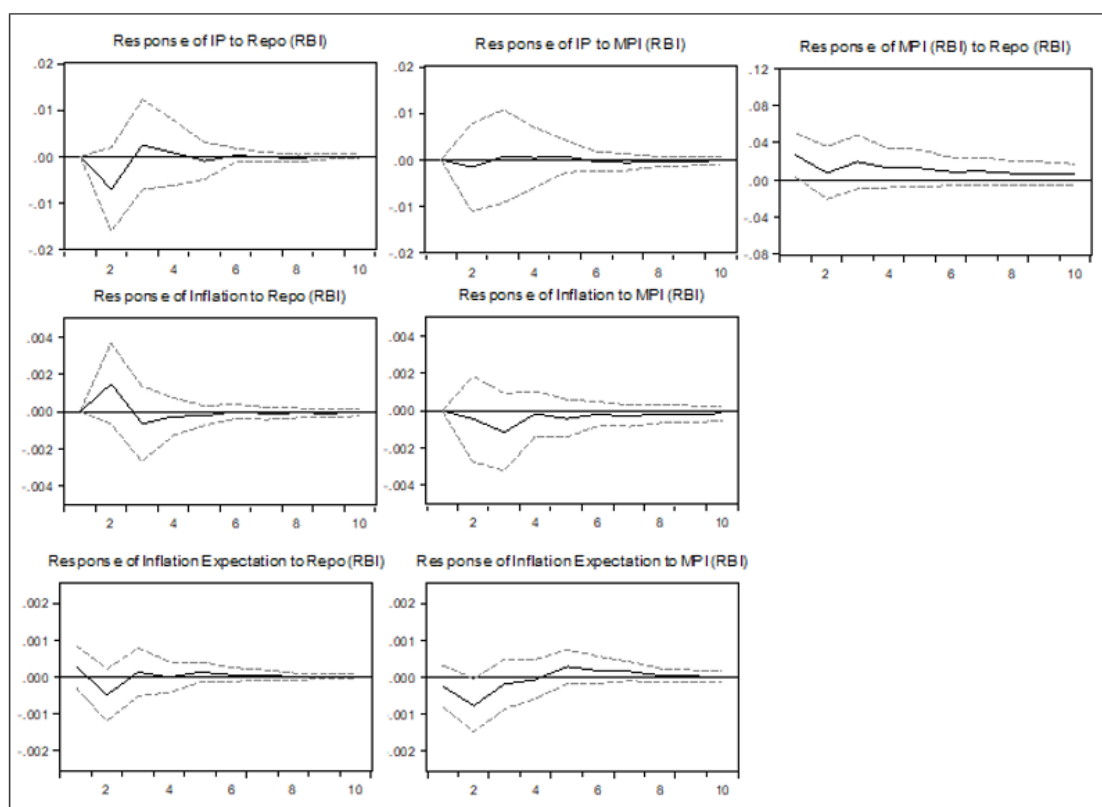


There are similar patterns from between the figures of repo and MPI. First, IP index both responds a decrease in terms of both monetary policy shock until 2 months, after which the IP starts to increase. The repo has a stronger effect compared to the MPI index. Second, the inflation's response to repo has a short time of increase, which might be the case of price puzzle, then the inflation starts to decline. The MPI index starts to influence inflation around 1 month later than repo. It reduces the inflation until 3 months. Third, the inflation expectation has some similar responses with that of inflation. The inflation expectation generally shows a decrease in response to repo shock, while the MPI index seems to have a larger and longer effect.

Besides the two 'single' versions, a more complete picture of monetary transmission mechanism is of interest when repo and communication combined, the 'combined' version. The

‘combined’ version uses all the five variables while the ‘single’ version uses either repo rates or the communication index as the monetary policy tool. It is assumed that central bank communication serves as an unconventional monetary policy that complements the conventional one. As well, it is interesting to see whether communications respond consistently to changes of the repos. The results are shown in Figure 6.14.

Figure 6.14: Responses to structural one standard deviation shock to RBI’s repo and RBI’s MPI index in the combined version



The above figures show that impulse responses of the ‘combined’ version does not change much compared with ‘single’ versions. First, an interest here is how MPI index response to repo, which is shown in the last figure (i.e. MPI to Repo). It illustrates that the shock of repo has a positive and consistent effect on the MPI. This indicates that, to some extent, communication about monetary policy inclination corresponded with the changes of repo in this case. Second, here are some changes compared with the ‘single’ versions. In terms of IP index, the response to repo has been increased a little while the response to MPI index decreases. It seems that the when repo and MPI index combined, the MPI index enhanced the repo a little. Then, the

response of inflation to repo at start, the price puzzle effect reduced a little. The MPI index is found to have a quicker response to reduce inflation. Both monetary policy tools improve the effect on inflation in the ‘combined’ version. The shock of repo on reducing inflation expectation has improved slightly in terms of the minimum level.

Then, Table 6.3 about variance decomposition helps to look at effects of repo and MPI index. The order is based on the economic rationale discussed in Section 6.2 about methodology.

Table 6.3: Variance decomposition of IP, inflation and inflation expectations of RBI

Period	S.E.	IP Index	Inflation	Repo	MPI Index	Inflation Exp
Variance Decomposition of IP Index						
1	0.0372	100.000	0.0000	0.0000	0.0000	0.0000
2	0.0416	94.964	0.3290	2.9373	0.1728	1.5974
3	0.0421	92.543	0.3753	3.2043	0.1899	3.6876
4	0.0425	91.868	0.3887	3.1735	0.1939	4.3754
5	0.0426	91.810	0.4132	3.2095	0.2156	4.3519
6	0.0427	91.789	0.4183	3.2117	0.2303	4.3509
7	0.0427	91.756	0.4182	3.2115	0.2503	4.3641
8	0.0427	91.723	0.4182	3.2181	0.2647	4.3759
9	0.0427	91.716	0.4184	3.2180	0.2718	4.3760
10	0.0427	91.711	0.4186	3.2181	0.2744	4.3782
Variance Decomposition of Inflation						
1	0.0913	0.4200	99.5800	0.0000	0.0000	0.0000
2	0.0950	1.1778	95.9525	2.4535	0.2441	0.1722
3	0.0972	1.1292	94.1750	2.8058	1.6932	0.1968
4	0.0974	1.1301	94.0654	2.8789	1.7266	0.1990
5	0.0976	1.1269	93.8111	2.9247	1.9225	0.2148
6	0.0976	1.1303	93.7642	2.9208	1.9626	0.2220
7	0.0977	1.1311	93.6414	2.9326	2.0583	0.2366
8	0.0977	1.1326	93.5944	2.9383	2.0938	0.2409
9	0.0978	1.1324	93.5411	2.9455	2.1374	0.2435
10	0.0978	1.1327	93.5108	2.9487	2.1634	0.2444
Variance Decomposition of Inflation Expectation						
1	0.0233	0.0048	0.0000	1.4825	1.1218	97.3909
2	0.0299	1.2502	0.0002	3.5078	7.2000	88.0417
3	0.0307	1.7722	0.1713	3.5174	7.1887	87.3504
4	0.0308	1.9218	0.4228	3.4812	7.1454	87.0288
5	0.0312	1.9357	0.4510	3.5704	7.7990	86.2439
6	0.0314	1.9280	0.4464	3.5754	8.0604	85.9898
7	0.0314	1.9307	0.4455	3.5952	8.2809	85.7478
8	0.0314	1.9291	0.4466	3.5928	8.2940	85.7375
9	0.0314	1.9311	0.4519	3.5909	8.2949	85.7312
10	0.0314	1.9345	0.4578	3.5904	8.2956	85.7217

The above variance decomposition shows that, first, the repo accounts for 3.2 percent while the MPI index accounts for 0.23 percent. For the inflation, the variance of repo still accounts for a higher percentage (around 2.8 percent) than that of the MPI index (around 2.0 percent), however, the MPI index has some comparable influence. Compared with the repo, the inflation

expectations respond more to the MPI index (around 7.8 percent).

ii. The Case of the PBOC

The next step is to compare the above findings with another developing economy, China, and its central bank, PBOC. Similar steps are made. As mentioned and showed in figures about data section, different economies are likely to have unique feature. For examples, the changes of repo of RBI is monthly while the PBOC changes the repo randomly. The aim is for common findings about patterns of impulse responses. First, these are the two ‘single’ versions of PBOC.

