A Forward Guidance Indicator For The South African Reserve Bank: Implementing A Text Analysis Algorithm

by

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Abstract

The growing prevalence of forward guidance, in addition to central banks' efforts to improve and structure its use, has spawned growing interest among market participants and academics. Several scholars have endeavoured to develop quantitative tools to measure, or express on a numerical scale, *qualitative* forward guidance of central banks. In the context of South Africa, such studies are extremely scant. The expansion of central bank communications and technological advances has given rise to an area of research that analyses the words and phrases used by central banks, using semantic-modelling and other text-mining techniques. Using these techniques, we construct a novel forward guidance indicator (FGI) for the South African Reserve Bank (SARB). Specifically, we apply text-mining and text-analysis techniques to monetary policy committee (MPC) statements to generate an index measuring the stance of monetary policy. Using a series of applications, we establish that our FGIs represent a useful tool to explain and predict future changes in the repo rate. Furthermore, our results indicate that our FGIs are primarily driven by inflation expectations.

Uitreksel

Die toenemende voorkoms van vooruitleiding, tesame met pogings van sentrale banke om dit te verbeter en die gebruik daarvan te struktureer, het 'n groeiende belangstelling by markdeelnemers en akademië gewek. Verskeie geleerdes het probeer om kwantitatiewe instrumente te ontwikkel om kwalitatiewe vooruitleiding van sentrale banke te meet of op 'n numeriese skaal uit te druk. In die konteks van Suid-Afrika is die studies uiters skaars. Die uitbreiding van sentrale bank kommunikasie en tegnologiese vooruitgang het gelei tot 'n navorsingsarea wat die woorde en frases wat deur die sentrale banke gebruik word, ontleed met behulp van semantiese modellering en ander ontginningstegnieke. Deur hierdie tegnieke te gebruik, stel ons 'n nuwe vooruitleiding-indikator (FGI) vir die Suid-Afrikaanse Reserwebank (SARB) op. Ons pas spesifiek tegnieke vir ontginning van teks en teksanalise toe op die verklarings van die monetêre beleidskomitee (MPC) om 'n indeks te genereer wat die standpunt van monetêre beleid meet. Deur gebruik te maak van 'n reeks toepassings, bepaal ons dat ons FGI's 'n nuttige instrument is om toekomstige veranderinge in die repokoers te verduidelik en te voorspel. Verder dui ons resultate daarop dat ons FGI's hoofsaaklik gedryf word deur inflasieverwagtinge.

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Abstract

The growing prevalence of forward guidance, in addition to central banks' efforts to improve and structure its use, has spawned growing interest among market participants and academics. Several scholars have endeavoured to develop quantitative tools to measure, or express on a numerical scale, *qualitative* forward guidance of central banks. In the context of South Africa, such studies are extremely scant. The expansion of central bank communications and technological advances has given rise to an area of research that analyses the words and phrases used by central banks, using semantic-modelling and other text-mining techniques. Using these techniques, we construct a novel forward guidance indicator (FGI) for the South African Reserve Bank (SARB). Specifically, we apply text-mining and text-analysis techniques to monetary policy committee (MPC) statements to generate an index measuring the stance of monetary policy. Using a series of applications, we establish that our FGIs represent a useful tool to explain and predict future changes in the repo rate. Furthermore, our results indicate that our FGIs are primarily driven by inflation expectations.

Keywords: Monetary policy, Text analysis, Forward guidance indicator, Inflation targeting

JEL classification: C43, C53, E42, E47, E52, E58

1. Introduction

Over the last few decades, all central banks have changed how they communicate to financial markets and the broader public. Historically, central banks were largely opaque – keeping public utterances to a minimum – since it was perceived that there were benefits associated with keeping markets guessing (Mishkin 2004, 1). However, since the 1990's there has been a movement towards greater transparency and openness (Stein 2014, 1). One of the primary arguments for greater transparency is the notion that independent central banks should be more accountable to the public (Blinder et al. 2008, 912). Independent central banks are required to disclose monetary

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policy decisions in a comprehensible manner, enhancing public confidence in the bank's ability to adhere to its mandate (Weidmann 2018, 2).¹ Central banks have placed substantial emphasis on improving their communication. This has largely been facilitated by way of more timely release of meeting minutes, more speeches by central bankers, embracing new communication channels on social media, increasing the scope and frequency of economic projections, introduction of post-meeting news conferences, and more news conferences (Stein 2014, 2; Shin 2017, 1).

Globally, the communication efforts of central banks became more expansive during the financial crisis of 2008-9 (Cœuré 2017, 814). These efforts were augmented with an extensive movement towards the provision of so-called *forward guidance*. In the context of conventional monetary policy, forward guidance is the provision of explicit information to provide a credible signal on the expected trajectory of inflation (or, more generally, the central bank's mandate), and the monetary policy committee's stance on the future path of the policy rate (Stein 2014, 8). Forward guidance is not confined to information about future interest rate trajectories but embodies *all* information about future monetary policy decisions (Weidmann 2018, 5). The form of forward guidance differs amongst central banks and can materialize in a qualitative and/or quantitative manner. Whereas *quantitative* forward guidance entails the explicit publishing of expected future policy rates, *qualitative* forward guidance is a suggestive (non-numerical) forecast of policy rates reported through the content of monetary policy statements and other material generated by central banks.

The growing prevalence of forward guidance, in addition to the central banks' efforts to improve and structure its use, has spawned growing interest among market participants and academics – even though forward guidance has been in the academic debate for some time.² The lion's share of existing studies focus on central banks that practice qualitative forward guidance. Important

¹As noted by Haldane (2017), there are various shades of independence, which depend on who sets the objective of monetary policy and the associated policy instruments, as well as how policymakers are appointed and held accountable. There is a small collection of scholars who measure these various dimensions of bank independence – see for example Grilli, Masciandaro, and Tabellini (1991); Cukierman et al. (1993); Arnone et al. (2007); Crowe and Meade (2008); Dincer and Eichengreen (2014); Bodea and Hicks (2015); and Garriga (2016). Nevertheless, the general definition of independence typically refers to operational independence.

²Countries that are close to the zero lower bound (ZLB) on nominal interest rates have been of particular interest (Christensen and Rising 2017, 2). As noted by Moessner, Jansen, and de Haan (2017), the lower bound on interest rates can be below zero, therefore, it is more appropriate to use the term effective lower bound (ELB) as opposed to zero lower bound (ZLB).

contributions include that of Gürkaynak, Sack, and Swanson (2005); Campbell et al. (2012); Moessner (2013); Swanson and Williams (2014); and Swanson (2015; 2017).

Several scholars have also endeavoured to develop quantitative tools to measure, or express on a numerical scale, the *qualitative* forward guidance of central banks. Even though there has been marked interest in quantitatively measuring qualitative forward guidance in recent years, there is, however, no ubiquitous quantitative measure of forward guidance. Notable contributions are that of Jansen and De Haan (2005); Musard-Gies (2006); Rosa and Verga (2007); Gerlach (2007); Reid and Du Plessis (2010); and Berger, de Haan, and Sturm (2011). To the best of our knowledge, the paper by Reid and Du Plessis (2010) is the only existing piece of literature that has constructed a quantitative measure of forward guidance for South Africa. More recently, with the expansion of central bank communication (publications in particular), recent technological advances have allowed researchers to analyse the words and phrases used by central banks using semantic-modelling and other text-mining techniques (see, for example, Tobback, Nardelli, and Martens (2017); and Christensen and Rising (2017)).³ To the best of our knowledge, there are presently no academic studies that attempt to quantify forward guidance in the case of South Africa using these novel techniques. By constructing a novel forward guidance indicator (FGI) for the SARB based on these methods, this paper not only contributes to the South African monetary literature but also to other emerging markets, more generally, since this is a particularly new field of research.

To do this, we implement a text analysis algorithm based on pre-constructed sentiment libraries to determine the number of “hawkish” (optimistic/bullish) and “dovish” (negative/bearish) terms, relating to the price stability mandate of the SARB, found in the SARB’s monetary policy announcement statements. In turn, these estimates were combined to construct an aggregate index.

We determined the usefulness of our FGIs by way of several applications, which primarily include whether the FGIs can systematically explain future changes in the policy rate (repo rate) and whether the FGI can consistently be explained by factors that are regarded as leading indicators

³Some of the most pre-eminent techniques include boolean and dictionary, latent semantic analysis, latent dirichlet allocation, and descending hierarchical classification. Bholat et al. (2015) provide a succinct discussion of these techniques – specifically in the context of central bank research.

of macroeconomic health (i.e., the business cycle) – an indirect determinant of the policy rate. The findings that are reported in this paper include:

The main empirical finding is that the FGIs, while controlling for domestic market expectations of future short-term interest rates, represent a useful tool to explain and predict future changes in the repo rate. Furthermore, our results indicate that our FGIs are primarily driven by inflation expectations (an average of trade union officials, business people, and financial analysts). However, business confidence for both FGIs and consumer confidence for FGI (Christensen) could prove to be important determinants of the FGIs in the event of large movements in these confidence indices.⁴ We also find that if the SARB did indeed explicitly target the mid-point of the inflation target band it had no effect on future repo rate changes.

In addition to our core findings, a range of additional robustness checks were performed to ensure the validity of these findings. More specifically, we tested the robustness of our FGIs by testing whether they are characterised by non-linearities: increasing/diminishing effects; asymmetrical effects; and ordinal vs. cardinal effects. Our results indicated that our FGIs do not encompass any increasing/diminishing effects. However, we found evidence of asymmetries when we decompose the FGIs into their respective negative and positive components, which is the proportion of hawkish and dovish words, respectively, of the total number of words found in the SARB's monetary policy announcement statements. In addition, we found some FGIs to be predominantly cardinal in nature, whereas others are primarily ordinal in nature. This means that incremental changes in some FGIs generate the same effect regardless of their reference value, whereas, for other FGIs, incremental changes are dependent on their reference value.

The remainder of the paper is organized as follows. Section 2 provides an overview of the literature pertaining central bank communication, forward guidance, and quantitative measures of forward guidance. Section 3 describes the data utilised in this paper. Section 4 outlines the sentiment libraries, the text analysis algorithm, and the formula used to derive the FGI indices. Section 5 details the applications used to determine the performance and usefulness of our FGIs. It also presents the most pertinent results pertaining to our study. Section 6 examines the robustness of our results by considering alternate model specifications. Section 7 concludes.

⁴This finding is based on BER confidence data obtained from Bloomberg (2019).

2. Literature Review

2.1. Central Bank Communication

In recent decades, practically all central banks have converged to greater openness (Blinder 2018, 568). A principal reason for greater transparency is the notion that more independent central banks should be more accountable to the public (Blinder et al. 2008, 912). Blinder (2018) maintains that the process will continue, arguing that once a central bank moves toward greater transparency it will never regress back to a less-transparent state. However, Blinder (2018) argues that the pace and details of this process will differ amongst central banks.

The better the alignment of expectations with the monetary policy mandate, the greater the ability of central banks to stabilise aggregate demand and, in turn, promote price stability. That is, monetary policy would be more effective if central banks can improve the coordination of market expectations (Morris and Shin 2002, 1523). In this regard, central bank *communication* can assist the public in forming expectations about future policy rate decisions (see Bernanke, Reinhart, and Sack (2004)). A fundamental question posited by Blinder et al. (2008) is whether communication contributes to the effectiveness of monetary policy by producing legitimate news (e.g., shifting market interest rates) or by reducing noise (e.g., lowering market uncertainty). However, the importance of communication is not limited to what is explicitly communicated, but also extends to that which is not communicated, which in itself can provide signals (Weidmann 2018, 1).

Communication can be characterised as a “two-way street”: there is a “talking part” as well as a “listening part”, from which an inherent trade-off emerges. The “talking part” refers to the provision of information on future policy rate changes by central banks, and the “listening part” refers to the observance of signals stemming from markets (Shin 2017). Often central banks’ pronouncements are amplified in the markets, prompting central banks to “speak in a whisper” (Stein 2014, 11–12). In this context, the softer the central bank talks, the more inclined the market is to listen, resulting in an “amplified whisper” (Stein 2014, 12).⁵ As a result, more “talking” implies less “listening” (Shin 2017, 5). According to Shin (2017), if central banks talk

⁵In response to this, Shin (2017) cautions against talking less, owing to the pervasive effects of central banks’ actions on the lives of ordinary people.

more in order to influence market prices, they should listen less to the signals stemming from those markets to prevent themselves acting on market signals that are a product of their own pronouncements. Hence, any attempt to regulate market fluctuations that are generated by central bank communication might be self-defeating (Stein 2014, 12). Stein (2014), therefore, argues that central banks should evaluate their communication performance by their ability to maintain tenable transparency as opposed to the extent announcements have affected markets.

This expectational mechanism is most effective in an environment characterised by central bank transparency (Blinder et al. 2001, 11). More specifically, transparency allows markets to respond to policy decisions in a smoother fashion since policy decisions are less likely to come as a surprise.⁶ It is also important to note, however, that effective coordination which keeps expectations away from fundamentals can result in asset prices distortions, potentially spawning financial distress (Morris and Shin 2002, 1523).

2.1.1. Limitations of Central Bank Communication

According to Haldane and McMahon (2018), several central banks have recently recognized the need to revise their communication strategies to improve their public reach. This reform can largely be ascribed to the recognition that communication can assist expectations.⁷ Moreover, it also addresses the concern stressed by Coibion et al. (2018) that the general public's inattention to central bank actions can induce more volatile inflation expectations. Nevertheless, the revision of communication strategies introduces both feasibility and desirability considerations (Haldane and McMahon 2018, 579).