Figure 6.15: Response to structural one standard deviation to repo and MPI of PBOC

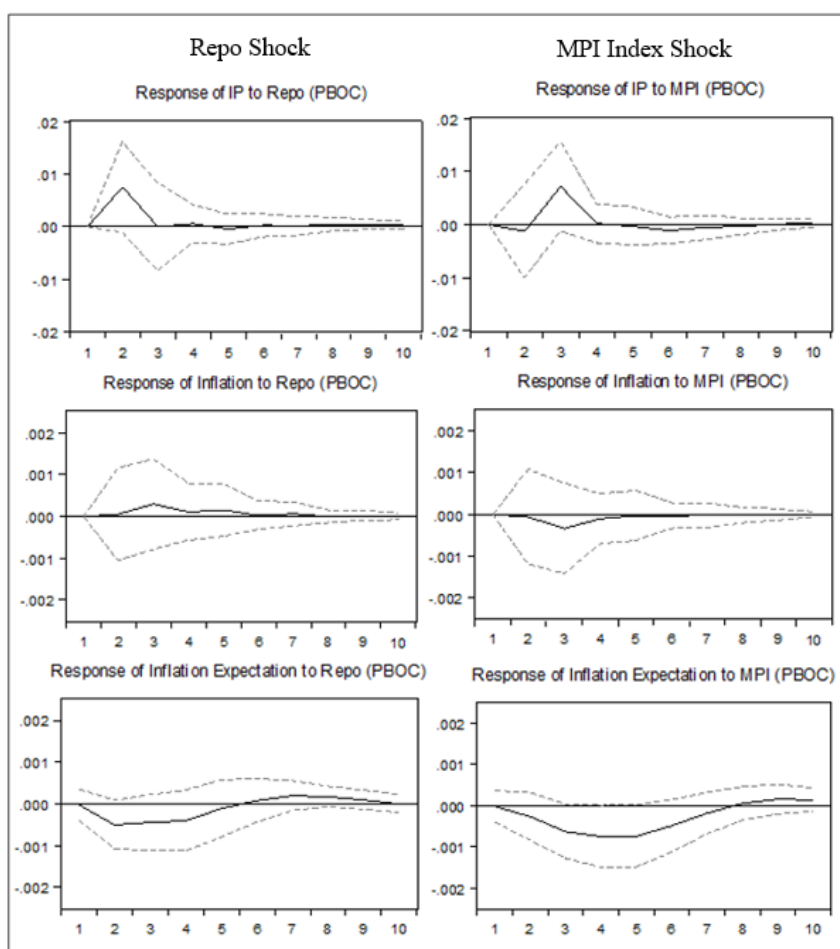
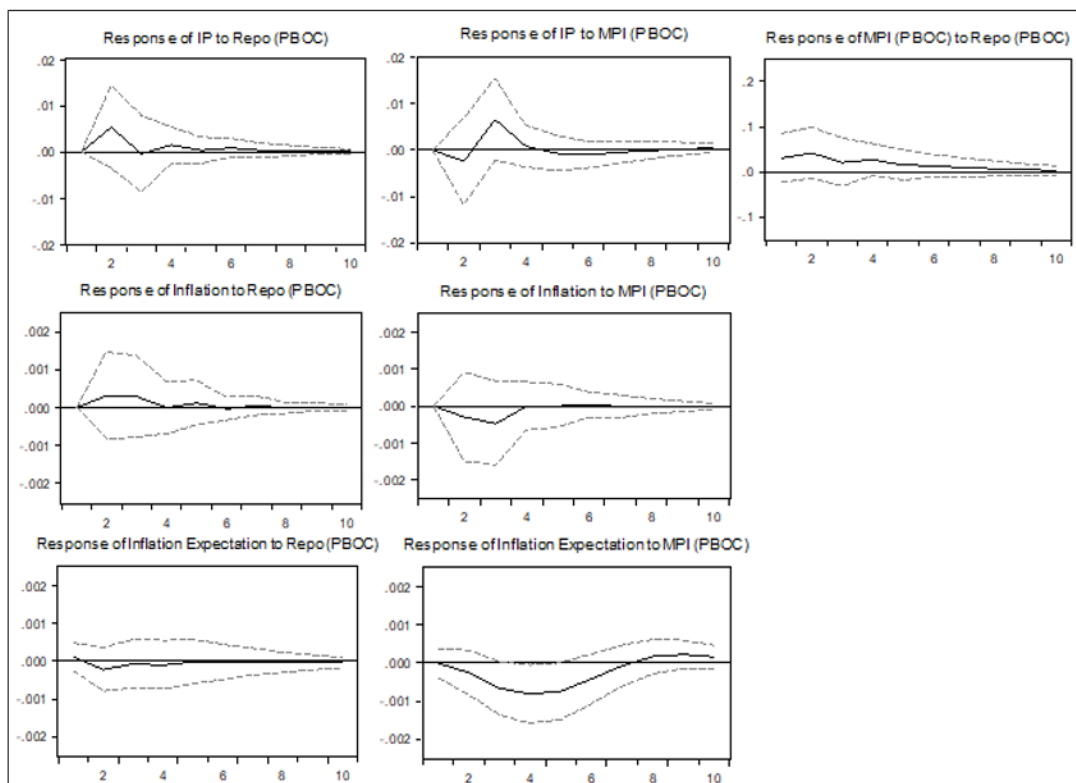


Figure 6.15 are the impulse responses to Repo and MPI of the PBOC. First, the IP index’s response to repo and MPI index has similarity. Both the repo and MPI index tend to increase the IP. Zhang and Hu (2013) found similar pattern of the MPI index on IP as well. The shock of repo is found to increase the inflation while the MPI tends to reduce the inflation. This is also

consistent with the studies of Zhang and Hu (2013) and Shi *et al.*, (2015). However, both has less responses to that of the RBI's case. This could be the reason that PBOC's communication still needs more development, which could be the case considering the development of formal websites of the PBOC compared to the RBI. It is also likely to be influenced by the case that inflation in China during the covering period tends to be less volatile. Third, the inflation expectation shows some decrease in both of monetary policy tools, while the similar finding with the RBI's case is MPI index tends to have larger influence on inflation expectation. This is consistent with some of studies, such as the Wang (2012) on China and Neuenkirch (2013) on ECB. Then, the 'combined' version is analysed in Figure 6.16.

Figure 6.16: Responses to structural one standard deviation of PBOC's repo and MPI in the combined version



First, similar finding with the case of RBI is that the react of the MPI index to the repo is also consistent and positive, shown in the last figure (i.e. MPI to Repo). The impulses responses in the 'combined version' also has some small changes. In terms of IP index, the MPI index's effect on IP index has been slightly increased before 2 months while no changes are found in the shock of repo on IP index. Then, similar with the case of RBI, the MPI index and repo both

have increased their effect on the inflation. The MPI index starts to influence inflation earlier. The inflation expectation's response to repo is reduced, while the MPI index seems to enhance its effect. Similarly, the variance decomposition is shown in the following table.

Table 6.4: Variance decomposition of IP, inflation and inflation Expectations of PBOC

Period	S.E.	IP Index	Inflation	Repo	MPI Index	Inflation Exp
Variance Decomposition of IP Index						
1	0.0366	100.0000	0.0000	0.0000	0.0000	0.0000
2	0.0374	97.0523	0.0420	2.0762	0.4281	0.4014
3	0.0386	92.4806	1.2625	1.9637	3.2919	1.0013
4	0.0390	91.0969	2.0709	2.0689	3.2671	1.4962
5	0.0391	90.3642	2.7417	2.0605	3.2720	1.5616
6	0.0392	90.0491	2.9589	2.0993	3.3340	1.5587
7	0.0392	89.9642	2.9797	2.1039	3.3437	1.6085
8	0.0392	89.9126	2.9808	2.1100	3.3421	1.6546
9	0.0392	89.8829	2.9942	2.1104	3.3450	1.6675
10	0.0392	89.8680	2.9992	2.1108	3.3548	1.6672
Variance Decomposition of Inflation						
1	0.0474	1.6194	98.3806	0.0000	0.0000	0.0000
2	0.0485	2.1568	97.0258	0.4304	0.3773	0.0098
3	0.0502	3.9238	94.0825	0.7467	1.2307	0.0163
4	0.0503	3.9442	94.0568	0.7452	1.2282	0.0257
5	0.0503	3.9364	94.0055	0.8028	1.2252	0.0301
6	0.0503	3.9358	93.9895	0.8064	1.2315	0.0368
7	0.0504	3.9336	93.9727	0.8157	1.2317	0.0465
8	0.0504	3.9335	93.9703	0.8160	1.2317	0.0485
9	0.0504	3.9332	93.9679	0.8175	1.2329	0.0486
10	0.0504	3.9333	93.9668	0.8175	1.2334	0.0491
Variance Decomposition of Inflation Expectation						
1	0.0164	4.0957	4.6639	0.3978	0.0052	90.837
2	0.0263	3.0254	16.3373	0.8839	0.9917	78.762
3	0.0326	4.4276	27.4210	0.6255	4.9310	62.595
4	0.0349	4.2340	30.5636	0.6343	9.7681	54.800
5	0.0361	4.0449	29.1693	0.5960	13.391	52.799
6	0.0372	4.2839	28.1768	0.5686	13.913	53.058
7	0.0380	4.4270	29.0326	0.5479	13.336	52.656
8	0.0385	4.4039	30.0922	0.5498	13.192	51.762
9	0.0387	4.3657	30.3486	0.5589	13.391	51.335
10	0.0387	4.3825	30.2057	0.5671	13.482	51.363

Table 6.4 shows that, first, for the IP, the repo accounts for around 2 percent while the MPI accounts for around 3.2 percent. A reason is the irregular repo changes of PBOC discussed above. Second, the repo and MPI have similar influence on the inflation of China, accounting for 0.8 percent and 1.2 percent respectively. Then, similar with the case of RBI, the MPI index has a larger influence on inflation expectation. When policy rate does not change regular with low frequency, the more communication could act as a monetary policy tool to influence the

economy along with other monetary policy actions, such as open market operation. When repo changes regularly, the communication complements the traditional monetary policy.

iii. Comparison of the two Cases

Then, a vertical comparison focuses on how the two monetary policies, repo and MPI index, changes from ‘single’ to ‘combined’ version. This is to see whether repo and MPI index improved in the ‘whole picture’. In each monetary policy tool, the first half is about the repos and second half about MPI indexes. It is assumed here that the earlier the starting month to influence, the longer time of influence and the larger the general desired effects, the better the two monetary policies, the respective findings are marked, where ‘S’ is the single version and ‘C’ is the combined version.

Table 6.5: Vertical comparison between impulses responses of RBI and PBOC

	IP			Inflation			Inflation Expectations		
	Start Month	Affected Months	Effects	Start Month	Affected Months	Effects	Start Month	Affected Months	Effects
	Repo: RBI and PBOC								
S: Repo	Same	Shorter	Smaller	Same	Shorter	Same	Same	Same	Same
C: Repo	Same	Longer	Larger	Same	Longer	Same	Same	Same	Same
S: Repo	Same	Shorter	Smaller	Later	Same	Smaller	Same	Longer	Larger
C: Repo	Same	Longer	Larger	Earlier	Same	Larger	Same	Shorter	Smaller
	MPI: RBI and PBOC								
S: MPI	Same	Longer	Larger	Later	Shorter	Smaller	Same	Shorter	Smaller
C: MPI	Same	Shorter	Smaller	Earlier	Longer	Larger	Same	Longer	Larger
S: MPI	Same	Same	Smaller	Later	Shorter	Smaller	Same	Same	Smaller
C: MPI	Same	Same	Larger	Earlier	Longer	Larger	Same	Same	Larger

Table 6.5 generally shows that in the ‘combined’ version, both repo and MPI index have improved their performance on the economy compared with the ‘single’ version, particularly on inflation and its expectation. Another similarity in ‘combined’ versions of both RBI³³ and PBOC³⁴ is that the MPI indexes are positively and consistently with the repo.

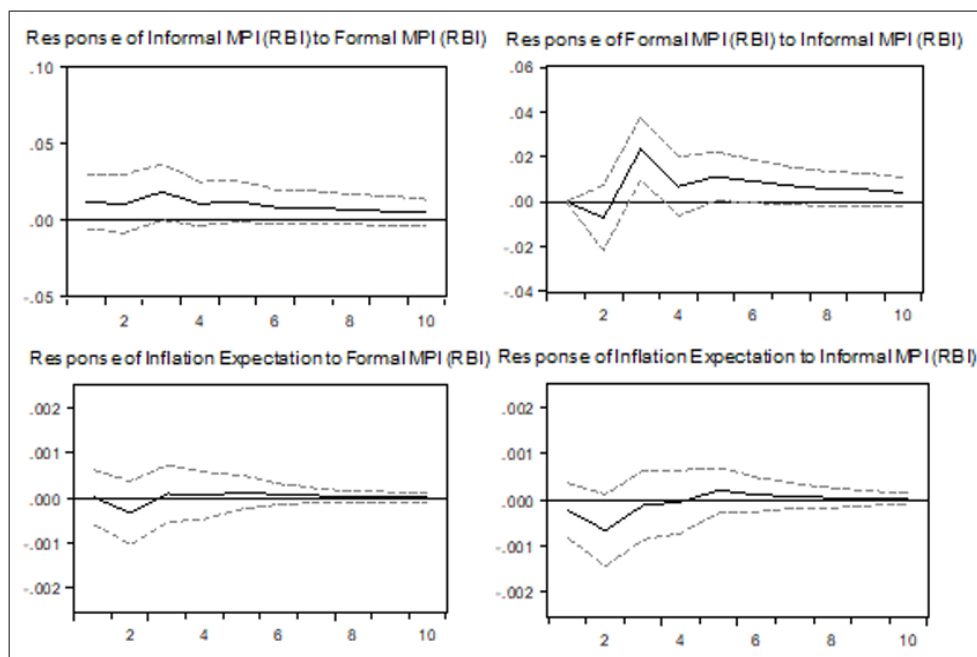
³³ This refers to Figure 6.14 in P.135.

³⁴ This refers to Figure 6.16 in P.138.

iv. Comparison of Communication Channels

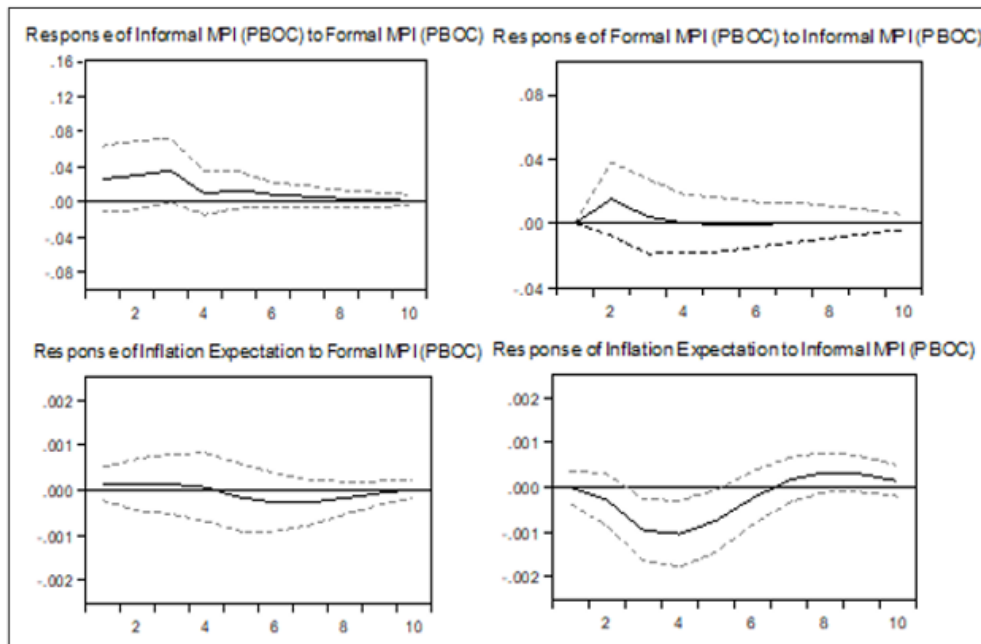
Communication channels have been compared in Chapter 4 and 5, which yield some different findings on case of PBOC. An important aspect of communication is on expectation management, then, the formal and informal MPI indexes of RBI and PBOC are analysed on inflation expectation. Another look is how communication channels influence each other. First, it is the case of RBI.

Figure 6.17: Structural impulse responses of communication channels of RBI



The above half shows the responses between communication channels of RBI. The informal MPI is positive and consistent with the shock of formal MPI, while the shock of informal MPI is more volatile. The second half is about inflation expectation, which shows that informal communication has a larger influence.

Figure 6.18: Structural impulse responses of communication channels of PBOC



To compare with the case of RBI for general findings, the above figure shows the case of PBOC. Similar patterns are found. Formal communication also has a positive and consistent effect on the informal communication, however, the informal MPI has some different view with the formal MPI shown in the second figure. Similarly, informal MPI is more volatile. The inflation expectation has a larger and quicker response to informal communication similar with some findings of the RBI. The case of Wang (2012) on inflation expectation finds that informal communication tends to be larger on the case of PBOC, while the formal communication may increase inflation expectation after some time lags. This might suggest that in terms of PBOC, the informal words, such as speeches, are watched more quickly by the market. An explanation is market participants may try to find extra information. The results in both cases indicate that informal communication is consistent with the formal one, while informal communication have effects on inflation expectations.

For robustness test, the aggregated communication indicator used in the previous chapter was used as discussed above, and the 2-month interval of data were tried with the model, which yield mostly similar findings.