Haldane and McMahon (2018) offer four reasons why communication with a wider audience may be desirable. Firstly, the "financial prices" channel is likely to function imperfectly since households form their expectations based on an amalgam of factors, not only interest rates or equity prices (Haldane and McMahon 2018, 579).⁸ Secondly, public understanding is likely to be a pivotal way to establish trust and credibility of the central bank and its policies alike, which are important

⁶Beechey, Johannsen, and Levin (2011), for example, show that inflation surprises have a direct association with changes in inflation expectations.

⁷See also Blinder (2008).

⁸See Shiller (2017) and Bailey et al. (2017).

for shaping households' expectations (Haldane and McMahon 2018, 579).⁹ Thirdly, traditional information liaisons (e.g. financial markets and mainstream media) might potentially benefit using simplified and innovative forms of communication (Haldane and McMahon 2018, 580). Lastly, central banks should listen more to messages from the general public since aggregating information constitutes one of the monetary policy committees' principal roles (Haldane and McMahon 2018, 580).

Even though there has been considerable expansion in central bank communication, Haldane and McMahon (2018) conjecture that it is uncertain whether the general public has benefited from this growth. Haldane and McMahon (2018) argue that a notable obstacle is the inaccessibility of the central banks' main form of communication: monetary policy decision statements. More specifically, consumers may not consider central bank communication as a striking source of information if they do not comprehend the importance of the central bank in shaping economic conditions, or if they are unable to comprehend how macroeconomic variables, discussed in central bank communication, impact them (Binder 2017, 242).¹⁰ In a similar vein, Dräger, Lamla, and Pfajfar (2016) assert that households are less likely to pay attention to central bank communication because people do generally not concern themselves with the central bank.¹¹ Under such circumstances, and given that central bank communication tends to circumvent large groups of the general public, monetary policies which aim to affect the public's expectations through communication policies are unlikely to be successful (Binder 2017, 242; Blinder 2018, 569).

In contrast to households, Sims (2010) argues that professional forecasters and financial market participants are more inclined to pay attention to central bank communication such as monetary policy statements. Blinder (2018) goes further to suggest that the most important element of central bank communication is that which is directed to financial markets, because financial market

⁹Haldane and McMahon (2018) argues that this is also important for political accountability.

¹⁰Binder (2017) notes that there is evidence that households are rationally inattentive to macroeconomic variables, which is generally the subject of central banks' communication, owing to a deficiency of the necessary information or motivation to be acceptant thereof (see also Easaw, Golinelli, and Malgarini (2013) and Cavallo, Cruces, and Perez-Truglia (2017)). However, Binder (2017) notes that the rational inattention literature for monetary policy communication predicts that households will pay more attention to central bank communication if it is believed to be beneficial (e.g. improved decision-making ability), yet affordable to do so.

¹¹Kumar et al. (2015), who studied central bank communication with the public in New Zealand, find that households rarely engage with the central bank developments (i.e. rarely read monetary policy reports and seldom receive any form of direct communication utilized by the Reserve Bank of New Zealand).

participants are ultimately the only ones listening.

2.1.2. The Role of Media in Central Bank Communication

There is also a growing number of studies which explore the role of media in intermediating central bank messages (Haldane 2017, 8). However, evidence on how well it executes its intermediary role is fairly mixed (Haldane 2017, 8). van der Cruysen, Jansen, and de Haan (2015) find that media prompts a better understanding of the European Central Bank's (ECB's) monetary policy. In contrast, Dräger, Lamla, and Pfajfar (2016) and Lamla and Lein (2014) find that for the United States and Germany, respectively, media may occasionally impair communication and bias opinion.

Other studies have examined the factors that influence how the media intermediate central bank messages. For example, Berger, Ehrmann, and Fratzscher (2011) find that press reports of ECB decisions are more critical when the decision surprises financial market analysts, or when inflation exceeds the inflation target. In contrast, the response is more favourable when press conferences are informative or if the ECB president has been active during the inter-meeting period (Berger, Ehrmann, and Fratzscher 2011, 691).

2.2. Forward Guidance

2.2.1. Forward Guidance in Theory

Formerly, the accepted belief was that withholding forward-looking information constituted proper central banking practice and that forward guidance was not required for monetary policy (Blinder 2018). However, after encountering the effective lower bound (ELB) during the Great Recession, the United States (US) Federal Reserve, for example, adopted forward guidance as a key monetary policy tool, alongside quantitative easing (Blinder 2018, 568). Even though forward guidance only became more familiar to the broader public following the Great Recession, it is not a monetary policy instrument confined to times of crisis (Weidmann 2018, 5). In fact, forward guidance is increasingly used in the narrative of day-to-day policy decisions.

This spreading practice of forward guidance has fundamentally changed the “nature and purpose” of central bank communication (Blinder 2018, 568). Formerly, communication was traditionally

viewed as a means to more effectively translate the overnight interest rate to medium- and long-term interest rates. Today, this line of communication has morphed into an instrument that may influence the longer-end of the yield curve. For example, the flattening of the yield curve is achieved by exerting downward pressure on long-term interest rates (Weidmann 2018, 5). Forward guidance, therefore, relies on the expectations theory of the term structure of interest rates (Blinder 2018, 568). On one hand, this intervention is to provide *immediate* economic stimulus. On the other hand, forward guidance can also serve to make central bank policy decisions more comprehensible, to help smooth the effects of policy on markets, and to reduce uncertainty in the future (Weidmann 2018, 5).

To ensure that forward guidance is deemed credible and effective, it must be anchored to the central bank's mandate (Cœuré 2017, 815). More specifically, Cœuré (2017) asserts that this entails central banks providing clarity about their reaction function, where they regularly adjust policy expectations in accordance with the current and expected future state of the economy, and execute appropriate policy adjustments.

The current literature defines two types of forward guidance: Delphic (conditional) forward guidance and Odyssean (unconditional) forward guidance (Weidmann 2018, 5).¹² Under Delphic forward guidance, the central bank announces its path based on current information about forecasted macroeconomic performance, but allows transgression thereof as more data becomes available (Weidmann 2018, 5; Cœuré 2017, 815). Under Odyssean forward guidance, the central bank does not deviate from its path, once announced, under any circumstances (Weidmann 2018, 5; Morris and Shin 2018, 572). According to Moessner, Jansen, and de Haan (2017), Odyssean communication about future policy rates does not currently exist in practice. See Table A.1 in Appendix A for an outline of the various classifications of communication about future policy rates in theory and practice.

Moessner, Jansen, and de Haan (2017) distinguish between two types of Delphic communication about future policy rates: (1) the frequent provision of interest rate forecasts as part of an inflation targeting framework, and (2) the provision of interest rate forecasts without a commitment of probable future monetary policy actions and occasional macroeconomic performance under unusual

¹²See also Campbell et al. (2012) who originally introduced the two classes of forward guidance.

circumstances (e.g., the effective lower bound on nominal interest rates).¹³ Moessner, Jansen, and de Haan (2017) term the latter “Aesopian forward guidance” – whereby the central banks choose the economic condition.

Filardo and Hofmann (2014) discuss three forms Aesopian forward guidance: (1) qualitative forward guidance, where no quantitative information is provided on the trajectory of policy rates or the envisaged timeframe; (2) calendar-based forward guidance where the central bank provides a clearly-specified time horizon; and (3) threshold-based forward guidance where future policy rates are linked to specific quantitative economic thresholds. The three forms are also typically referred to as open-ended, time-contingent, and state-contingent forward guidance, respectively (Moessner, Jansen, and de Haan 2017, 679).

2.2.2. Theoretical Challenges and Concerns of Forward Guidance

When choosing a particular type of forward guidance, central banks encounter a trade-off between anchoring their commitment and being informative, at the expense of less explicit communication (Moessner, Jansen, and de Haan 2017, 679). For example, if market participants expect the central bank to be fully committed, changes in economic conditions may induce a central bank to deviate from its announced path, which adversely affects its credibility (Moessner, Jansen, and de Haan 2017, 681). This may suggest that careful statements are preferable. Yet, careful statements may not be as effective as unequivocal ones.

The nuances of forward guidance are further complicated by the central banks’ “two-way street” line of communication with financial markets (Cœuré 2017, 813–17). Moreover, the notion that forward guidance ought to work in practice is not a forgone conclusion, because the expectations theory with rational expectations falters empirically (Blinder 2018, 568).

Another risk confronting forward guidance relates to quantitative forecasts. Specifically, the signal associated with policy rate forecasts might be misconstrued as a commitment (Issing 2005, 70).¹⁴

¹³Some central banks publish the path of future policy rates as part of their inflation targeting (IT) strategy, whereas others communicate about future rates as a way to enhance the effectiveness of monetary policy by influencing private-sector expectations. A discussion of the former falls beyond the scope of this paper; Svensson (2015) provides several reasons as to why quantitative forward guidance may constitute a natural part of monetary policy under a flexible IT regime.

¹⁴A similar view is conveyed by Detmers, Karagedikli, and Moessner (2018).

However, these forecasts are typically contingent on current insights about future economic developments. Blinder et al. (2008) maintain that this is the primary concern, in practice, preventing many central banks from adopting such practices.

Goodhart (2001) and Mishkin (2004) also argue against the use of quantitative forward guidance for the reason that it may convolute the decision-making process of the monetary policy committee. Central banks use monetary policy (which may encompass forward guidance) to steer the economy in the appropriate direction by affecting market prices through financial markets. Simultaneously, market prices assist central banks to decide in which direction to steer the economy. Hence, monetary policy actions affect market prices which, in turn, influences monetary policy decisions (and, if applicable, the nature of forward guidance) (Morris and Shin 2018, 572). Morris and Shin (2018) dub this circularity amid market prices and monetary policy as the “reflection problem”.

The fact that it is necessary for market participants to imitate the actions of the central bank gives rise to this reflection problem (Morris and Shin 2018, 572). Therefore, the reflection problem causes the value of the market signal – of the underlying economic fundamentals – to be endogenous (Morris and Shin 2018, 572). More specifically, if central banks have confidence in market participants to guide monetary policy decisions, it may inadvertently induce the reflection problem – making market prices uninformative (Morris and Shin 2018, 573). The reflective problem also introduces the risk of de-anchoring monetary policy on financial conditions (Cœuré 2017, 818).

The reflection problem can be further understood in the context of the Lucas critique or Goodhart’s law, which point out that any predictable statistical measure of the effects of a change in policy become trivial if adopted as a target. In other words, if market signals are fully informative, central banks would adopt policies that would render these market signals to be uninformative (Morris and Shin 2018, 576). To, therefore, avert the circularity between market prices and monetary policy, Svensson and Woodford (2004) argue that policymakers should commit to a policy rule. However, Weidmann (2018) asserts that if central banks use communication as a monetary policy tool, fear of a probable counter-reaction by markets should not cause central banks to falter on providing the necessary guidance, otherwise the communication circularity problem will arise (Weidmann 2018, 4).

2.2.3. Forward Guidance in Practice

2.2.3.1. *Empirical Effects.* There is a rapidly growing body of academic evidence which suggests that central bank communication embodies a compelling monetary policy instrument (see for example, Gürkaynak, Sack, and Swanson (2005), Campbell et al. (2012), Moessner (2013), and Swanson and Williams (2014) for the US; Moessner and Nelson (2008) and Detmers and Nautz (2012) for New Zealand; Chehal and Trehan (2009) and He (2010) for Canada; Andersson and Hofmann (2009) for Sweden, Norway and New Zealand; and Kool and Thornton (2015) for Sweden, Norway, New Zealand and the United States). However, as noted by Haldane and McMahon (2018), most studies focus primarily on the effect of central bank communication on expectations reflected from financial instruments (e.g., asset prices) and forecasting professionals. Nonetheless, important contributions include that of Gürkaynak, Sack, and Swanson (2005); Campbell et al. (2012); Moessner (2013); Swanson and Williams (2014); and Swanson (2015; 2017).

Gürkaynak, Sack, and Swanson (2005) investigate the effect of US monetary policy announcements on asset prices using a high-frequency event study analysis. The authors find that this effect is characterised by two factors: the first factor is the surprise component associated with changes in the *current* federal funds rate target, and the second factor is the “forward guidance” component associated with changes in *futures* rates that are independent of the current federal funds rate. The former is closely associated with monetary policy *actions*, while the latter is closely associated with published Federal Open Market Committee (FOMC) statements.

Subsequently, Gürkaynak, Sack, and Swanson (2005) analyse the effects of these factors on asset prices (i.e., stock prices and long-term bond yields) using an intra-day dataset spanning from 1990 to 2004. The authors find that the Federal Reserve’s (Fed) FOMC statements have an important effect on stock prices and bond yields. FOMC statements do not, however, constitute a policy tool that is entirely independent of the federal funds rate target but likely affects financial markets through its influence on expectations of future policy actions.

Moessner (2013) explores the quantitative effects of explicit FOMC policy rate guidance on interest rate expectations at the ZLB using Eurodollar interest rate futures. To this end, Moessner (2013) regress daily changes in *m*-year-ahead Eurodollar futures rates on a dummy variable, which signifies announcements of explicit FOMC policy rate guidance, and on the surprise component of

11 macroeconomic data releases to control for the effects of economic data on interest rate expectations. Moessner (2013) find that explicit FOMC policy guidance announcements notably reduce implied interest rates (of interest rate futures), and hence a flattening of the yield curve.

Swanson (2015; 2017) extend the methods of Gürkaynak, Sack, and Swanson (2005) to separately identify the effects of the Fed's forward guidance and large-scale asset purchases (LSAPs) at the ZLB that transpired during 2009 to 2015. In contrast to Gürkaynak, Sack, and Swanson (2005), Swanson (2015) identifies the two dimensions of monetary policy over this period as changes in forward guidance and LSAPs, whereas Swanson (2017) identifies three dimensions of monetary policy that correspond to changes in the federal funds rate, changes in forward guidance, and changes in LSAPs. Overall, these two studies find that forward guidance has a relatively small effect on Treasury yields with long maturities and virtually no effect on corporate bond yields. In addition, Swanson (2015) and Swanson (2017) find that forward guidance affects stock prices and exchange rates.