Overall, although there are some differences between the two central banks, the findings

yield some general conclusions. First, central bank communication itself has effects on influencing the economy, mainly on inflation expectations. Second, compared with communication, the repo has a larger effect on influencing the IP index. Third, the communication could be a complementary tool to traditional monetary policy. This is consistent with findings with in the literature, for example, Wang (2012) on inflation expectation of China, Zhang and Hu (2013) on IP and inflation, and Sethaparmote and Luangaram (2016) who find that communication index in Thailand complements the effect of traditional monetary policy if combined. Finally, the informal communication has larger effects on inflation expectation.

6.4 Conclusion

The starting point in this chapter is that more research could focus on the central bank communication in developing economies which act an increasingly important role under globalization. First, research normally focuses on one central bank's communication and its economy (e.g., the Fed and the US), the comparative study about two central banks' communication is less covered in the extant literature, particularly in the cases of developing economies. This is the main contribution of this chapter, where communications of RBI and PBOC are compared for common findings about effectiveness of central bank communication. Second, the use of VAR is also less common in the communication literature, which is used in the chapter. Third, compared with the previous research about PBOC's communication, this chapter has a more complete picture of monetary policy transmission mechanism where IP index, inflation and inflation expectations are incorporated into the VAR.

The main findings are, first, the MPI indexes influence the economy, particularly inflation expectations. This supports the view that central bank communication acts as an unconventional monetary policy to manage market expectations, mostly analysed on developed economies. Second, the findings show improvement of policy transmission when repo and communication indexes are combinedly used, particularly on inflation and its expectations. Central bank communication has potential effectiveness as unconventional monetary policy that influences the economy and complements the traditional monetary policy.

Chapter 7

Conclusion

7.1 Synopsis

Central banks are more willing to communicate their monetary policies including reasons behind policy changes, the path of future interest rates, economic outlook now than before. This trend responds to the increasing demand for central bank transparency, adoption of the inflation targeting regime and development of financial markets. Meanwhile, potential effectiveness of communication as an unconventional monetary policy has been gradually recognized. Whether central banks use communication to directly signal possible changes or to indirectly align consensus view of markets, there is more emphasis on this potential toolkit of monetary policy.

It is argued that, first, communication influences asset prices, therefore, central banks may guide markets towards the desired direction. Second, communication helps central banks manage market expectations. Third, central bank communication has been adopted by some central banks (e.g., the Federal Reserve) as an unconventional monetary policy. It helps to deal with unusual situation or to complement traditional monetary policy, such as maintaining financial stability during financial crisis. Even when there were no actual policy changes, central banks could talk about potential changes in the future, therefore influencing market expectations before the real action.

This chapter is structured as four sections. Section 7.2 reviews the main contributions, findings of the research and their policy implications. Section 7.3 proposes potential improvements in communication design. Section 7.4 discusses the areas for future research.

7.2 Main Contributions, Findings and Policy Implications

7.2.1 Main Contributions

This thesis mainly contributes to the literature on central bank communication about developing

economies. Here are the main contributions.

1) Chapter 3 reviews central bank communication in practice where two developed economies' central banks (BOE and the Fed) and two developing economies' central banks (PBOC and RBI) are focused. It provides more background about central bank communication, particularly the comparison about the four banks.

2) Chapter 4 focuses on the case of PBOC and three financial markets in China. First, before empirical analysis, the chapter examines the PBOC's credibility in terms of monetary policy action and communication. Second, the main contributions are the communication indexes. Compared with the previous literature, the communication indexes were extracted from all the formal and informal communication during 2010 to 2014. Furthermore, a new communication index about world economic outlook was created. Third, it extends the previous literature about the effects of PBOC's communication on foreign exchange markets, where five currencies are included. Fourth, this chapter contributes to the literature by the comparison between communication channels and particularly the analysis of three communication strategies of PBOC from 2010 to 2014.

3) Chapter 5 continues the research about the PBOC's communication. It is found that the research of communication and predictability of monetary policy stance usually focuses on cases of developed economies, more evidences of developing economies could be meaningful. First, compared with the previous literature that focuses on the PBOC's formal reports only, this chapter extends the dataset used in Chapter 4 and codes the communication indexes from a more comprehensive dataset from 2009 to 2015. Second, a new communication index about money supply was created considering that PBOC sometimes sent signals about money supply. Third, with the communication indexes covering all the formal and informal communications, communication channels are compared for predictability of PBOC's monetary policy stance.

4) Chapter 6 examines the role of communications in RBI and PBOC. First, the extant literature normally focuses on one central bank's communication, however, the comparative study about more central banks' communications was overlooked in the literature. Furthermore, there are

also very few studies about central bank communications of two developing economies. This motivated this chapter about a comparative analysis of RBI and PBOC. Second, the VAR is less used in the communication literature, the use of VAR for the study of developing economies' central bank communication is worthwhile. Third, compared with few existing studies about the PBOC's communication and VAR, this chapter has a detailed analysis about communication index and also includes more variables (i.e. IP index, inflation and inflation expectations) into the VAR. Finally, there is a brief look at the 'how-to-communicate' question, by comparing the effects of communication channels of RBI and PBOC on inflation expectations.

7.2.2 Main Findings

The findings in the literature lead to a general agreement of communication's effectiveness in the economy. However, research mostly focused on developed economies, this thesis focuses on developing economies with the aim to identify effects of communication in this study group.

Chapter 3 introduces information background and discusses the main research questions. It focused on the BOE and the Fed, and the PBOC and the RBI. This is to review central bank communication in practice. Chapter 4 looks at the main role of communication in the financial market, its ability to influence markets' prices and volatility, where the main finding on the PBOC's communication suggests that it has influence on the mean level and volatility of the three financial markets in China (i.e. interbank money market, equity market and foreign exchange market). Furthermore, informal communication has a larger effect on reducing volatility in general. Lastly, three communication strategies are found to be effective on the interbank money market. For example, the introduction of fix-date testimony reduces the market volatility.

Chapter 5 looked at the pivotal role of communication in the short and medium term, management of market expectations and predictability of monetary policy stances. In the case of China, the Taylor rule model with forward-looking elements and communication signals have been used. The original model suggests that the communication signals have predictability power of future repo changes. When combining with forward-looking elements, predictability

power of communication is improved. In terms of the ‘how-to-communicate’ question, the findings show that communication channels matter for predictability, where the informal communication is more useful in the case of PBOC, consistent with the findings on interbank money market and stock market in Chapter 4. In terms of the communication about money supply, it improves the communication models. Chapter 6 analyses the communication’s role as an unconventional monetary policy tool in monetary policy transmission mechanism. To contribute the literature by comparing communications of RBI and PBOC on their developing economies, it identified the communication effects on the economy and also communication’s complementary role as an unconventional monetary policy. In particular, the findings support the view that communication helps central banks manage market expectations. The informal communication is found to be more effective than the formal communication in the two cases.

7.2.3 Policy Implications

In general, the thesis shows that central bank communication can play a vital role in the management of an economy not just in the case of developed economies, but also of developing economies. The work indicates the ability of central bank of the emerging economies in moving the markets, management of markets’ expectations, and the role of unconventional monetary policy. For regulators and policy makers, this suggests that communication should be used well to achieve monetary policy objectives. For example, to direct market expectations towards an easing monetary policy, when there were no policy rate changes in the case of the PBOC. For investors, communication in developing economies should be closely watched, which can have impact on stock market and foreign exchange markets.

Second, although some effectiveness of communication is presented in this study, the results differ. For example, the PBOC’s communication has a larger effect on interbank money market while a smaller effect on the equity and foreign exchange market. However, general evidence in the literature (e.g., Rosa, 2011; Hayo *et al.*, 2012b) found the effects of communication on the equity market. There are certainly some differences between developing and developed economies, such as the development of financial markets. Considering the case of China where the equity market is less developed, findings in Chapter 4 indicates that it could be better to

influence interbank money market with the use of communication, while the use of communication itself for equity market is not enough. The combination of policy announcement and communication of PBOC such as testimonies and press conferences, could be desirable.

Finally, the findings could be useful for communication design. For example, communication channels should be chosen based on their evidence-based impact. The findings of PBOC's communication channels suggest that, for regulators, informal communication particularly on inflation could be used to guide market expectations about monetary policy inclination, while the formal information about foreign exchange market and its policy should be communicated well. The informal signals can be sent more to influence Chinese interbank money market and stock market. For investors, differences between communication channels are potentially associated with their investment opportunities, for example, to hedge exporting goods when tightening monetary policy has been forecast. Another example is the diversity of communication on the same day, which should be carefully communicated by regulators as are closely watched by investors who care about volatility.

7.3 Potential Improvement of Communication Design

Besides implications, potential improvements of central bank communication are discussed, based on the findings of this study. 1)The data availability of communication on the formal website can be improved. Sometimes, it is found that the content of communication is rather short and incomprehensive. For example, it will be possible to introduce more information into the brief minutes of the PBOC's monetary policy meetings. The minutes of PBOC normally contain less information. However, more detailed information might not necessarily be a plus for central bank design as argued by several papers (e.g., Morris and Shin, 2002), but this can be an experimented once communication becomes more comprehensive. 2)Numbers of communication events are fewer compared with the ones in developed economies' central banks, a fact found during the data collection of both the RBI and the PBOC. Although communication events and disclosure have certainly been increasing, for example, the PBOC's communication before 2009 were fewer compared with recent. The formation of the RBI's Communication Department is a welcome development and this trend should be encouraged. 3)Finally, central

bank communication starts from senders (central banks) via channels to receivers (the public and markets). In this process, one of the key roles is alignment of market expectations, therefore making monetary policy effective. What also matters are responses of receivers, and therefore, it would be better to obtain feedbacks from the receivers (e.g., by surveys) to help improve communication design. These feedbacks could provide valuable information such as areas that need more information, the markets' preferred channels about monetary policy stances, etc. Communication process is seen as a two-way road, the senders and receivers both exchange information that is beneficial for both parties.

Communication design is mainly influenced by central banks, although the developing economies' central banks indeed have more areas of improvement than the developed economies' central banks, the general trend is a more transparent and clearer communication system in central banks worldwide.

7.4 Potential Areas for Future Research

Some areas for future research are discussed based on the main research questions.

(1) For what-to-communicate questions, communicating explicit path of future policy rates has an increasing attention (e.g., ECB, BOE). Blinder *et al.* (2008) suggest that research in this area is of great importance. Communicating an explicit path of future policy rates is argued to have ability to enhance transparency and market confidence, particularly at zero-lower bound. Considering more central banks employs the forward guidance tool, the research on this aspect of communication could be more. Besides, little research is conducted on the relationship between central bank communication and fiscal policy (e.g., Allard, 2013). It would be interesting to analyse effects of communication about monetary policy combined with the communication about fiscal policy.

(2) For how-to-communicate questions, starting from earlier work of Fraztscher (2006), research on this aspect has been increasing in the literature. Rosa (2011) and Farka (2011) looked at effectiveness of different channels of communications, but yet to establish which

channel is the best. Another related question that also requires further research is, under given conditions which channels are superior to others or more locally preferred (Berger *et al.*, 2008; Born *et al.*, 2012). This study has provided some findings about this question, for example, the better influence of the PBOC's communication on the interbank money market rather than the equity market and foreign exchange markets in the case of China. However, more central banks could be analysed to shed light on the question. In addition, differences in characteristics of committee members have been noticed by few researchers, such as different performance of committees' members (Berk and Bierut, 2011) and determinants of speeches by the ECB representatives (Hayo and Neuekirch, 2012). More research could be carried out on this aspect.

For the receivers of communication, Berger *et al.* (2008), Blinder *et al.* (2008) and Rosa (2011) agree that it is still not clear how the public perceives information about monetary policy, this is a meaningful aspect that also helps central bank design. However, the research may be not easy because of data collection. For example, as discussed above, the data of receivers' feedback are not yet available in the case of RBI and PBOC.

(3) For when-to-communicate questions, the best timing of communication needs further information. For example, De Haan *et al.* (2006) propose how much information should be communicated and with what timing and frequency. One of the important aspect about timing is the purdah periods that are the non-communication periods. This has been found in most central banks. For example, Ehrmann and Fratzscher (2008) analyze the purdah periods of the ECB, but there is little research on other central banks. Another aspect about the timing of communication is the financial crisis. Some researchers (e.g., Hayo *et al.*, 2012b; Born *et al.*, 2014) have found the different effects of communication before and during financial crisis. It is possible to bring more cases.

(4) In terms of communication environment, communication as an unconventional monetary policy is argued to be very effective in dealing with unusual circumstances. The research may require the economic status. For example, Rossouw and Padayachee (2009) use questionnaire in South Africa and suggest researching the impact of communication in deflation periods. Another example is Rosa (2013) who proposes examining the Fed under uncovered

interest rate parity. The research on this question could be continued with the new situation coming. For example, it is possible to examine the use of central bank communication and its effectiveness on reducing inflation.

(5) For components of optimal central bank communication, this topic has received some attention in the literature. As Erhmann and Fraztscher (2005) suggest, there might be no single best approach for decision-making process and communication strategy. However, some components of communication have been researched for potential improvement, for example, the clarity of communication of the Fed (Jansen and De Haan, 2006; Jansen, 2011). In terms of the clarity's effect, it is possible to look at other central banks' communication.

(6) For impact-type questions, communication's role on financial stability and macro-prudential policies have attracted some researchers. It has been suggested to continue examining how communication affects financial stability (Knutter *et al.*, 2011; Born *et al.*, 2012; Born *et al.*, 2014), therefore contributing to communication design. Another aspect on this question, which is also discussed in Chapter 6, is that the communication literature normally focuses on one central bank's communication and its economy, the research about spillover and integration effects of communication is less covered in the extant literature. For example, Rosa (2011) compares the effects and connections between the ECB and the Fed. Researchers have suggested to look at more cases about spillover and integration effects of communication. For example, Smales (2012) suggests researching the spillover effects of other monetary policy committees on Australia. The comparison between different economies and their central banks has difficulty, because of differences in central banks, data availability, economic background. In the future research, it is possible to compare central bank communication of developed and developing economies or of two developing economies.

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Appendix

A.1 Construction of Communication Indexes

This section gives information about construction of the communication indexes in the three empirical chapters. Chapter 4 uses the daily communication indexes for daily financial markets, while Chapter 5 and Chapter 6 use the transformed communication indexes to fit with quarterly and monthly macroeconomic indicators.

Daily Communication Indexes

To analyse the effects of PBOC's communication on daily financial markets in China, the daily communication indexes are used in Chapter 4. As discussed in Literature Review³⁵ and Section 4.2 in Chapter 4³⁶, there are two main approaches for constructing communication indexes, one is by researchers and the other is by computer software. It is found that the PBOC's communication sometimes tends to be subtle, therefore, the narrative approach that relies on the reading of researchers is used, which is consistent with most of the extant studies about the PBOC's communication.

The three empirical chapters have different methods and research interests, however, they all start with the daily communication indexes. Taking Chapter 4 as an example, three communication indexes are constructed, which are communication index about domestic economic outlook (DEO), communication index about world economic outlook (WEO) and communication index about monetary policy inclination (MPI). Here is a brief look at what the original communication index looks like, using the daily MPI index as an example. It is assumed that when the monetary policy stance is tightening, the policy rate goes up, while when the monetary policy stance is easing, the policy rate goes down. For example, when the PBOC signals a tightening monetary policy to deal with high inflation, the communication is coded as +1, which is shown as the following:

³⁵ See p.41.

³⁶ See p.68.

$$MPI = \begin{cases} > 0 & \text{tightening monetary policy inclination} \\ < 0 & \text{easing monetary policy inclination} \end{cases}$$

In 2011, when the inflation was increasing in China, the PBOC talked about its determination about reducing inflation. For example, in the minutes³⁷ of the MPC's meeting on March 28th, 2011, it recorded that 'the MPC emphasized that the stability of price level is the main task'. On April 18th and 19th, 2011, two deputy governors talked about the similar idea in public speeches³⁸. Here is a table showing the original MPI indexes for these communications.

Table A.1: Original MPI index of the PBOC (sample)

Date	Minutes	Formal MPI	Speech	Informal MPI
2011/3/28	1	1		
2011/4/18			1	1
2011/4/19			1	1

Table A.1 shows that how the above formal and informal communications are coded into MPI indexes. The construction of DEO indexes and WEO indexes is with the same process. In the time-series data, the communication is considered as a shock that has a value such as -1 or +1, and the days without communication has the value of 0.

Transformed Communication Indexes

In Chapter 5 and Chapter 6, the main interest is to examine the communication's effects on the economy in the short and medium term. Therefore, the daily communication indexes are transformed into quarterly or monthly communication indexes. Following the literature, three methods for transforming daily communication indexes are used.

In Chapter 5, the quarterly communication indexes are used. Two methods for transforming daily communication indexes are employed. The first method by Heinemann and Ullrich (2007)

³⁷ From the PBOC: <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2850878/index.html>.

³⁸ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2891464/index.html>.
<http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2891464/index.html>.

is mainly used. This indicator focuses on the frequency of words and the inclination as follows:

$$WI_t = \sum_{i=1}^t \frac{\text{numberofObs}(X_{i,t}) - \text{meanofObs}_t(X_i)}{\text{stdv}(X_i)} * \text{sign}(X_i) * \text{weight}(X_i) \quad (\text{A.1})$$

Where WI is the aggregated MPI index, t is the event window which is a month here, $\text{numberofObs}(X_{i,t})$ is the number of communication event (e.g., monetary policy report) in the month, $\text{meanofObs}_t(X_i)$ is the mean value of all the communication index, $\text{stdv}(X_i)$ is the standard deviation of all the communication indexes, $\text{sign}(X_i)$ is from the three communication indexes that focus on the domestic economic outlook, the inflation, and the money supply, $\text{weight}(X_i)$ is used as 1 in this case. The second method is the simple aggregation of communication indexes in each quarter:

$$\text{Aggregated communication index} = \frac{\sum \text{Value of Indexes}}{\text{Number of Indexes}} \quad (\text{A.2})$$

where the index divides the sum of index values by the total number of indexes in each time interval, to account for seasonal effects.