It is also conceivable that central banks can be affected by international spillovers from central banks' communication, which may or may not contain forward guidance. Recently, Armelius et al. (2018) investigates whether there are any international spillovers from central bank communication sentiment and, granted any exist, the effects thereof on critical macroeconomic and policy variables.¹⁵ To this end, Armelius et al. (2018) use structural (sign-restricted) vector autoregressions (VARs) based on data for 23 countries for the period of 2002-2017.

The analysis yields the important result that sentiment shocks can generate cross-country spillovers in sentiment, policy rates, and unemployment (Armelius et al. 2018, 32). Moreover, Armelius et al. (2018) find that the Fed is instrumental in prompting sentiment spillovers, while the ECB is predominantly influenced by other central banks. Although the SARB was not among the 23 countries considered by Armelius et al. (2018), it is conceivable that the SARB might be vulnerable to spillovers from other central banks. In this instance, communication by the SARB would, therefore, contain systematic biases that could result in suboptimal policy outcomes.

¹⁵Armelius et al. (2018) use dictionary-based methods outlined in Loughran and McDonald (2011) for extracting content from central bank speeches to construct a measure of 'net positivity', which reflects central bank communication sentiment.

2.2.3.2. Quantitative vs. Qualitative Forward Guidance. The form of the communicated information varies substantially among central banks. Some central banks use qualitative statements to communicate their policy outlook, whereas others (for example, the Reserve Bank of New Zealand (RBNZ), Norges Bank, and the Sveriges Riksbank) utilize quantitative interest rate forecasts in their communication (Detmers, Karagedikli, and Moessner 2018, 2).

Detmers, Karagedikli, and Moessner (2018) investigate whether the nature of a central bank's forward guidance (qualitative or quantitative) is of any consequence to market participants' view of future monetary policy decisions. More specifically, the authors utilize a "quasi-experiment" from the policy announcements of the RBNZ. They find that market participants do not only infer forward guidance from quantitative interest rate forecasts but also from qualitative information encompassed in monetary policy statements. In addition, the results suggest that the marginal effect of providing interest rate forecasts, over and above qualitative information in the monetary policy statements, on market participants' perception of forward guidance is small (Detmers, Karagedikli, and Moessner 2018, 8). That is, markets deduce similar forward guidance from monetary policy announcements, whether or not the announcement or statement are supplemented by a quantitative forecast. These results indicate that financial markets are able to deduce comparable forward guidance from qualitative or quantitative forms of forward guidance.

Section 2.2.2, highlighted that concern has been exercised over whether market participants understand the conditional nature of forward guidance. However, several studies have established that market participants do indeed recognize quantitative forward guidance (explicit interest rate forecasts) to be a conditional commitment (see, for example, Moessner and Nelson (2008); Detmers and Nautz (2012); and Detmers, Karagedikli, and Moessner (2018) for New Zealand; and Moessner, de Haan, and Jansen (2016) and Åhl (2017) for Sweden).

2.3. Forward Guidance Indicators (FGIs)

The notion of FGI is based on the premise that a central bank's communication about future monetary policy can then be translated into an index, which can be used to identify the direction (and the magnitude) in which they intend to influence markets. The index, also enables one to evaluate how consistent and effective the central bank has communicated its monetary policy. Yet,

the literature on the construction and implementation of FGI's is particularly scant. Nonetheless, a small collection of scholars and practitioners have endeavoured to develop FGI's and subsequently test their efficacy.

Early research manually classified central bank statements as “dovish” (negative), neutral (zero) or “hawkish” (positive) – see for example Jansen and De Haan (2005); Musard-Gies (2006); Rosa and Verga (2007); Gerlach (2007); Reid and Du Plessis (2010); and Berger, de Haan, and Sturm (2011).¹⁶ A more contemporary method is to quantify the sentiment (dovish/hawkishness) of central bank communication by employing a “bag-of-words” measurement. More specifically, this entails measuring the number of occurrences of a dictionary of keywords or word associations in the text of a central bank statement. However, this method does not account for word order and grammar of words (Bholat et al. 2015, 8).¹⁷ This methodology has been adopted by, amongst others, Heinemann and Ullrich (2007), Apel and Blix Grimaldi (2012), and Christensen and Rising (2017). There has also been growing interest in supervised machine learning methods such as support vector machines (e.g., Tobback, Nardelli, and Martens (2017)) and Naïve Bayes (e.g., Moniz and de Jong (2014)) classifiers to construct sentiment indices such as FGIs.

In the following two subsections, Section 2.3.1 and Section 2.3.2, we discuss the FGI literature that is particularly relevant to our paper.

2.3.1. *International Indicators*

Using media reports ranging from January 1999 to March 2016, Tobback, Nardelli, and Martens (2017) construct a FGI for the European Central Bank, based on the media's perception of the ECB's tone at each press conference. They adopt two methods to construct their FGI: a dictionary approach, determines the number of occurrences of pre-defined hawkish and dovish words or expressions in media reports, and support vector machine (SVM) text classification to predict the “tone” (hawkish or dovish). The SVM, in contrast to the dictionary approach, examines a document as a whole to derive the tone thereof. Therefore, the SVM largely mitigates the heavy

¹⁶Rosa and Verga (2007) formulated a glossary of words and phrases, which served as a guide to establish their index.

¹⁷The method can be extended to include phrases, which account for word order and grammar, and to some degree, context.

reliance on a pre-defined list of words. Tobback, Nardelli, and Martens (2017) allow the perception to assume a numerical value between -1 (most dovish) and $+1$ (most hawkish). In turn, these values indicate whether the perceived tone in the ECB's communication is indicative of monetary policy tightening (hawkish) or loosening (dovish). The authors find the SVM yields more stable and accurate measurements of perception. They illustrate the potential use of their FGIs by way of several applications (a correlation analysis with a set of interest rates amongst others). The results provide compelling evidence to suggest that the use of an advanced text mining classification model to measure the media's perception is superior to the dictionary approach.

A particularly relevant, private sector, report by Christensen and Rising (2017) introduces a novel FGI. More specifically, Christensen and Rising (2017) constructed a list of approximately 100 "dovish" and "hawkish" words, respectively, which is used to determine the magnitude and frequency of each in the policy statements of central banks over time. The number of "dovish" and "hawkish" occurrences are subsequently used to calculate their FGI using a simple formula to standardise the index between -2 (completely "dovish") and 2 (completely "hawkish"). When applied to policy statements of the FED and ECB, Christensen and Rising (2017) not only find the FGI to be a particularly useful measure of forward guidance over time but also find it to be a highly consistent and objective measure.

2.3.2. Domestic Indicators

In the context of South Africa, the study by Reid and Du Plessis (2010) is the first to construct a FGI. The primary objective of Reid and Du Plessis (2010) is to assess how successful the SARB's monetary policy committee has been in communicating to the public its policy since adopting an inflation targeting framework. To this end, Reid and Du Plessis (2010), emulating Rosa and Verga (2007) and Ehrmann and Fratzscher (2007), subjectively construct a (numerical) index of monetary policy "inclination" (i.e., the likelihood of a policy change) for 01/2000 to 06/2009, based on the information content of the SARB's monetary policy statements that accompany each MPC meeting. In turn, the index serves as an analytical tool to analyse the consistency of the SARB's communication. To construct the index (FGI), the two researchers independently read each MPC statement and judged the monetary policy inclination that each statement portrays by attributing a numerical (integer) value between -2 and $+2$ to each statement. The authors maintain that

this limits the inherent subjectivity concomitant with the adopted method. Nonetheless, Reid and Du Plessis (2010) argue that the use of a subjective index is substantiated by the hermeneutic argument of Rosa and Verga (2007).¹⁸

In addition, the respective index values had to be assigned and justified in accordance with a series of themes.¹⁹ Subsequent to their independent evaluations, the two researchers conducted a detailed discussion about each report and their associated evaluation in order to establish a consensual index value, which signifies the degree of monetary policy inclination:

- -2: imminent interest rate reduction
- -1: possible interest rate reduction
- 0: unlikely interest rate change in the near future²⁰
- +1: possible interest rate rise
- +2: imminent interest rate rise

Reid and Du Plessis (2010) use the FGI to conduct several applications in order to investigate the nature and success of the communication of the SARB. More specifically, these applications include: (i) exploratory data analysis, (ii) econometric tests, and (iii) OLS and ordered probit regression analyses (Reid and Du Plessis 2010, 4). Reid and Du Plessis (2010) find evidence to suggest that the SARB MPC has been able to provide consistent signals about its likely future policy decisions over the sample period.²¹

¹⁸Rosa and Verga (2007) argue that hermeneutic theory and textual analysis underscore that a message is not defined objectively by the particular words the sender chooses to use, which induce the subjective nature of communication. Furthermore, Rosa and Verga (2007) emphasise that the content of a message is characterised not only by the interpretation of the receiver but also the context in which the message is sent.

¹⁹As per Reid and Du Plessis (2010), these themes are: "...comments about headline and core inflation, and expected inflation (especially the SARB's own forecast, the BER's survey of inflation expectations and the break-even inflation rate from the bond market); comments about the business cycle and the output gap; comments about wages and labour-market pressures; comments about money supply; comments about external accounts; and finally, overall comments about the appropriateness of the monetary policy stance."

²⁰This, according to Reid and Du Plessis (2010), indicates that monetary policy at the time was appropriate.

²¹Consistency, in this case, refers to the degree to which the SARB's actions coincide with foregoing communication about monetary policy.

3. Data

3.1. Text Data

The SARB has multiple channels through which it communicates with markets and other economic actors. Aside from monetary policy reviews, forums, speeches, and testimonies at public hearings, the SARB's main communication channel consists of statements from its monetary policy committee (MPC) that are published after each MPC meeting. We rely solely on these MPC statements to construct the forward guidance indicator.

For the purposes of this paper, we use MPC statements from 02/03/2000 to 22/11/2018. This is done to restrict our sample to meetings which were exclusively held under an inflation targeting (IT) regime, which was introduced by the SARB in February 2000. A particular problem associated with the use of MPC statements, regardless of the sample, is the fact that inter-meeting intervals fluctuate. This predicament is likewise echoed by Reid and Du Plessis (2010). However, the majority of meetings are 8 or 9 weeks (approx. 2 months) apart.²² As a consequence, this paper utilizes a monthly data frequency. We address the missing data predicament by assuming the content of the text persists until new information arrives. The dataset consisting of *actual* datapoints will be referred to as the *unaugmented* textual data and the dataset without any missing datapoints will be referred to as the *augmented* textual data.

3.2. Economic Data

A range of economic variables are used during the course of our empirical analysis. The relevant variables are tabulated in Table 3.1, together with their respective definitions and sources. The rationale for using the respective variables are deferred to the relevant applications in Section 5.2. The majority of the economic data is of monthly frequency, however, some economic variables, which are survey-based, are available exclusively at a quarterly frequency. As with the textual data, we manage this complication by maintaining the current values pending the arrival of new information.

²²We use a weekly measurement since it circumvents the need to work with months that vary in duration, which introduce inconsistencies. The various meeting dates and the associated inter-meeting intervals are presented in Table B.1 in Appendix B.

Table 3.1: Definitions, Frequency, and Sources of Economic Variables

Variable	Definition	Frequency	Source
Repo Rate	Benchmark repurchase (interest) rate at which the central bank lends money to commercial banks.	Monthly	SARB
Inflation Expectations	Inflation expectation survey for the current and next two years (where participants include financial analysts, business people, and trade union officials). Average CPIX inflation expectations until 2008, after which, the average headline CPI inflation expectations are used. The one-year and two-year ahead forecast for 2008 are based on headline CPI. These adjustments are performed since CPIX was discontinued in 2008.	Quarterly	SARB/BER
Business Confidence (BCI)	BER South Africa composite business confidence index. Target audience: senior executives from 3 sectors: manufacturing, trade, and construction. Sample size: 1400 individuals in construction, 1400 in trade, and 1000 in manufacturing.	Quarterly	Bloomberg
Consumer Confidence (CCI)	BER South Africa consumer confidence. Target audience: households. Sample size: 2500 individuals.	Quarterly	Bloomberg
JIBAR (3month)	The money market rate that is used by South Africa. The JIBAR rates are daily fixed rates calculated by the exchange based on quotes received from five contributing banks, from which the top two and bottom two are dropped to remove outliers.	Monthly	Bloomberg
ICE USD LIBOR (3m)	London - Interbank Offered Rate - ICE Benchmark Administration Fixing for US Dollar. The LIBOR is a widely used benchmark for short-term interest rates, providing an indication of the average rates at which LIBOR panel banks could obtain wholesale, unsecured funding for set periods in particular currencies. The rate is an average derived from the quotations provided by the banks determined by the ICE Benchmark Administration. The top and bottom quartile are eliminated and an average of the remaining quotations are used to arrive at a single rate.	Monthly	Bloomberg

Table 3.1 (Continued)

US Interest Rate Swap (1y)	USD ICE swap rate is recognised as the principal global benchmark for swap rates and spreads for interest rate swaps. It represents the mid-price for interest rate swaps (the fixed leg).	Monthly	Bloomberg
SA Interest Rate Swap (2y)	The rate associated with a vanilla interest rate swap between two counterparties to exchange cashflows (fixed vs. floating) in the same currency.	Monthly	Bloomberg
<u>Inflation</u>			
Headline	The consumer prices (CPI) are a measure of prices paid by consumers for a market basket of consumer goods and services. The growth rate represents the inflation rate.	Monthly (y-o-y)	Bloomberg
Core	The core inflation rate is derived from exclusions from the CPI. These exclusions comprise of food, petrol, and energy.	Monthly (y-o-y)	Bloomberg
CPIX	Inflation of CPI excluding interest rates on mortgage bonds from the basket of goods and services used to compile CPI.	Monthly (y-o-y)	Bloomberg

Source: Author.