In Chapter 6, the monthly communication indexes are used. Similar with Chapter 5, two methods for transforming daily communication indexes are employed. The method shown in Equation A.1 is used for a robustness test. Chapter 6 mainly uses the method by Jansen and De Haan (2009), which are represented as:

$$\text{MPI}(t) = \sum_{d=1}^t (n_d^+ - n_d^-) * \left(\frac{NT^{avg}}{N_t^* T_t} \right) \quad (\text{A.3})$$

where the MPI is the transformed MPI index, t is the number of days in the event window which is monthly data here, d is the number of days, n_d^+ is the number of days with tightening monetary policy inclination, n_d^- is the number of days with easing monetary policy inclination.

Then, with the multiplier $\frac{NT^{avg}}{N_t^* T_t}$, the equation results a balanced monthly MPI indexes.

A.2 Communication of the PBOC and RBI

Communication of the PBOC

This section gives more information about communication of the PBOC. Results in Chapter 4 indicate that communication channels matter for effective communication, therefore, this section takes a closer look at communication channels of the PBOC.

Formal Communication

MPC of the PBOC holds monetary policy meetings quarterly. After every meeting, a brief is published on the PBOC's formal website. It is not as extensive as minutes, but it is the earliest formal signal that the markets can receive about the meeting.

It discusses current domestic and foreign economic outlook. For example, in the second minutes³⁹ of monetary policy meeting on July 4, 2011, it stated that 'the committee considered that domestic economy is going under control, however, the challenges are still complicated. The economy worldwide is recovering slowly. The domestic economy would develop smoothly, however, the inflation pressure is still urgent.' As it shows, the discussion is short but to the point. Then, the monetary policy in next quarter is presented briefly. Since inflation started to soar from 2011 in China because of various reasons such as the relatively easing monetary policy in the period before 2011 as a response to the subprime crisis. The third brief minutes⁴⁰ of the MPC's meeting on September 30, 2011, stated that inflation is still high and the committee emphasized that 'the prudent monetary policy should be carried out continually while maintaining price levels is the primary goal'. General investors could grasp the message of the PBOC from these minutes. The time lags between for brief and monetary policy reports there is a time lag of around one month. The minutes would be more beneficial as they contain more details including voting record in the meeting.

³⁹ From the PBOC: <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2846244/index.html> (translated to English and also for other communication).

⁴⁰ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2890009/index.html>.

Monetary Policy Reports

This is the most important formal monetary policy communication of the PBOC, followed by the minutes. Since 2001, the monetary policy report has been published quarterly and it indeed contains extensive discussion about various aspects of economy. Firstly, it starts with an abstract which summarizes domestic economy in the last quarter including review on monetary policy. Then, it discusses the money supply, M2, discussed above which is an important benchmark of the PBOC's monetary policy. Subsequent parts are on the monetary policy inclinations.

The report is made of five parts, which are the money credit, the operation of monetary policy, the analysis of financial markets, the analysis of macroeconomic conditions and monetary policy inclination. The first three parts discuss about the situation previously, such as the increase rate of M2 and the volume about open market operation. However, these three parts focus more on the summary of macroeconomic condition. As central bank communication helps in managing market expectations, the information provided by central banks about future is the main point that is included in the last two parts on macroeconomics conditions and monetary policy inclination. In the fourth part, it conveys the PBOC's view about current world economic situation and outlook. The major economies such as the US, the UK, the EU and Japan are usually discussed about their economic conditions and then followed by the focus on international financial market such as foreign exchange markets and global stock markets. For example, in the second monetary policy report⁴¹ on August 7, 2015, it stated that 'The US economy enjoys a stable trend of recovery accompanied with some good signs of macroeconomic indexes', 'volatilities of emerging markets have increased due to various reasons such as the uncertainty of tightening monetary policy of the Fed'. There is also one part describing monetary policy in these major economies. For example, still in this 2nd monetary policy report in 2015, the report included various monetary policy in major economies, for example, 'the Bank of England continued maintaining the benchmark policy rate of 0.5% with unchanged asset purchase plan', 'the chair of the board of governors of the Fed, Mrs Yellen,

⁴¹ <http://www.pbc.gov.cn/zhengcehuobisi/125207/125227/125957/2161441/2926066/index.html>.

stated in the congress hearing in July that the possibility of increasing benchmark rate is high if macroeconomics condition is in line with expectation'. In addition, the potential challenges in world economy are described. Still in this report, because the uncertainty of tightening policy rates in the US, the reports considered 'due to various reasons such as the macroeconomic condition in Greece, the possibility of tightening policy rates has increased, which create uncertainty and volatility in international financial markets.' Overall, it is clear that the PBOC closely watch world economic condition and has been trying to communicate its views about current and future possibilities. This is also the interest of the first empirical chapter, which is central bank communication about world economic outlook. Because most of papers focus on the communication about domestic economy, whether central bank communication about world economic outlook itself affects various markets could be an interesting and meaningful point.

The fourth part is communication about domestic economy. It focuses mainly on macroeconomic condition in previous quarters, ranging from basic consumption, investment and exports to the information such as agriculture, employment and balance of account. For example, in the second monetary policy report⁴² on August 2, 2013, it contained 'consumer price is stable in general with a 2.4% increase of CPI compared with the first half of the year', 'the employment is increasing', 'The real estate transactions have gone down, however, the credit supply for the security continues increasing'. Overall, this part gives details about figures and growth rates in various sectors in macro economy of China.

The fifth part could be considered as the section for domestic economic outlook and monetary policy inclination, both of which share the equal importance in the report. In more detail, communication about domestic economic outlook contains the projection of the PBOC based on both domestic and worldwide economic condition. For example, under the background of increasing inflation starting from 2011, in the second monetary policy report⁴³ in 2011, it stated that 'the situation about inflation is still not optimistic', 'the growth worldwide still needs more with the fiscal burden and the debt crisis', 'it is needed to closely watch the international situation', 'however, with the decrease of money supply and relatively calm international

⁴² <http://www.pbc.gov.cn/zhengcehuobisi/125207/125227/125957/125991/2869042/index.html>.

⁴³ <http://www.pbc.gov.cn/zhengcehuobisi/125207/125227/125957/125997/2880010/index.html>.

commodity markets, there are more factors contributing the stability of price levels'. Another interesting point is that in the analysis process, it is noticed that the PBOC also talks about its formal survey for market expectation of residents, entrepreneurs and bankers in China. These surveys are the only formal survey conducted by the PBOC and communicated to general public, which is important. Therefore, by combining these survey data, it would be possible to add market expectation into the research.

Then, what the PBOC emphasizes at last in the report is monetary policy inclination. This part can be considered as a comprehensive version of the final section of the brief minutes and also the abstract in monetary policy reports. It normally starts with the emphasis of monetary policy in next quarter followed by details of various aspects such as credit supply, credit structure, interest rate liberalization and reform of exchange rate regime. For example, in 2011, the price level in China gone up quickly, rising from 2.96% in the fourth quarter to 5.69% in the third quarter, the primary goal at that time was reflected evidently by the PBOC's communication. In the second monetary policy report on August 12, 2011, the section of monetary policy inclination starts with 'the PBOC will continue focusing the price level as the primary monetary policy goal'⁴⁴. The similar efforts reflected by central bank communication were found clearly in that year, for example, in the monetary policy report or other informal communication. At that time, the PBOC communicated tightening inclination to address rising inflation and to calm down the markets. Combined with great efforts including the conventional monetary policy such as open market operation and cut of policy rates, the inflation issue was relatively tackled.

Other Formal Central Bank Communication

In addition to the important monetary policy report, other formal communication of the PBOC is discussed here. All kinds of formal communication of the PBOC were extracted, which are minutes, monetary policy reports, international financial market reports, macroeconomic analysis, financial markets development reports, financial stability reports, annual reports,

⁴⁴ <http://www.pbc.gov.cn/zhengcehuobisi/125207/125227/125957/125997/2880010/index.html>.

financial industry reform plan, China rural financial service reports and added communication. Besides the minutes and monetary policy reports, other communication has a lower frequency, normally once a year. For example, the financial stability report, which documents the running of financial sectors in China, normally publishes in the mid of year. Compared with minutes and monetary policy reports, most of these formal communication focuses on a specific sector only, for example, the rural area, the reform of financial industry. It starts with a detailed abstract and followed by a comprehensive discussion about the sector. So, when analyzing these qualitative data, the abstract rather than the whole report is focused. Notably, the annual report of the PBOC discusses broader information and statistical figures of various sectors including domestic and world economy, domestic financial sector, financial reform, foreign exchange market and Renminbi, balance of payments, international cooperation, etc. Because of mass details in this annual report, domestic economic outlook and monetary policy inclination are targeted to code communication indexes. For example, in the PBOC's 2012 annual report⁴⁵, it included that (in translation to English) 'in 2012, domestic and worldwide economy was faced with complicated situation, the management of macro economy and financial sector is under huge pressure. The PBOC unwaveringly sets the primary goal as maintaining price level while the efforts of prudent monetary policy are evident.', 'the general work guideline in the next year is to make progress while maintaining the stableness of price level.'

In the analysis process, it is noticed that besides the communication documented in various reports, the PBOC clearly shows a trend of more formal communication about its latest important movements in order to send more signals via the PBOC's formal website. For example, when the agriculture sector was under the challenge of credit supply, the PBOC communicated its actions and views about the support to this sector, which was on the website on March 7, 2012 with the words 'increasing the support to agriculture sector is a significant approach to enhancing the real economy in China'⁴⁶. On December 19, 2014, the PBOC conveyed its determination about the newest 'The Decree of Government Information Openness'⁴⁷ in the PBOC with details discussing that how the PBOC would improve its

⁴⁵ <http://www.pbc.gov.cn/chubanwu/114566/115296/115371/2868019/index.html>.

⁴⁶ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2858653/index.html>.

⁴⁷ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2893908/index.html>.

communication via various channels, for example, more interviews and press conferences. Therefore, formal communication could be important because it relates to the latest indications of policy changes, therefore signaling the timely information to the public.

Informal Central Bank Communication

Compared with formal communication, informal communication is more flexible and frequent. Because most of formal communication of the PBOC, for example, the monetary policy report, publishes regularly every year, the informal communication such as the governor's speech can hit the markets in a timeliness manner. Here are some details about informal communication channels of the PBOC.

Conferences

The PBOC normally focus on particular areas in each conference, such as payment systems, anti-corruption waves, research and financial reforms. These conferences summarize the work last year and emphasize the key in the next period, however, these key points are focused on specific areas only, for example, improvement of payment system. Therefore, signals about economic outlook or monetary policy inclination is mentioned and discussed briefly. But, these conferences still are important information for bankers and markets because of its signals about future reforms. In particular, three conferences of the PBOC enjoy the largest attractiveness, which are the working conference, the conference of money supply and the mid-year working conference for branch managers. For example, in January of each year, the PBOC holds a working conference for the guideline in the whole year. It summarizes the results of previous year and signals the emphasis of the coming year including aspects such as the monetary policy inclination, money supply and financial reform. On January 10, 2014, the working conference⁴⁸ stated that the 'the PBOC will continue the prudent monetary policy while focusing on financial stability'. Followed by this is the second important conference, the conference of money supply, which is in January as well. The main point is to discuss the guideline for money and credit supply. The communication in this important conference is sent to markets with details about

⁴⁸ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2804960/index.html>.

how the credit supply would likely to be, for example, the words ‘increasing support for priority areas such as infrastructure, new strategic industries, scientific culture, modern service industries and new-type urbanization’ included in the 2014 working conference of money supply.

These two forward-looking conferences are at the beginning of every year, because guideline may change to accommodate various new situations. Therefore, the mid-year conference for branch managers serves an important role of signaling markets in the second half year. It would convey the view of the PBOC on domestic and world economic running as well as monetary policy inclination. In the 2013 mid-year conference⁴⁹, it emphasized that ‘although world and domestic economic condition is complicated with some downward pressures, inflation and economic development remain stable in general, therefore prudent monetary policy would still be implemented’ and ‘it is needed to maintain the stability of money markets and financial markets’. Overall, the PBOC’s conferences each year have regularity in terms of content, which give markets insightful signals about the future.

Testimonies

Testimonies are the PBOC holds a meeting with several PBOC’s or government officials and experts about issues in the economy, which usually broadcasted or newspaper reported. The testimonies of the PBOC are less frequent with less information about domestic economic outlook and monetary policy inclination when compared with conferences. Therefore, this informal communication is considered as complementary signals that the PBOC sends to markets. It is noticed that there are some testimonies about cooperation with the developed economies, such as the UK and German, however, the information needs more details. For example, a testimony⁵⁰ of offshore Renminbi markets was held by the PBOC, British Embassy in China and City of London on July 8, 2014, which mainly focuses on offshore Renminbi markets.

⁴⁹ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2869051/index.html>.

⁵⁰ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2807264/index.html>.

Interviews

Interviews are usually made with the media such as financial newspapers or TV stations, where a single person or a number of people chat and answer questions from the host. Interviews have been widely used in the PBOC, made by members of the MPC. It is found that the interviews of the PBOC are mostly done the governor. When less people talk, it has a potential benefit for consistency, because the more communication conveyed by different members, the more likely the dispersed information to be. Although Bohm *et al.* (2012) find that the more dispersed communication, the more favorableness and coverage of media will be, which means that communication is likely to be perceived by a wider audience, few research provides evidence that the more active and more consistent communication improves predictability of future monetary policy (Ehrmann and Fratzscher, 2013). The evidence in the first empirical chapter also shows that when dispersed communication appears, it is likely to dampen the asset returns and to create the market volatility in the Chinese interbank money market.

For the interviews, some discusses real economy and monetary policy inclination, which are usually conducted by the formal media of the PBOC or the government, while some is through the popular media. With regard to the information, it usually contains a wide range of irregular topics, for example, domestic economic outlook, financial reforms, the RMB internationalization, monetary policy inclination, all of which are closely related to the current trend of real economy. For example, in 2011, when China is under huge inflation pressure, communication relating to inflation appears frequently, which can also be seen from the interview in that year. On October 26, 2011, the governor stated⁵¹, ‘we watch very closely about inflation and we will not ignore this because of the focus on economic growth.’ Another example is about communication about world economic outlook. At that time, the world economy is under reconstruction, the governor expressed the view of the PBOC and the MPC with the words ‘In general, we hold a relatively optimistic view about the future, and as the prime minister Mr Wen said, we still believe the EU and the euro zone have a strong ability to overcome difficulty, to further the reform for a stable financial environment’. The clear and

⁵¹ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2872921/index.html>.

strong signals by the governor could calm the markets. As well, there are some interviews by members of the MPC and also senior government officials, mostly cover topics about domestic economic outlook. For example, there was a time when the markets were worried about the increasing money supply in the end of 2011, one deputy governor stated in an interview by formal media, ‘the increasing of money supply recently is a process of metabolism in the real economy’. The communication in this interview was indeed consistent with the fact that the decrease of money supply from 3.9% to 3.5% during the end of 2011 to the start of 2012. There is another type of interview that has been used more frequently, the brief interview on the formal website, mostly targeting the real and hot issue in the economy. This interview normally focuses on specific questions with few paragraphs of analysis from the PBOC’s perspective.

In rare cases, the governor would promise future changes of policy rates, which is the main aim of forward guidance that has been adopted by some central banks such as the Fed. The forward guidance, which has been discussed in the literature, is argued to be an effectively unconventional monetary policy for market expectations, particularly in the liquidity trap. Because of the increasing popularity of this monetary policy tool, the governor of the PBOC and the chair of the MPC, Mr Zhou, also expressed his view about forward guidance and inclination for more communication of the PBOC. For example, in one of the recent interview⁵² (February 16, 2016), he clearly emphasized the strong determination of the PBOC to communicate with the public.

Speeches

Speeches by members of the MPC and the PBOC’s senior officials also contain important information. Speech tends to be conveyed in some informal communication such as conferences, but does not count as a solely communication event. Speeches are carried out in a highly flexibility manner, however, with regard to the PBOC, speeches are preferable during periods of urgency that require quick information provision or clarifications. For members of the MPC, they tend to talk in a rather formal event, such as the interview sessions by the major financial

⁵² From the Financial Times: <http://www.ftchinese.com/story/001066203#adchannelID=5000> (in Chinese).

media. Speeches are generally provided by the governor rather than other members of the MPC or senior officials of the bank as the practice in other central banks such as the BOE. An example of using this informal channel is on November 24, 2010, the deputy governor and a member of the PBOC's MPC, Mr Hu Xiaolian, made a speech⁵³ signaling a tightening monetary policy inclination to tackle rising inflation. The speech emphasized (in translation from Chinese to English) 'the focus is on relation between achieving stable economic growth, reconstructing economic structure and managing inflation expectation, in order to continue guiding the money supply back to the desired level'. Speeches as informal communication have been widely examined in the empirical literature.