4. Methodology

The notion of a FGI is based on the premise that each MPC statement issued by the SARB contains words and phrases that can be categorised as “hawkish” or “dovish”, regarding either the state of the economy or the monetary policy outlook. This paper employs text-mining techniques to extract the relative “hawkishness” or “dovishness” from strings: letters, words, or phrases.²³ This is done by determining the relative frequency by which these textual elements occur within a document. The underlying intuition is that the relative frequency by which certain words or phrases occur in a text is a good indicator of the sentiment conveyed in the particular text. In this regard, we adopt a “dictionary” approach.

The dictionary approach is based on a pre-defined list of words and/or phrases (i.e., a lexicon)

²³Text-mining is a blanket term for a series of computational tools and statistical techniques that quantify text (Bholat et al. 2015, 1). Text mining is also commonly referred to as computational linguistics or natural language processing.

that are underpinned by general theory (e.g., linguistic, financial, and economic), which makes it easily scalable. The dictionary approach has two clear advantages compared to manual classification. Firstly, the dictionary method largely overcomes the subjectivity associated with the manual classification of statements. Secondly, the method is not reliant on real-time classification, which in the case of manual classification can be influenced by how financial markets perceived the prevailing signals (which are inferred by the tone of the statements).

The dictionary approach, however, does encompass some disadvantages. Firstly, the words in the dictionary are selected by the researcher, which imposes an element of subjectivity on the data. Secondly, the dictionary approach does not explicitly account for context, since it purely matches words in the library (i.e., sentiment vectors). Lastly, the presence of certain redundant words or the absence of keywords can heavily distort the FGI, since trivial or no matches will occur between the dictionary and the content of the statement.

We adopt a computer-enabled approach (computational and statistical analysis) that allows us to potentially extract meaning from the text that human readers – as in the case of Reid and Du Plessis (2010) – might have missed by overlooking certain patterns. According to Bholat et al. (2015), these patterns are unnoticed by human readers since they do not conform to prior beliefs and expectations. Furthermore, a computer-enabled approach allows for more expeditious processing of text from a document or a collection of documents (a corpus) compared to a human reader.

4.1. Text Analysis Algorithm

A preliminary step in our text-mining procedure is to dissect the MPC documents into ‘tokens.’²⁴ This step involves representing the text of each document in the corpus as a list of numbers, symbols, signs, words, and phrases. However, it is difficult to write an algorithm that tokenise text such that it always conveys the correct meaning. To demonstrate, consider the following sentence:²⁵

²⁴The MPC documents prior to 18/07/2013 were only available in a non-readable PDF format. This problem was addressed by using Adobe’s ‘Acrobat Pro DC’ software to generate readable renditions of the documents.

²⁵This example was taken from Bholat et al. (2015).

The marriage of Isabella of Castile to Ferdinand of Aragon created a united kingdom in Spain.

If our algorithm classified every instance where “United” is followed by “Kingdom” as an instance of “United Kingdom”, our algorithm would incorrectly regard “united” and “kingdom” in the sentence above as one token instead of two. To address this hurdle, our algorithm allows for the size of tokens to vary. Specifically, we allow tokens to range from 1 word to 4 words. However, a drawback of this method is that it increases the dimensionality of the list of tokens substantially.

Therefore, a second preliminary step is to reduce the dimensionality of the list of tokens, which also eliminates noise and directs attention to the documents’ distinctive content (Bholat et al. 2015, 7). We utilize a number of techniques to reduce the dimensionality of the list of tokens, namely:²⁶

- 1) Removing all punctuation, special characters, and rare words.
- 2) Removing stopwords such as articles and prepositions e.g., “it”, “the”, and “a”.
- 3) Case folding: converting all alphabetic tokens to lowercase.²⁷

This paper employs three different pre-existing lexicons to derive the sentiment from our list of tokens, namely:²⁸

- i) Loughran (Loughran and McDonald (2011))
- ii) Henry (Henry (2008))
- iii) Christensen (Christensen and Rising (2017))

These dictionaries were chosen over more common dictionaries (e.g., psychological Harvard-IV dictionary) since they are specifically designed for the use in a financial or economic context.

²⁶Stemming, which entails “cutting” off affixes and counting stems, is also widely used in practice. For example, the word “banking” contains the stem “bank” and the affix “-ing”, hence the two words would (after stemming) be considered two instances of the same token. We do not apply this technique since it can result in errors (overstemming and understemming) and, moreover, prove difficult to infer sentiment from stems that are potentially derived from words, which may express contrasting sentiment.

²⁷Although case folding might obscure the meaning for proper nouns in some cases, this does not pose a problem for our analysis. Misleading occurrences of case folding can occur, but the adoption of multi-word tokens largely prevents this from occurring.

²⁸Owing to the scope of the Loughran dictionary we do not provide a detailed list thereof, however, it is available at: <https://sraf.nd.edu/textual-analysis/resources/#LM%20Sentiment%20Word%20Lists>. See Table C.1 and Table C.2 in Appendix C for the list of words contained in the Henry and Christensen dictionaries.

These financial dictionaries account for the fact that the connotations of certain words (phrases) are different within a financial and economic context. Hence, the use of these dictionaries would yield a more accurate sentiment score.

Following the two (aforementioned) preliminary steps, our algorithm determines the number of matches between the “hawkish” and “dovish” words/phrases in a particular dictionary and the list of tokens for each document in our corpus. In turn, we use the aggregate number of “hawkish” and “dovish” words contained in each document to construct our forward guidance indicator according to the following formula:

$$FGI_t = 2 \cdot \frac{(H_t - D_t)}{H_t + D_t}, \quad (4.1)$$

where H and D are the number of “hawkish” and “dovish” words, respectively, in the policy statements over the analysed period. We set the range of our index to be between -2 and 2 simply for comparative purposes. Analogous to Christensen and Rising (2017), our FGI can assume a *continuous* value between -2 and 2 , whereas the FGI developed by Reid and Du Plessis (2010) takes on discrete values.²⁹ In all cases, a value of -2 signifies the most dovish tone, whereas 2 signifies the most hawkish tone. The FGI, therefore, expresses whether the perceived tone of the SARB’s MPC communication is suggestive of tightening monetary policy (hawkish perception) or, alternatively, loosening monetary policy (dovish perception). Although a maximum value of -2 or 2 is theoretically possible, it would require *all* the words to be “dovish” or “hawkish”, respectively, which is highly unlikely. Therefore, our FGI is not strictly comparable to that of Reid and Du Plessis (2010).

We determine whether the FGI model developed here accurately captures the forward guidance implied by the policy statements using two methods. Firstly, we conduct an informal exploratory data analysis by exploring the relationship between the FGI and policy rate changes. Secondly, a more formal approach is adopted, where we make use of a subsequent regression analysis. The two measures are pursued in Section 5.1 and Section 5.2, respectively.

²⁹An advantage of using a continuous FGI emanates from its ability to accommodate both marginal and acute changes in sentiment, whereas a discrete FGI can merely accommodate acute changes.

5. Forward Guidance Indicators (FGIs)

5.1. Exploratory Data Analysis

The respective FGIs and the associated policy rate changes at MPC meetings are illustrated in Figure 5.1 to Figure 5.3. The figures are, however, based on the unaugmented textual data to provide a more accurate depiction of the sentiment corresponding to the respective MPC statements. We also present the FGI of Reid and Du Plessis (2010) in Figure 5.4, to exhibit how our FGIs compare to the only existing FGI for the SARB.

Figure 5.1: FGI (Henry) for the Period of 03/2000 to 11/2018

In Figure 5.1, it is apparent that there is an association between FGI (Henry) and changes in the repo rate, which suggests that the FGI has some predictive power. Evidently, the FGI rarely assumes a negative value when there has been a reduction in the repo rate – particularly for large negative changes. Therefore, it appears the FGI is more geared to accurately predict positive changes in the repo rate as opposed to negative changes. On one hand, this could be attributable to monetary policy authorities tending not to signal negative policy rate changes. On the other

hand, this could stem from the Henry (2008) library, which encompasses negative terms that do not frequently appear in SARB MPC statements (e.g., “failure”). Moreover, the imbalance between the number of positive (105) and negative (85) words in the dictionary could exacerbate this hawkish bias.

Figure 5.2: FGI (Loughran) for the Period of 03/2000 to 11/2018

It is evident from Figure 5.2, that FGI (Loughran) exhibits a rather weak association with changes in the repo rate, which suggest that the FGI does not possess any predictive power of future repo rate changes. In Figure 5.1, we noted that FGI (Henry) exhibits a rather modest association with repo rate changes. It is, therefore, plausible that a more compact library, which contains the most relevant words, is able to produce results superior to that of a comprehensive library.

Also, it is evident that FGI (Loughran), in contrast to FGI (Henry), does not assume any significant positive values. Hence, the FGI is less likely to predict positive changes in the repo rate compared to negative changes in the repo rate. This occurrence could be ascribed to the library encompassing positive terms which do not frequently appear in SARB MPC statements. However, given the comprehensiveness of the Loughran and McDonald (2011) library (354 positive words), this would

be unlikely. A more plausible explanation arises from the fact that the Loughran and McDonald (2011) library contains only 354 positive words compared to 2355 negative words. By implication, FGI (Loughran) is more sensitive to the use of negative words since the likelihood of a “match” between a token and a word in the library is greater. Hence, FGI (Loughran) has an implicit tendency to generate additional negative values, on a relative basis.

Figure 5.3: FGI (Christensen) for the Period of 03/2000 to 11/2018

In Figure 5.3, it is evident that FGI (Christensen) displays a particularly strong association with changes in the repo rate, suggesting that the FGI possess meaningful predictive power of future repo rate changes. However, the FGI has been unable to reflect certain prominent movements in the repo rate, most notably, decreases during 2001-2004 and increases during 2014-2016.

In contrast to FGI (Henry) and FGI (Loughran), FGI (Christensen) features both significant positive and negative values. This may suggest that the Christensen and Rising (2017) library more accurately captures both positive and negative words used in the SARB MPC statements, and that the library is well-balanced. That is, it does not favour a particular sentiment group.

Figure 5.4: Reid and Du Plessis (2010) FGI for the Period of 03/2000 to 11/2018

It is noticeable from Figure 5.4, that the FGI of Reid and Du Plessis (2010) shows a close association with repo rate changes for the limited sample. This is largely expected since the FGI is constructed based on the values assigned by two researchers, who not only have extensive economic knowledge but who were also able to infer the sentiment of an MPC statement by reviewing and contextualising phrases and sentences as a whole. In contrast, the algorithm underlying the preceding FGIs cannot perform this process with the same accuracy.

The use of a graphical depiction in determining the strength of the association between two variables may frequently be ineffective vis-à-vis the use of a correlation coefficient. This derives from the fact that the correlation coefficient is based on standardized variables, making the measurement immune to changes in the scale or units of measurement. Hence, we further explore the relationship between the FGIs and the SARB's policy rate by analysing the correlation structure between the FGIs and the repo rate (*level*), as well as the correlation structure between the FGIs and the repo rate decisions (*changes*) of the SARB. We will not specify, a priori, a specific lag/lead, but will rather consider a range of potential lag/lead orders. The results for the correlation between the various FGIs and the repo rate, as well as changes in the repo rate, are given in Table 5.1 and

Table 5.2, respectively.

Table 5.1: Correlation Between FGIs and the Repo Rate (level) at Various Horizons

FGI	Repo Rate					
	$(t + 1)$	$(t + 2)$	$(t + 3)$	$(t + 4)$	$(t + 5)$	$(t + 6)$
FGI (Henry)	0.40	0.44	0.47	0.49	0.51	0.51
FGI (Loughran)	0.06	0.07	0.07	0.07	0.08	0.09
FGI (Christensen)	0.37	0.40	0.43	0.44	0.45	0.46
Reid and Du Plessis (2010) FGI	0.40	0.48	0.54	0.59	0.62	0.63

Notes: The Pearson correlation method was used with pairwise complete observations.

The results for the Reid and Du Plessis (2010) FGI is based on the sample of 03/2000 to 06/2009, whereas the other results are based on the sample of 03/2000 to 11/2018.

Source: Author's calculations.

From Table 5.1, it is evident that all the FGIs, except FGI (Loughran), display a moderate correlation with the repo rate at time $t + 1$, with incremental increases as the horizon lengthens. Furthermore, it is apparent that the FGI of Reid and Du Plessis (2010) is superior to the other FGIs – particularly at longer time horizons. Also, it is noticeable that FGI (Loughran) essentially exhibits no correlation with the repo rate, regardless of the time horizon.

Table 5.2: Correlation Between FGIs and Changes in the Repo Rate at Various Horizons

FGI	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI (Henry)	0.24	0.33	0.33	0.32	0.31	0.27
FGI (Loughran)	0.04	0.08	0.08	0.08	0.10	0.10
FGI (Christensen)	0.18	0.25	0.27	0.25	0.23	0.21
Reid and Du Plessis (2010) FGI	0.50	0.58	0.56	0.53	0.49	0.45

Notes: The Pearson correlation method was used with pairwise complete observations.

The results for the Reid and Du Plessis (2010) FGI is based on the sample of 03/2000 to 06/2009, whereas the other results are based on the sample of 03/2000 to 11/2018.

Source: Author's calculations.

It is evident from Table 5.2, that FGI (Henry) and FGI (Christensen) display a lower correlation

with changes in the repo rate compared to the level of the repo rate for *all* time horizons. In the case of the Reid and Du Plessis (2010) FGI, the correlation with changes in the repo rate for $m = 1$ ($m = 4$) to $m = 3$ ($m = 6$) is larger (smaller) compared to the repo rate level counterpart. For the FGI (Loughran), the correlation with changes in the repo rate is slightly larger than that with the level of the repo rate except for $m = 1$. We also find that all the FGIs, except FGI (Loughran), increase up to $m = 4$, whereupon it decreases. In addition, we find that the correlations are overall more stable in comparison with the correlations to the repo rate level. That said, the correlation of the FGIs are generally weaker, with the exception being that of Reid and Du Plessis (2010).³⁰

This section has shown that the FGIs are unique in nature owing to the underlying libraries used in their construction. The differences between the FGIs can be succinctly summarised by way of the distributions of their index values. The distributions of FGI (Henry), FGI (Loughran), and FGI (Christensen) are presented in Figure 5.5. These distributions will be of greater importance during the ensuing sections that encompass our analyses.

³⁰The Reid and Du Plessis (2010) FGI may not be systematically better than the other FGIs, since the variance of repo rate changes have become smaller in recent times. Therefore, in addition to the above results, we replicated the procedure for the unaugmented textual data, for the sample corresponding to that of Reid and Du Plessis (2010), and the combination thereof. Explicit results are tabulated in Table D.1 to D.6 in Section D.1 of Appendix D. The main findings are: (1) keeping the MPC stance constant until new information arrives does not materially change the association between the FGIs and the repo rate, as well as the changes in the repo rate, (2) the correlations in the first case (unaugmented text data) and third case (reduced sample and unaugmented text data) are only marginally different, and (3) the correlations in the second case (reduced sample) are substantially lower (higher) for the repo rate level (changes).

Figure 5.5: The Distribution of Index Values for FGI (Henry), FGI (Loughran), and FGI (Christensen).

5.2. Regression Analysis

In the preceding section, an informal analysis indicated that the FGIs do display association with the repo rate and changes in the repo rate. In turn, this suggests that our FGIs possess, to some degree, the ability to predict the future level of the repo rate and changes in the repo rate. In this section, we employ a more formal analysis in the form of regression analyses based on the augmented textual data. We demonstrate the potential use of our FGI with several applications, which are presented in the ensuing subsections. We omit the use of FGI (Loughran) from the ensuing analyses owing to its poor performance.³¹

5.2.1. Application 1: Predictability of FGI on Policy Rate Changes

The first application explores the predictability of the FGI on policy rate changes. To this end, we regress the SARB's instrument rate (the repo rate) on the FGI. We also control for market expectations of future short-term interest rates by including, $DomExp_t$, the difference between the 3-month JIBAR rate and the rate affiliated with the 2-year South African interest rate swap.³² Furthermore, we include a dummy variable to account for the technical adjustment of the repo rate on 5 September 2001 that was aimed at improving the functioning of the refinancing system (see South African Reserve Bank (2001)). The resulting regression model is as follows:

$$(Repo_{t+m} - Repo_t) = \alpha + \beta_1 FGI_t + \beta_2 DomExp_t + \beta_3 TechDum_t + \epsilon_t, \quad (5.1)$$

where $Repo_t$ is the repo rate at time t , α is a regression constant, FGI_t is the forward guidance index value, $DomExp_t$ is domestic expectations of future short-term interest rates, $TechDum_t$ is a technical dummy variable (09/2001 = 1 ; 0 elsewhere), and ϵ_t is the error term.

The results associated with the regression in Eq. 5.1 for the horizons $m = 1, \dots, 6$ (that is, the change in the repo rate between time t and $t + m$) are presented in Table 5.3 and Table 5.4, respectively. The coefficient estimates associated with the FGI variable should deliver some insight into the relationship between the change in the repo rate and the FGI, reflecting the degree to which the FGI provides information on future monetary policy decisions.

³¹The regression results for FGI (Loughran) are available upon request.

³²A 2-year interest rate swap is used since it is slightly less volatile compared to the 1-year interest rate swap.

Table 5.3: Results for Application 1 (Henry Library)

Variable	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.14*** (0.05)	0.31*** (0.07)	0.40*** (0.09)	0.48*** (0.11)	0.53*** (0.12)	0.50*** (0.14)
DomExp	0.12*** (0.02)	0.25*** (0.03)	0.41*** (0.04)	0.58*** (0.05)	0.73*** (0.06)	0.87*** (0.07)
TechDum	–0.01 (0.30)	–0.02 (0.43)	–0.01 (0.57)	1.00 (0.69)	1.01 (0.80)	2.05** (0.90)
Constant	–0.12*** (0.03)	–0.25*** (0.04)	–0.35*** (0.06)	–0.44*** (0.07)	–0.52*** (0.08)	–0.55*** (0.09)
Observations	224	223	222	221	220	219
R ²	0.17	0.30	0.37	0.43	0.46	0.48
Adjusted R ²	0.16	0.29	0.36	0.42	0.45	0.47

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

Table 5.4: Results for Application 1 (Christensen Library)

Variable	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.10** (0.04)	0.21*** (0.06)	0.30*** (0.08)	0.35*** (0.09)	0.36*** (0.11)	0.35*** (0.12)
DomExp	0.13*** (0.02)	0.27*** (0.03)	0.43*** (0.04)	0.59*** (0.05)	0.75*** (0.06)	0.89*** (0.07)
TechDum	0.02 (0.30)	0.04 (0.44)	0.07 (0.57)	1.09 (0.70)	1.12 (0.81)	2.15** (0.91)
Constant	-0.05** (0.02)	-0.11*** (0.03)	-0.17*** (0.04)	-0.23*** (0.05)	-0.28*** (0.06)	-0.33*** (0.06)
Observations	224	223	222	221	220	219
R ²	0.16	0.28	0.35	0.41	0.44	0.47
Adjusted R ²	0.14	0.27	0.35	0.40	0.44	0.46

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

It is evident from Table 5.3 that the coefficient of the FGI is significant at all horizons and that the size of the coefficient increases with the length of the horizon. The results suggest that a unit increase (approximately 2 standard deviations) in the FGI index (i.e., a more hawkish outlook) predicts a 0.3% increase in the repo rate within the next two months and a 0.5% increase within the next 6 months. Although the size of the FGI coefficient for $m = 1$ is particularly weak, it remains significant. This can primarily be ascribed to the fact that MPC meetings were predominantly two months apart, which translates to little variation in the dependent variable which in this case is $Repo_{t+1} - Repo_t$ (Reid and Du Plessis 2010, 18). The FGI coefficient for $m = 2$ to $m = 4$ is largely similar to that of Reid and Du Plessis (2010), regardless of the larger sample and the inclusion of domestic market expectations of future short-term interest rates. Furthermore, we also find that the coefficient estimates for domestic market expectations of future short-term interest rates are positive and significant. Analogous to the FGI correlations, the magnitude of the coefficients

increase with the length of the horizon. The estimates suggest that a 1% increase in domestic market expectations of future short-term interest rates, will be associated with a 0.25% and 0.87% increase within the next 2 and 6 months, respectively. We also find the R^2 to be modest in size, indicating that our model encompasses informational content.

From Table 5.4, it is apparent that the results associated with the use of the Christensen library are largely similar to those that use the Henry library. The main difference between the two sets of results is that the coefficient estimates associated with FGI (Christensen) are slightly smaller than that of FGI (Henry). Hence, FGI (Henry) predicts larger increases in the repo rate at all horizons, compared to FGI (Christensen), for a marginal change in the FGI. Additionally, in both cases, we find that the technical dummy variable to be insignificant for all but $m = 6$. In the case of Reid and Du Plessis (2010), the dummy variable was found to be significant for $m = 4$ to $m = 6$. This discrepancy could be attributed to the fact that the dummy takes on the value of 1 for only one period and that its effect is overpowered by that of the FGI and domestic market's expectations of future short-term interest rates.

5.2.2. Application 2: Systematic Response of FGI to Economic Variables

The second application entails regressing the FGIs on macroeconomic variables that encapsulate the price stability mandate of the SARB. The underlying rationale is that if the FGI is an accurate measure of forward guidance – and by extension, a measure of the SARB's future intended responses with the policy instrument – the lion's share of changes in the FGI should be ascribed to changes in the macroeconomic variables that underpin the mandate of the SARB. For the purposes of this paper, we consider business confidence, consumer confidence, inflation expectations, and US market expectations of short-term interest rates (the difference between the 3-month LIBOR rate and the rate associated with the 1-year USD interest rate swap). We also include a dummy variable to account for the global financial crisis (10/2008 to 03/2009). The regression is specified as follows:

$$FGI_t = \alpha + \beta_1 BCI_t + \beta_2 CCI_t + \beta_3 InflExp_t + \beta_4 IntExp_t + \beta_5 FinDum_t + \epsilon_t, \quad (5.2)$$

where FGI_t is the forward guidance index value at time t , α is a regression constant, BCI_t is the business confidence, CCI_t is the consumer confidence, $InflExp_t$ is the inflationary expectations

one year ahead, $IntExp_t$ is US market expectations of short-term interest rates, $FinDum_t$ is a dummy variable (10/2008 to 03/2009 = 1 ; 0 elsewhere), and ϵ_t is the error term.

The coefficient estimates (see Table 5.5) associated with the various explanatory variables should deliver some insight into whether there is any relationship between the FGI and economic variables that typically reflect the state of the economy, and hence future repo rate changes.

Table 5.5: Results for Application 2

Variable	Model	
	Henry FGI	Christensen FGI
Business Confidence	0.02*** (0.00)	0.02*** (0.00)
Consumer Confidence	-0.00 (0.00)	0.01*** (0.00)
Inflation Expectations	0.12*** (0.03)	0.17*** (0.03)
US Short-Term Interest Rate Expectations	0.11 (0.09)	0.19* (0.10)
Financial Crisis Dummy	-0.61*** (0.14)	-0.90*** (0.16)
Constant	-1.21*** (0.20)	-1.88*** (0.24)
Observations	219	219
R ²	0.52	0.52
Adjusted R ²	0.50	0.51

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

Results are based on a reduced sample owing to a few missing data points at the start and/or end of the sample for the Business Confidence, Consumer Confidence, and Inflation Expectations variables.

Source: Author's calculations.

Table 5.5 shows that the coefficient on inflation expectations is significant and large for both FGIs, indicating that it is a notable predictor of the indices. More specifically, a 1% rise in inflation expectations predicts a 0.12 and 0.17 unit increase in the FGI (i.e., more hawkish) for the Henry

and Christensen libraries, respectively. We find that the negative coefficient for financial crisis dummy variable to be significant and substantial in size for both FGIs. This implies that the tone during the financial crisis was significantly more dovish (i.e., the FGIs were 0.61 and 0.9 lower, respectively), which is to be expected owing to the unexpected severity of the global financial crisis. It is also evident that the business and consumer confidence coefficients for both FGI (Henry) and FGI (Christensen) are largely trivial yet significant – except for consumer confidence which is insignificant in the case of FGI (Henry). However, given that these variables are measured on a scale from 0 to 100 and -100 to 100 , respectively, large movements can imply significant changes in the FGI. We also find that US short-term interest rate expectations are responsible for an influential role in the determination of the FGI value (e.g., a one percentage point increase in US short-term interest rate expectations results in a 0.11 and 0.19 increase in the Henry and Christensen FGIs, respectively). Nonetheless, the coefficient is only significant for FGI (Christensen). Overall, we find the coefficients are largely comparable for the two FGIs, with only a more pronounced difference for the financial crisis dummy variable. The R^2 for both is relatively high (0.52), indicating that the economic variables can explain a modest amount of the FGIs variation.

5.2.3. Application 3: SARB Explicitly Targeting Different Points in the Target Band

The third application of this paper allows for different regimes under which the SARB may have explicitly targeted different points within the inflation target band of 3% to 6%, using the specification in Application 1. We focus specifically on the explicit targeting of the mid-point of the inflation target band, measured by the repo rate changes at various horizons. In Figure 5.6, we depict both the core- and headline inflation rate for the period of 03/2000 to 11/2018. Although the official target of the SARB is headline inflation, the monetary policy committee does not respond to external shocks that heavily affect certain components of headline inflation (e.g. food and fuel prices). Hence, the MPC essentially “looks through” headline inflation and targets core inflation. We would, therefore, expect that the SARB would be more inclined to keep core inflation within the target band. From Figure 5.6, we find this to be true in practice.

It is important to point out that the target has been reviewed a few times since the adoption of the flexible inflation targeting (IT) framework in February 2000. Initially, the target was specified as an average annual rate of increase of between 3% and 6% in the CPIX (metropolitan and other urban

areas) for the calendar year, two years ahead. However, in November 2003, the annual average specification of the inflation target was terminated in favour of a target that applies *continuously*. Since February 2009, the inflation target has been within a range of 3% and 6% for the year-on-year increase in *headline CPI* (CPI for all urban areas) on a continuous basis.

Figure 5.6: Core- and Headline Inflation for 03/2000 to 11/2018

Figure 5.6 illustrates that the SARB may have explicitly targeted the mid-point of the inflation target band during the approximate period of 2003 to 2007, and more recently, from 2017 onwards. To test this more formally, we use a structural break test based on the algorithm described in Bai and Perron (2003), which suggests that the periods SARB may have likely targeted the mid-point of the target band to be 10/2003-02/2007 and 06/2017-11/2018, respectively. Therefore, to account for the prospect of such phenomena, we include a regime dummy variable ($RegDum$) which takes on the value of 1 for the two periods and a value of 0 elsewhere. Our regression model supplemented by the dummy variable is specified as follows:

$$(Repo_{t+m} - Repo_t) = \alpha + \beta_1 FGI_t + \beta_2 DomExp_t + \beta_3 RegDum_t + \beta_4 TechDum_t + \epsilon_t, \quad (5.3)$$

where $Repo_t$ is the repo rate at time t , α is a regression constant, FGI_t is the forward guidance index value, $DomExp_t$ is domestic expectations of future short-term interest rates, $RegDum_t$ is the regime dummy variable ($\dots t \dots = 1 ; 0 \text{ elsewhere}$), $TechDum_t$ is the technical dummy variable ($09/2001 = 1 ; 0 \text{ elsewhere}$), and ϵ_t is the error term.