More Background of the RBI

In Chapter 3, some background of the RBI has been presented. The focus here is about communication. Some differences have also been discussed in Chapter 3 about central bank communication in practice, for example, the formation of RBI's MPC in 2016 that releases meeting minutes with voting record. In detail, there are 26 departments in the RBI including regional offices and branches, training centres, research institutes, etc. One of the interesting things is the formation of the Department of Communication, which signals that the RBI makes its communication role serious.

Apart from core activities, the RBI does care about its communication and information asymmetric. According to the quote of one brochure of the RBI, it says 'our emphasis on communication involves a range of activities, all aimed at sharing knowledge about the financial arena'⁵⁴. This is affirmed in the wide range of communication channels including conference call, speeches of monetary policy committees. Furthermore, when collecting the data, it is found that the RBI has indeed shared a large amount of updated data to the public. Compared with the PBOC, one difference is that the RBI has a forward guidance in its formal communication, although the PBOC has not formally published this arguably important communication. With the increasing importance of central bank communication perceived by the PBOC these years,

⁵³ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/2849001/index.html>.

⁵⁴ Google 'brochure of RBI' or <https://rbi.org.in/Scripts/OccasionalPublications.aspx?head=Reserve%20Bank%20of%20India%20-%20Brochure>.

it is possible that such communication tools are introduced and received attention from researchers. Overall, the emphasis that RBI places on central bank communication makes it worthwhile and interesting to see the potential effects.

Communication of the RBI

This section gives a more detailed discussion about central bank communication of RBI. As discussed in the Literature Review, because central bank communication is generally perceived as information-sharing with the public via communication channels, namely formal and informal communication. For example, formal communication is annual reports while the informal communication can be the governor's speeches. When processing the data, it is found that the RBI's communication is in line with this normality of central bank communication (one extra found is that compared with the PBOC, RBI's categorize its communication according to time lags of publication on formal website, which is convenient and also relevant to central bank transparency). The details are addressed in the following parts.

Formal Communication of the RBI

For RBI's formal communication, it includes some communication types based on time lag. Starting from the annual communication, the RBI mainly presents the annual report, report on trend and progress of banking in India, report on currency and finance, a profile of banks, etc. The half yearly communication is financial stability report that is a popular communication worldwide, monetary policy report and report on foreign exchange reserves. Notably, the monetary policy report used to be called the macro economic and monetary development published quarterly before September 2014. The quarterly communication contains quarterly review of monetary policy, and various surveys that are useful and credible because of its authority credited by the RBI. This is comparable to the case of PBOC presented in the previous Chapter 5 where the survey data were carried out for the public expectation. In addition to the monetary policy report, the RBI places emphasis on updated information about monetary policy between the publication lags of monetary policy reports, which are the quarterly or bi-monthly review of monetary policy. This indeed adds information to the markets. For the bi-monthly

data, the difference with PBOC is that the RBI has surveys of professional forecasters. Monthly communication is included in the RBI bulletin, and monetary and credit information review. Others are the weekly statistical supplement that normally contains the figures and some occasional reports such as the RBI working papers.

Overall, formal communication contains a lot of information and when compared with the informal communication that is discussed later, it is shown that the RBI seems to have a larger weight on its formal communication. The monetary policy report, quarterly review of monetary policy, financial stability report and the annual report are the four of the most important communication resources, here is a closer look at the formal communication.

Monetary Policy Report (Macro Economic and Monetary Developments)

The monetary policy report is the main formal communication among central banks worldwide, including the RBI. Before September 2014, this bi-annually monetary policy report was published with a quarterly report called Macro Economic and Monetary Development. The contents of these two reports are basically the same in despite of the publication lags and the structure. For the monetary policy report before September 2014, it has the structure of an overview, the aggregate demand, the external economy, monetary conditions including the money supply, the financial markets where international and domestic markets are covered, the price situation, and the macroeconomic outlook. The structure of the monetary policy report after September 2014, however, has changed. For example, discussion starts with the macroeconomic outlook that used to be talked in the final part, which may give more direct signals. In the overview, recent monetary policy changes and all the general conclusions in each part of the report are presented. Furthermore, there is a sentence for summary under each part of the overview, which clearly signals the main thought of the RBI. This rather comprehensive overview normally accounts for one fifth of the total. For example, in the macroeconomic and monetary development⁵⁵ published on January 28, 2013, the RBI communicated about the price situation in the overview with a summary sentence ‘Headline inflation moderates but

⁵⁵ From the RBI and the same for the following communication:
<https://rbi.org.in/Scripts/AnnualPublications.aspx?head=Macroeconomic+and+Monetary+Developments>.

upside risks persist'. When readers get confused about the lengthy discussion, this summary makes things clear.

To analyse the RBI's communication in line with the method used in previous chapters, the monetary policy reports and the following communication focus on economic outlook both domestically and internationally, and monetary policy stances. Based on this idea, in the monetary policy report, it is found that RBI normally communicates current situations and followed by various outlooks, for example, about the domestic economy, the price situation and possible patterns.

Quarter Review of Monetary Policy

In addition to the monetary policy reports, the RBI also conveys more updated information to the public, which can be published bi-monthly or quarterly. This review is rather short compared with the monetary policy report. The summarized information would be normally communicated by the governor, mainly about the recent changes of monetary policy such as repo rate. Then, it has an assessment about current domestic and world economy. Finally, there is a part that discusses policy stances and the reason behind policy changes. Compared with the monetary policy report, quarterly review of monetary policy has macroeconomic outlook and sometimes includes forward guidance. The forward guidance is a rather pioneer communication approach that has been adopted by some developed economies' central banks (e.g., the European Central Bank). It is found that the RBI uses this forward guidance to manage market expectations mostly on inflation. For example, in the mid-quarter monetary policy review⁵⁶ on December 18, 2012, the RBI reports in the forward guidance that 'In view of inflation pressures ebbing, monetary policy has to increasingly shift focus and respond to the threats to growth from this point onwards', which signalled a clear information about its monetary policy stance. The communication tool has facilitated the grasps of the RBI's ideas, and it makes readers understandable of the general perception of the RBI. Overall, compared with the monetary policy report, the quarterly review can be considered as a short but straightforward formal communication.

⁵⁶ https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=27783.

Financial Stability Report

The RBI's financial stability report is published bi-annually whereas the PBOC publishes this report annually. Besides the formal version, there is also an online statement that highlights important information in this report, for example, the current state of world economy (financial stability report in first half year of 2013⁵⁷). The normal pages of this report would be twice longer than the monetary policy report, it contains comprehensive and unique information such as the stress test in India. Although the report is mainly about information about financial stability and changes of regulation, formal version of this report talks about macroeconomic outlook. For example, in the second financial stability report in 2010, it includes 'buoyed by strong domestic demand. GDP growth rates have rebounded after some moderation in the aftermath of the global financial crisis.'⁵⁸ However, compared with the monetary policy report and the quarterly review of monetary policy, financial stability report contains less information about monetary policy stances. Overall, this is an essential formal communication but with fewer content of outlook.

Annual Report

The RBI publishes the annual report to summarize work in the last year. It includes a more comprehensive content than the formal communication discussed above; however, the structure has similarity. It begins with an overview about the assessment of the last year and the prospects for the next year. Then, there are other parts focusing on the economic review, the regulation and operation of the RBI including the financial stability, the currency management and balance sheet, etc. With respect to central bank communication and expectation management, the prospect section in the overview usually signals detailed information to the public (e.g., the inflation outlook). This is in line with some overview parts discussed above, although the annual report has a larger part of summarizing the previous work. For example, in the 2013 annual report⁵⁹ on the August 22, 2013, it includes inflation outlook that 'although headline inflation

⁵⁷ https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=30280.

⁵⁸ https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=23666.

⁵⁹ <https://rbi.org.in/Scripts/AnnualReportPublications.aspx?year=2013>.

had moderated in Q1 of 2013-13 to an average of 4.7 per cent, risks on the inflation front are still significant', followed by reasons and discussion behind this prospect. For signalling effects of communication, not only the annual report does signals a longer prospect of economic state and monetary policy, it shares reasons with readers as well.

In addition to the above formal communication, there are certainly other formal communication, for example, report on foreign exchange reserves with detailed information. In terms of signalling effect, the above communication contains clearer and even specific parts, for example, the forward guidance in the quarterly review of monetary policy. Therefore, communication signals are extracted from these resources.

Informal Communication

The RBI's informal communication is the conferences, interviews and speeches, similar to central banks worldwide. Having a closer look at these communication, speeches account for a large amount of the total communication, while the interviews published on the RBI's formal website are relatively fewer. One thing about the RBI's informal communication is that the RBI makes it clear on its website that all the informal communication about monetary policy are presented in a specific section, making these data relatively convenient to access. Another feature is that most of the important informal communication (e.g., conferences and speeches) are summarized in monthly bulletin. Informal communication tends to be flexible, therefore it is noticed that there is less information about economic outlook or monetary policy inclination than the formal communication with a regular structure.