The results associated with the regression in Eq. 5.3 are presented in Table 5.6 and Table 5.7, respectively.

Table 5.6: Results for Application 3 (Henry Library)

Variable	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.15*** (0.05)	0.33*** (0.07)	0.42*** (0.09)	0.50*** (0.11)	0.54*** (0.13)	0.49*** (0.14)
DomExp	0.12*** (0.02)	0.26*** (0.03)	0.42*** (0.04)	0.58*** (0.05)	0.73*** (0.06)	0.87*** (0.07)
RegDum	–0.03 (0.05)	–0.06 (0.07)	–0.07 (0.09)	–0.05 (0.11)	–0.04 (0.13)	0.04 (0.15)
TechDum	–0.01 (0.30)	–0.04 (0.43)	–0.03 (0.57)	0.98 (0.69)	1.00 (0.80)	2.06** (0.90)
Constant	–0.11*** (0.03)	–0.24*** (0.05)	–0.34*** (0.06)	–0.44*** (0.07)	–0.51*** (0.09)	–0.55*** (0.10)
Observations	224	223	222	221	220	219
R ²	0.17	0.31	0.37	0.43	0.46	0.48
Adjusted R ²	0.16	0.29	0.36	0.42	0.45	0.47

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *RegDum* is a dummy variable for periods where the mid-point of the target band was explicitly targeted. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

Table 5.7: Results for Application 3 (Christensen Library)

Variable	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.11** (0.04)	0.24*** (0.06)	0.34*** (0.08)	0.38*** (0.10)	0.39*** (0.12)	0.35*** (0.13)
DomExp	0.13*** (0.02)	0.27*** (0.03)	0.43*** (0.04)	0.59*** (0.05)	0.75*** (0.06)	0.89*** (0.07)
RegDum	-0.04 (0.05)	-0.09 (0.07)	-0.12 (0.10)	-0.10 (0.12)	-0.08 (0.14)	0.00 (0.16)
TechDum	0.01 (0.30)	0.02 (0.44)	0.04 (0.57)	1.07 (0.70)	1.10 (0.81)	2.15** (0.91)
Constant	-0.05* (0.02)	-0.09*** (0.03)	-0.15*** (0.04)	-0.21*** (0.05)	-0.26*** (0.06)	-0.33*** (0.07)
Observations	224	223	222	221	220	219
R ²	0.16	0.28	0.36	0.41	0.44	0.47
Adjusted R ²	0.14	0.27	0.35	0.40	0.43	0.46

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *RegDum* is a dummy variable for periods where the mid-point of the target band was explicitly targeted. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

The principal finding in the two tables is that the regime dummy variable is statistically insignificant for both FGIs over all horizons. Hence, if the SARB did indeed explicitly target the mid-point, it had no effect on future repo rate changes. Importantly, when compared to Table 5.6 (Application 1), the coefficient estimates for domestic expectations of future short-term interest rates and the dummy variable for the technical adjustment are largely unaffected. We do, however, find that the estimates associated with the FGI variables are marginally higher (for $m = 1$ to $m = 5$).

5.3. General Discussion

In the preceding two sections, we have found that our FGIs exhibit some correlation with changes in the repo rate for horizons up to six months. Moreover, we found that a unit change (approximately 2 standard deviations) in our FGIs predict modest changes in the repo rate. In addition, we have found that our FGIs are highly driven by inflation expectations, and US market expectations of short-term interest rates in the case of FGI (Christensen). Business confidence and consumer confidence are less significant determinants of the FGI for marginal increases. Lastly, we established that the explicit targetting of the mid-point displays a trivial effect on the repo rate, suggesting that the FGI is systematically predictive across regime changes. In both Section 5.1 and Section 5.2, we noticed that the results at times differed moderately. This raises the question of whether the use of a naïve sentiment library, which does not consider country characteristics, is superior to a library tailored to a country that can account for its unique economic conditions. For example, the term “political instability” might not be included in a naïve library since it is not a concern for most countries. However, in the context of South Africa, this might be particularly important. Therefore, it is probable that a tailored sentiment library (lexicon) might produce more fruitful results compared to the libraries employed in this paper.

6. Robustness Analysis

In addition to our core findings in the preceding section, a broad range of additional regression analyses were performed to ensure the validity of these findings. More specifically, we tested the robustness of our FGIs against possible non-linearities. Firstly, we investigate whether the FGIs encompass any increasing (diminishing) effects, such that higher index values produce larger (smaller) effects. This is justified based on the fact that the monetary policy committee might react more accutely to macroeconomic conditions – which indirectly determines the FGI – that are *highly* favourable (unfavourable) compared to *less* favourable (unfavourable) conditons. Secondly, we determine whether the FGIs entail any asymmetries, since it is unlikely that individuals’ responses to positive and negative information are symmetric (see, for example, Soroka (2006)). To this end, we decompose the FGIs into their hawkish and dovish components and test whether the effect of each component significantly differs from one another. Additionally, to compare with the analysis

of Reid and Du Plessis (2010), we determine whether the FGI is ordinal or cardinal in nature, which involves creating a dummy variable for each index value and testing their joint equality.

6.1. Robustness Measure 1: Increasing/Diminishing Effects in Sentiment

To determine whether there are any increasing/diminishing effects in sentiment, we repeat Application 1, however, we also include the square of the FGI:

$$(Repo_{t+m} - Repo_t) = \alpha + \beta_1 FGI_t + \beta_2 FGI_t^2 + \beta_3 DomExp_t + \beta_4 TechDum_t + \epsilon_t, \quad (6.1)$$

where $Repo_t$ is the repo rate at time t , α is a regression constant, FGI_t is the forward guidance index value, $DomExp_t$ is domestic expectations of future short-term interest rates, $TechDum_t$ is a technical dummy variable (09/2001 = 1 ; 0 elsewhere), and ϵ_t is the error term.

The results associated with the regression in Eq. 6.1 are presented in Table 6.1 and Table 6.2, respectively.

Table 6.1: Results for Application 4 (Henry Library)

Variable	$\text{Repo}_{t+m} - \text{Repo}_t$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.08 (0.09)	0.25* (0.14)	0.39** (0.18)	0.38* (0.22)	0.27 (0.25)	0.10 (0.28)
FGI Squared	0.05 (0.07)	0.05 (0.10)	0.01 (0.13)	0.08 (0.15)	0.21 (0.18)	0.32 (0.20)
DomExp	0.13*** (0.02)	0.26*** (0.03)	0.41*** (0.04)	0.58*** (0.05)	0.74*** (0.06)	0.89*** (0.07)
TechDum	0.00 (0.30)	-0.01 (0.43)	-0.01 (0.57)	1.01 (0.69)	1.05 (0.80)	2.11** (0.90)
Constant	-0.11*** (0.03)	-0.24*** (0.05)	-0.34*** (0.06)	-0.43*** (0.08)	-0.48*** (0.09)	-0.49*** (0.10)
Observations	224	223	222	221	220	219
R ²	0.17	0.30	0.37	0.43	0.46	0.49
Adjusted R ²	0.16	0.29	0.36	0.42	0.45	0.48

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

Table 6.2: Results for Application 4 (Christensen Library)

Variable	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.08* (0.05)	0.21*** (0.07)	0.28*** (0.09)	0.30*** (0.10)	0.29** (0.12)	0.23* (0.14)
FGI Squared	0.04 (0.07)	0.01 (0.10)	0.08 (0.14)	0.14 (0.17)	0.25 (0.19)	0.41* (0.22)
DomExp	0.13*** (0.02)	0.27*** (0.04)	0.43*** (0.05)	0.61*** (0.06)	0.78*** (0.06)	0.93*** (0.07)
TechDum	0.03 (0.30)	0.05 (0.44)	0.09 (0.57)	1.13 (0.70)	1.19 (0.81)	2.25** (0.90)
Constant	-0.06** (0.03)	-0.12*** (0.04)	-0.19*** (0.05)	-0.27*** (0.07)	-0.35*** (0.08)	-0.43*** (0.08)
Observations	224	223	222	221	220	219
R ²	0.16	0.28	0.36	0.41	0.45	0.48
Adjusted R ²	0.14	0.26	0.34	0.40	0.44	0.47

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

It is evident from Table 6.1 and Table 6.2, that the coefficient estimates for the technical dummy variable and the domestic market's expectations of future short-term interest rates are qualitatively the same as in Application 1. We find the *net effect*, the sum of the FGI variable and the FGI Squared variable, of a unit increase (approximately 2 standard deviations) in the FGI to be largely similar to the FGI coefficient in Application 1 for the Henry library (e.g., 0.3 vs 0.31 for $m = 2$ and 0.42 vs 0.50 for $m = 6$). In the case of the Christensen library, we find that the net effect is slightly larger for longer horizons compared to the FGI coefficient in Application 1 (e.g., 0.54 vs 0.36 for $m = 5$ and 0.64 vs 0.35 for $m = 6$). Despite these findings, the coefficient on the FGI Squared variable is insignificant for the Henry library over all horizons, and all horizons except $m = 6$ for the Christensen library. This indicates that the variable provides no explanatory power

and should rather be omitted. Moreover, the insignificance of the variable suggests that there are no increasing/diminishing effects in sentiment.

6.2. Robustness Measure 2: Asymmetric Effects in Sentiment

6.2.1. Asymmetric Effects Between Negative and Positive Sentiment

The first asymmetric measure endeavours to determine whether the FGIs exhibit any asymmetries. To this end, we decompose the FGIs into their hawkish and dovish components and test whether the effect of each component significantly differs from one another:

$$(Repo_{t+m} - Repo_t) = \beta_1 \underbrace{2 \cdot \frac{H_t}{H_t + D_t}}_{\text{Positive Component}} + \beta_2 \underbrace{2 \cdot \frac{D_t}{H_t + D_t}}_{\text{Negative Component}} + \beta_3 DomExp_t + \beta_4 TechDum_t + \epsilon_t, \quad (6.2)$$

where $Repo_t$ is the repo rate at time t , H_t is the number of hawkish words, D_t is the number of dovish words, $DomExp_t$ is domestic expectations of future short-term interest rates, $TechDum_t$ is a technical dummy variable ($09/2001 = 1$; 0 elsewhere), and ϵ_t is the error term.

In contrast to the preceding regressions, a regression constant is not included in Eq. 6.2 in order to remedy the multicollinearity problem that stems from the positive (negative) component being a linear combination of the regression constant and the negative (positive) component. The results pertaining to the regression in Eq. 6.2 are presented in Table 6.3 and Table 6.4, respectively.

Table 6.3: Results for Application 5 (Henry Library)

Variable	$\text{Repo}_{t+m} - \text{Repo}_t$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI Positive Component	0.08** (0.04)	0.19*** (0.05)	0.23*** (0.07)	0.26*** (0.08)	0.28*** (0.09)	0.23** (0.11)
FGI Negative Component.	-0.20*** (0.06)	-0.44*** (0.08)	-0.58*** (0.11)	-0.70*** (0.13)	-0.79*** (0.16)	-0.77*** (0.18)
DomExp	0.12*** (0.02)	0.25*** (0.03)	0.41*** (0.04)	0.58*** (0.05)	0.73*** (0.06)	0.87*** (0.07)
TechDum	-0.01 (0.30)	-0.02 (0.43)	-0.01 (0.57)	1.00 (0.69)	1.01 (0.80)	2.05** (0.90)
Observations	224	223	222	221	220	219
R ²	0.17	0.31	0.38	0.43	0.47	0.49
Adjusted R ²	0.16	0.30	0.36	0.42	0.46	0.48

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

Table 6.4: Results for Application 5 (Christensen Library)

Variable	$\text{Repo}_{t+m} - \text{Repo}_t$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI Positive Component	0.07* (0.04)	0.15*** (0.06)	0.21*** (0.07)	0.23** (0.09)	0.22** (0.10)	0.19 (0.12)
FGI Negative Component	-0.12*** (0.04)	-0.27*** (0.06)	-0.38*** (0.08)	-0.46*** (0.10)	-0.50*** (0.12)	-0.52*** (0.13)
DomExp	0.13*** (0.02)	0.27*** (0.03)	0.43*** (0.04)	0.59*** (0.05)	0.75*** (0.06)	0.89*** (0.07)
TechDum	0.02 (0.30)	0.04 (0.44)	0.07 (0.57)	1.09 (0.70)	1.12 (0.81)	2.15** (0.91)
Observations	224	223	222	221	220	219
R ²	0.16	0.28	0.36	0.42	0.45	0.48
Adjusted R ²	0.14	0.27	0.35	0.40	0.44	0.47

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

DomExp is a measure of the domestic market's expectations of future short-term interest rates. *TechDum* is dummy variable for the technical adjustment of the repo rate.

Source: Author's calculations.

We notice from Table 6.3 that both the positive component and the negative component of the FGI are statistically significant across all horizon lengths and with the expected sign: positive for the positive component and negative for the negative component. However, for FGI (Henry), the coefficient associated with the negative component is substantially larger than the coefficient of the positive component. This indicates that negative sentiment has a greater absolute effect in comparison to its positive counterpart. This asymmetry could plausibly stem from the fact that individuals are more sensitive to negative news vis-à-vis positive news, and hence adjust their inflation expectations accordingly (see Soroka (2006)). Nevertheless, since we found that the FGIs had positive coefficients in Application 1, we can infer that the positive component has a significant offsetting effect when considered jointly with the negative component. Similarly, it is apparent from Table 6.4 (Christensen Library) that both the positive component (except for $m = 6$) and the negative component of the FGI are statistically significant across all horizon lengths. However, the

magnitude of the coefficients is slightly less, when compared to those in Table 6.3. As with the previous applications, we find domestic market expectations of future short-term interest rates to be significant for both FGIs over all horizons.

6.2.2. Nature of the FGI (Ordinal vs. Cardinal)

The second asymmetric measure sets out to determine whether the values of the index displays a cardinal or ordinal relationship. This measure closely follows the procedure adopted by Reid and Du Plessis (2010). This entails regressing the change in the repo rate on dummy variables for each of the five possible index values. Since our FGI is continuous in nature, we construct discrete values based on the following scheme:

$$FGI'_t = \begin{cases} -2 & \text{if } FGI_t < CentralTendency - 2\sigma \\ -1 & \text{if } CentralTendency - 2\sigma \leq FGI_t < CentralTendency - \sigma \\ 0 & \text{if } CentralTendency - \sigma \leq FGI_t \leq CentralTendency + \sigma \\ 1 & \text{if } CentralTendency + \sigma < FGI_t \leq CentralTendency + 2\sigma \\ 2 & \text{if } FGI_t > CentralTendency + 2\sigma, \end{cases}$$

where σ is the standard deviation of the FGI in question (see Figure 5.5). We use the median (0.5) as the central tendency for FGI (Henry) since the distribution of its values follows a *skew* normal distribution (see Figure 5.5). In contrast, we use the mean (0.1219) for FGI (Christensen) since its values are normally distributed (see Figure 5.5). Subsequently, we create dummy variables for each of the index (FGI'_t) values. Again, we control for the technical adjustment of September 2001 (by including a dummy variable) and domestic market's expectations of future short-term interest rates. The subsequent regression model is, therefore, specified as follows:

$$\begin{aligned} (Repo_{t+m} - Repo_t) = & \beta_1 D_{-2} + \beta_2 D_{-1} + \beta_3 D_0 + \beta_4 D_1 + \beta_5 D_2 \\ & + \beta_6 DomExp_t + \beta_7 TechDum_t + \epsilon_t, \end{aligned} \quad (6.3)$$

where: $Repo_t$ is the repo rate at time t , D_x for $x \in \{-2, -1, 0, 1, 2\}$ are the index dummy variables, $DomExp_t$ is domestic expectations of future short-term interest rates, $TechDum_t$ is a technical

dummy variable (09/2001 = 1 ; 0 *elsewhere*), and ϵ_t is the error term.

The results associated with the regression in Eq. 6.3 are presented in Table 6.5 and Table 6.6, respectively.

Table 6.5: Results for Application 6 (Henry Library)

Variable	Repo _{t+m} - Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
Dummy ₋₂	-0.39** (0.18)	-1.13*** (0.25)	-1.44*** (0.33)	-1.73*** (0.40)	-1.86*** (0.46)	-1.49*** (0.53)
Dummy ₋₁	-0.14** (0.06)	-0.27*** (0.09)	-0.46*** (0.12)	-0.58*** (0.15)	-0.63*** (0.18)	-0.70*** (0.20)
Dummy ₀	-0.05** (0.02)	-0.09*** (0.03)	-0.14*** (0.04)	-0.20*** (0.05)	-0.26*** (0.06)	-0.32*** (0.07)
Dummy ₁	0.01 (0.06)	0.02 (0.08)	0.06 (0.11)	0.05 (0.13)	0.05 (0.15)	-0.04 (0.17)
Dummy ₂	0.23** (0.09)	0.46*** (0.13)	0.58*** (0.16)	0.71*** (0.20)	0.83*** (0.23)	0.86*** (0.26)
DomExp	0.11*** (0.02)	0.22*** (0.03)	0.37*** (0.04)	0.53*** (0.05)	0.68*** (0.06)	0.84*** (0.07)
TechDum	0.03 (0.30)	0.05 (0.42)	0.08 (0.54)	1.12* (0.66)	1.16 (0.77)	2.19** (0.87)
Observations	224	223	222	221	220	219
R ²	0.19	0.36	0.43	0.48	0.51	0.52
Adjusted R ²	0.17	0.34	0.41	0.47	0.50	0.51

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

Dummy₋₂, Dummy₋₁, Dummy₀, Dummy₁, and Dummy₂ are dummy variables for each of the index values.

Source: Author's calculations.

Table 6.6: Results for Application 6 (Christensen Library)

Variable	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
Dummy ₋₂	-0.48*** (0.16)	-1.22*** (0.22)	-1.61*** (0.29)	-1.71*** (0.36)	-1.70*** (0.42)	-1.45*** (0.48)
Dummy ₋₁	-0.03 (0.05)	-0.06 (0.07)	-0.14 (0.10)	-0.22* (0.12)	-0.28** (0.14)	-0.31** (0.15)
Dummy ₀	-0.06** (0.03)	-0.11*** (0.04)	-0.17*** (0.05)	-0.23*** (0.06)	-0.29*** (0.07)	-0.36*** (0.08)
Dummy ₁	0.06 (0.05)	0.12* (0.07)	0.19** (0.09)	0.20* (0.11)	0.19 (0.13)	0.18 (0.14)
Dummy ₂	-0.14 (0.30)	-0.27 (0.42)	-0.44 (0.55)	-0.64 (0.68)	-0.83 (0.79)	-1.02 (0.89)
DomExp	0.12*** (0.03)	0.23*** (0.04)	0.39*** (0.05)	0.56*** (0.06)	0.73*** (0.07)	0.89*** (0.08)
TechDum	0.04 (0.30)	0.07 (0.42)	0.11 (0.55)	1.15* (0.67)	1.18 (0.79)	2.23** (0.89)
Observations	224	223	222	221	220	219
R ²	0.19	0.35	0.42	0.46	0.48	0.50
Adjusted R ²	0.16	0.33	0.41	0.44	0.47	0.48

Notes: ***, **, and * signify that a variable is significant at the 1%, 5% and 10% levels.

Dummy₋₂, Dummy₋₁, Dummy₀, Dummy₁, and Dummy₂ are dummy variables for each of the index values.

Source: Author's calculations.

It is evident from Table 6.5 (Henry Library) and Table 6.6 (Christensen Library), that domestic market expectations of future short-term interest rates are, once again, significant for both FGIs for all horizon lengths. In Table 6.5, we notice that the coefficients on four of the index values ($-2, -1, 0, 2$) are significant (increasing with horizon length), which suggest that these values of the index contain fairly reliable information. Furthermore, the signs of the coefficients on the dummy variable for index values $-2, -1$ and 2 are as expected, but the coefficient for the index value 0 is unexpectedly negative and significant (although it is significantly smaller than the coefficients for

-1 and -2). Reid and Du Plessis (2010) note that this supports the notion that communication has a slight bias towards overstating the inflationary risk. Overall, we can conclude that repo rate changes are more predictable after the realisation of a statement that is associated with negative sentiment. That is, repo rate changes are more likely when the FGI is lower, while when the FGI is highly positive (equal to 2) the SARB is less likely to raise rates.

In contrast to Table 6.5, we notice from Table 6.6 that the coefficients on three of the index values ($-2, -1, 0$) are significant (increasing with horizon length), which suggest that these values of the index contain fairly reliable information. The overall results are analogous to Table 6.5: the signs of the coefficients on the dummy variable for index values -2 and -1 are as expected, but the coefficient for the index value 0 is negative and significant (although it is significantly smaller than the coefficients for -1 and -2). Again, this underscores the bias towards overstating the inflationary risk. The results in Table 6.6, likewise to Table 6.5, suggest that repo rate changes are more predictive after the realisation of a statement that is associated with negative sentiment. However, in this case we can not make any conclusions about positive FGI values given their insignificance.

To determine whether the FGI was ordinal or cardinal in nature (that is, whether or not the relative ordering between the respective index values is significant) a Wald test was employed to test the following null hypothesis:

$$\begin{aligned}\beta_1 - \beta_2 &= \beta_2 - \beta_3, \\ \beta_2 - \beta_3 &= \beta_3 - \beta_4, \\ \beta_3 - \beta_4 &= \beta_4 - \beta_5 .\end{aligned}$$

We notice in 6.7, that the null hypothesis of the Wald test is rejected at practically all horizons for index values based on the Christensen library. In contrast, the null hypothesis of the Wald test is not rejected for any of the horizons for the index values based on the Henry library. The results suggest that FGI (Christensen) is ordinal in nature – consistent with Reid and Du Plessis (2010) – whereas FGI (Henry) is cardinal in nature.

Table 6.7: Walt Test Results for the Henry and Christensen FGI for Various Horizons

FGI	Horizon					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
Henry	Do not reject	Do not Reject	Do not reject	Do not reject	Do not reject	Do not reject
Christensen	Do not reject	Reject	Reject	Reject	Reject	Reject

Notes: Results are based on a heteroskedasticity-robust version of the Wald test.

Source: Author's calculations.

6.3. General Discussion

In the preceding two sections, we find there are asymmetries between the positive and negative component of the FGI, but we find that our FGIs do not exhibit any increasing/diminishing effects. In addition, we find that FGI (Henry) can be considered cardinal in nature whereas FGI (Christensen) can be considered ordinal in nature. As with Section 5, we find the results to vary between the two FGIs, which again, raises the question of whether a sentiment library tailored for South Africa would be beneficial.

7. Conclusion

Globally, the communication efforts of central banks grew considerably during the financial crisis of 2008-09. These efforts were augmented with an extensive movement towards the provision of so-called *forward guidance* for monetary policies during and following the crisis. Forward guidance is the provision of explicit information to provide a credible signal on the expected trajectory of the central bank's target (e.g., inflation), and the monetary policy committees stance on the future path of its instrument (e.g., the policy rate). The growing prevalence of forward guidance, in addition to central bank efforts to improve and structure its use, has led to growing interest among market participants and academics. Several scholars have also endeavoured to develop quantitative tools to measure, or express on a numerical scale, the *qualitative* forward guidance of central banks. However, Reid and Du Plessis (2010) is the only existing piece of literature that has constructed a quantitative measure of forward guidance for South Africa.

The expansion of central bank communications (publications in particular) and technological advances has allowed researchers to analyse the words and phrases used by central banks using semantic-modelling and other text-mining techniques, and therefore, quantify the expected stance of monetary policy (i.e., forward guidance). To the best of our knowledge, there are presently no academic studies who have attempted to quantify forward guidance in the case of South Africa, using semantic-modelling and other text-mining techniques. This paper has contributed to the South African monetary policy literature by constructing a novel FGI for the SARB based on these methods. To this end, we implemented a text analysis algorithm to determine the number of “hawkish” and “dovish” terms (relating to the price stability mandate of the SARB) found in the SARB’s monetary policy announcement statements based on pre-constructed sentiment libraries – the so called “bag-of-words” approach. In turn, these estimates were combined to construct an aggregate index.

Subsequently, we determined the usefulness of our FGIs by way of several applications, which primarily include whether the FGIs can systematically explain future changes in the policy rate (repo rate) and whether the FGI can consistently be explained by factors that are regarded to be leading indicators of macroeconomic performance (i.e., the business cycle), which is an indirect determinant of the realised policy rate.

The main empirical finding is that the FGIs, while controlling for domestic market expectations of future short-term interest rates, represent a useful tool to explain and predict future changes in the repo rate. Furthermore, our results indicate that our FGIs are primarily driven by inflation expectations (an average of trade union officials, business people, and financial analysts). However, business confidence for both FGIs and consumer confidence for FGI (Christensen) could prove to be important determinants of the FGIs in the event of large movements in these confidence indices. We also find that if the SARB did indeed explicitly target the mid-point of the inflation target band it had no effect on future repo rate changes.

In addition to our core findings, a range of additional robustness checks were performed to ensure the validity of these findings. More specifically, we tested the robustness of our FGIs by testing whether they are characterised by non-linearities (increasing/diminishing effects; asymmetries; and ordinal vs. cardinal). Our results indicated that our FGIs do not encompass any increas-

ing/diminishing effects. However, we found evidence of asymmetries when we decompose the FGIs into their respective negative and positive components, which relates to the proportion of hawkish and dovish words, respectively, of the total number of words found in the SARB's monetary policy announcement statements. In addition, we found some FGIs to be predominantly cardinal in nature, whereas others are primarily ordinal in nature. This means that incremental changes in some FGIs generate the same effect regardless of their reference value, whereas for other FGIs, incremental changes are dependent on their reference value.

Our study does not acknowledge a number of essential elements which will form the groundwork of future research. Firstly, we use sentiment dictionaries that primarily contain words opposed to phrases i.e., “unigram” vs. “n-gram”. As a consequence, the context of these words is implicitly ignored. Arguably, the use of a lexicon containing a multitude of phrases would greatly mitigate this problem by accounting for the said context. Alternatively, more sophisticated methods, such as support vector machines (SVMs), could be implemented to account for context. Secondly, we used low-frequency data on macroeconomic performance to estimate the impacts of central bank communications. The use of high-frequency data from financial markets ought to be more fruitful since financial markets react quickly to central bank communications whereas interest rates and asset prices affect the economy with long and variable lags (see Blinder (2008)). Thirdly, our study focused exclusively on MPC statements to construct our FGIs. The research could be extended to analyse the other channels of communication (e.g., comments by the governor at press conferences) in a similar fashion.

An interesting field of forthcoming research would be to construct a sentiment library specifically tailored to South Africa and analyse how the results compare with the use of a naïve library. An additional stream of prospective research pertains to the cost of more communication. More specifically, it would be interesting to determine whether using more words has an impeding effect on the sentiment implied by an MPC statement.

Appendix A: Forward Guidance Classification

Table A.1: Classification of Communication about Future Policy Rates in Theory and Practice

Theory	Practice	Important Characteristics
Delphic		
<u>Publication of interest rate forecasts</u>		
Mishkin (2004)	Reserve Bank of New Zealand (since	Discretion, time-consistent
Svensson (1997)	June 1997)	Conditional forecasts
Woodford (2013)	Norges Bank (since Nov. 2005)	
Eusepi and Preston (2007)	Riksbank (since Feb. 2007)	
Gosselin <i>et al.</i> (2008)		
Gersbach and Hahn (2011)		
<u>Aesopian forward guidance</u>		
—	Bank of England (Aug. 2013, Feb. 2014)	Discretion, time-consistent
	European Central Bank (Jul. 2013)	
	Federal Reserve (Aug. 2003, Dec. 2008, Mar. 2009, Aug. 2011, Jan., Sep. & Dec. 2012, Dec. 2013, Mar. & Oct. 2014, Jan. & Mar 2015)	Possible forms: open-ended; time contingent; state contingent (with or without thresholds)
	Bank of Japan (Apr. 1999, Oct. 2010, Feb. 2012, Jan. & Apr. 2013)	
	Bank of Canada (Apr. 2009)	
Odyssean		
<u>Publication of interest rate forecasts</u>		
Rudebusch and Williams (2008)	—	Commitment, time-inconsistent
Ferrero and Secchi (2009)		
Laséen and Svensson (2011)		
<u>Odyssean forward guidance</u>		
Krugman (1998), Eggertsson and Woodford (2003), Werning (2011), Levin <i>et al.</i> (2010), Campbell <i>et al.</i> (2012), Carlstrom <i>et al.</i> (2012), Del Negro <i>et al.</i> (2012), English <i>et al.</i> (2013), Coenen and Warne (2013), Eggertsson and Mehrotra (2014), Da Costa (2014), De Graeve <i>et al.</i> (2014), Gavin <i>et al.</i> (2014), Haberis <i>et al.</i> (2014), Florez-Jimenez and Parra-Polnaia (2014), Kiley (2014), McKay <i>et al.</i> (2015), Harrison (2015), Boneva <i>et al.</i> (2015), and Gersbach <i>et al.</i> (2015)	—	Commitment, time-inconsistent
		Possible forms: open-ended; time contingent; state contingent (with or without thresholds)

Source: Constructed from Moessner, Jansen, and de Haan (2017).

Appendix B: Supplementary Data Description

Table B.1: SARB MPC Meeting Dates and Inter-Meeting Intervals

Dates	Inter-Meeting Interval	Dates	Inter-Meeting Interval	Dates	Inter-Meeting Interval
2000/03/02	*	2006/06/08	8	2012/07/19	8
2000/04/06	5	2006/08/03	8	2012/09/20	9
2000/05/19	6.14	2006/10/12	10	2012/11/22	9
2000/06/15	3.86	2006/12/07	8	2013/01/24	9
2000/08/11	8.14	2007/02/15	10	2013/03/20	7.86
2000/09/21	5.86	2007/04/12	8	2013/05/23	9.14
2000/10/16	3.57	2007/06/07	8	2013/07/18	8
2000/11/16	4.43	2007/08/16	10	2013/09/19	9
2001/01/19	9.14	2007/10/11	8	2013/11/21	9
2001/03/16	8	2007/12/06	8	2014/01/29	9.86
2001/04/25	5.71	2008/01/31	8	2014/03/27	8.14
2001/06/14	7.14	2008/04/10	10	2014/05/22	8
2001/07/26	6	2008/06/12	9	2014/07/17	8
2001/09/20	8	2008/08/14	9	2014/09/18	9
2001/11/15	8	2008/10/09	8	2014/11/20	9
2002/01/15	8.71	2008/12/11	9	2015/01/29	10
2002/03/14	8.29	2009/02/05	8	2015/03/26	8
2002/06/13	13	2009/03/24	6.71	2015/05/21	8
2002/09/12	13	2009/04/30	5.29	2015/07/23	9
2002/11/28	11	2009/05/28	4	2015/09/23	8.86
2003/03/20	16	2009/06/25	4	2015/11/19	8.14
2003/06/12	12	2009/08/13	7	2016/01/28	10
2003/08/14	9	2009/09/22	5.71	2016/03/17	7
2003/09/10	3.86	2009/10/22	4.29	2016/05/19	9
2003/10/16	5.14	2009/11/17	3.71	2016/07/21	9
2003/12/11	8	2010/01/26	10	2016/09/22	9
2004/02/26	11	2010/03/25	8.29	2016/11/24	9
2004/04/22	8	2010/05/13	7	2017/01/24	8.71
2004/06/10	7	2010/07/21	9.86	2017/03/20	7.86
2004/08/12	9	2010/09/09	7.14	2017/05/25	9.43
2004/10/14	9	2010/11/18	10	2017/07/20	8
2004/12/09	8	2011/01/20	9	2017/09/21	9
2005/02/10	9	2011/03/24	9	2017/11/23	9
2005/04/14	9	2011/05/12	7	2018/01/18	8
2005/06/09	8	2011/07/21	10	2018/03/28	9.86
2005/08/11	9	2011/09/22	9	2018/05/24	8.14
2005/10/13	9	2011/11/10	7	2018/07/19	8
2005/12/08	8	2012/01/19	10	2018/09/20	9
2006/02/02	8	2012/03/29	10	2018/11/22	9
2006/04/13	10	2012/05/24	8		

Notes: Inter-meeting intervals are given in weeks. * Since 2000/03/02 marks the first meeting under an IT regime, we disregard prior meetings, hence no interval is provided.

Source: Author's Calculations.

Appendix C: Sentiment Libraries

Table C.1: Henry (2008) Sentiment Dictionary (Lexicon)

Positive			Negative		
above	excellent	opportunities	below	fall	slump
accomplish	expand	opportunity	challenge	fallen	slumped
accomplished	expanded	pleased	challenged	falling	slumping
accomplishes	expanding	positive	challenges	falls	slumps
accomplishing	expands	positives	challenging	fell	smaller
accomplishment	expansion	progress	decline	hurdle	smallest
accomplishments	good	progressing	declined	hurdles	threat
achieve	greater	record	declines	least	threats
achieved	greatest	reward	declining	less	uncertain
achievement	grew	rewarded	decrease	low	uncertainty
achievements	grow	rewarding	decreased	lower	under
achieves	growing	rewards	decreases	lowest	unfavorable
achieving	grown	rise	decreasing	negative	unsettled
beat	grows	risen	depressed	negatives	weak
beating	growth	rises	deteriorate	obstacle	weaken
beats	high	rising	deteriorated	obstacles	weakened
best	higher	rose	deteriorates	penalties	weakening
better	highest	solid	deteriorating	penalty	weakens
certain	improve	strength	difficult	risk	weakness
certainty	improved	strengthen	difficulty	risks	weaknesses
definite	improvement	strengthened	disappoint	risky	worse
deliver	improvements	strengthening	disappointed	shrink	worsen
delivered	improves	strengthens	disappointing	shrinking	worsening
delivering	improving	strengths	disappointment	shrinks	worsens
delivers	increase	strong	disappoints	shrunk	worst
encouraged	increased	stronger	down		
encouraging	increases	strongest	downturn		
enjoy	increasing	succeed	drop		
enjoyed	larger	succeeded	dropped		
enjoying	largest	succeeding	dropping		
enjoys	leader	succeeds	drops		
exceed	leading	success	fail		
exceeded	leading	successes	failing		
exceeding	more	successful	fails		
exceeds	most	up	failure		

Source: Constructed from Henry (2008).

Table C.2: Christensen and Rising (2017) Sentiment Dictionary (Lexicon)

Hawkish			Dovish		
above	high	rise	adverse	depreciation	political tensions
accelerate	higher	rises	adjusted down	depressed	political uncertainty
accelerated	higher than expected	rising	adjusting down	depressing	precautionary
acceleration	higher-than-expected	scale up	below	deteriorate	protracted
adjusted up	highest	scaling up	bust	deteriorated	receded
adjusting up	improve	solid	conflict	devast	recession
ample	improved	strength	constrain	devastated	reduce
best	improvement	strengthen	constrained	difficult	reducing
better	improving	strengthened	constraints	difficulty	reduction
boom	increase	strengthening	contracted	diminished	reductions
bottleneck	increased	strong	contraction	disaster	scale back
edged up	increases	stronger	contractions	disinflation	scale down
edging up	increasing	strongest	crises	disorderly	slack
elevated	inflationary	strongly	crisis	disruption	slow down
expand	job creation	support	curtail	disruptions	slowdown
expanded	lack of capacity	supported	curtailed	do not bode well	slowed
expanding	momentum	supporting	cut	downgrade	slower
expansion	overheating	supportive	cuts	downgrading	slowing
expansions	overshoot	supports	cutting	downside	subdued
fast	overshooting	surged	damp	downturn	tension
faster	picked up	surging	dampen	downward	tensions
fastest	picking up	sustained	dampened	fall	turmoil
favorable	positive	tailwind	decline	falling	unfavourable
favourable	rapidly	tight	declined	headwinds	unfavorable
good	reacceleration	tightening	declining	losses	uncertainties
great	rebounded	tightens	declines	low	uncertainty
greater	recovered	tighter	decrease	lower	unrest
greatest	recovery	upside	decreased	lower than expected	volatility
heating up	revised up	upswing	decreasing	lower-than-expected	vulnerable
			deep	lowest	war
			deeper	moderate	weak
			deepest	moderated	weakened
			deflation	moderating	weakening
			deflationary	muted	weaker
			deleveraging	negative	weakness
			depreciated	political risk	

Source: Constructed from data obtained from Christensen and Rising (2017).

Appendix D: Supplementary Results

D.1. Exploratory Analysis

Table D.1: Correlation Between FGIs and the Repo Rate at Various Horizons (unaugmented text data)

FGI	Repo Rate					
	(t+1)	(t+2)	(t+3)	(t+4)	(t+5)	(t+6)
FGI (Henry)	0.36	0.41	0.44	0.47	0.49	0.51
FGI (Loughran)	0.08	0.10	0.11	0.11	0.12	0.12
FGI (Christensen)	0.33	0.37	0.40	0.43	0.44	0.46
Reid and Du Plessis (2010) FGI	0.32	0.44	0.50	0.55	0.59	0.62

Notes: The Pearson correlation method was used with pairwise complete observations.

The results for the Reid and Du Plessis (2010) FGI is based on the sample of 03/2000 to 06/2009, whereas the other results are based on the sample of 03/2000 to 11/2018.

Source: Author's calculations.

Table D.2: Correlation Between FGIs and Changes in the Repo Rate at Various Horizons (unaugmented text data)

FGI	Repo _{t+m} – Repo _t					
	m = 1	m = 2	m = 3	m = 4	m = 5	m = 6
FGI (Henry)	0.19	0.31	0.34	0.35	0.37	0.36
FGI (Loughran)	0.05	0.10	0.12	0.10	0.12	0.12
FGI (Christensen)	0.22	0.27	0.31	0.32	0.31	0.31
Reid and Du Plessis (2010) FGI	0.54	0.61	0.61	0.60	0.58	0.55

Notes: The Pearson correlation method was used with pairwise complete observations.

The results for the Reid and Du Plessis (2010) FGI is based on the sample of 03/2000 to 06/2009, whereas the other results are based on the sample of 03/2000 to 11/2018.

Source: Author's calculations.

Table D.3: Correlation Between FGIs and the Repo Rate at Various Horizons (reduced sample)

FGI	Repo Rate					
	(t+1)	(t+2)	(t+3)	(t+4)	(t+5)	(t+6)
FGI (Henry)	0.07	0.16	0.22	0.28	0.33	0.34
FGI (Loughran)	-0.39	-0.35	-0.32	-0.29	-0.25	-0.22
FGI (Christensen)	-0.03	0.04	0.11	0.16	0.19	0.21
Reid and Du Plessis (2010) FGI	0.40	0.48	0.54	0.59	0.62	0.63

Notes: The Pearson correlation method was used with pairwise complete observations.

Source: Author's calculations.

Table D.4: Correlation Between FGIs and Changes in the Repo Rate at Various Horizons (reduced sample)

FGI	Repo _{t+m} - Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI (Henry)	0.37	0.51	0.51	0.50	0.49	0.44
FGI (Loughran)	0.12	0.20	0.21	0.22	0.24	0.25
FGI (Christensen)	0.31	0.43	0.46	0.44	0.42	0.39
Reid and Du Plessis (2010) FGI	0.50	0.58	0.56	0.53	0.49	0.45

Notes: The Pearson correlation method was used with pairwise complete observations.

Source: Author's calculations.

Table D.5: Correlation Between FGIs and the Repo Rate at Various Horizons (reduced sample and unaugmented data)

FGI	Repo Rate					
	(t+1)	(t+2)	(t+3)	(t+4)	(t+5)	(t+6)
FGI (Henry)	0.08	0.19	0.26	0.31	0.37	0.40
FGI (Loughran)	-0.29	-0.22	-0.19	-0.16	-0.14	-0.10
FGI (Christensen)	-0.02	0.07	0.14	0.21	0.24	0.29
Reid and Du Plessis (2010) FGI	0.32	0.44	0.50	0.55	0.59	0.62

Notes: The Pearson correlation method was used with pairwise complete observations.

Source: Author's calculations.

Table D.6: Correlation Between FGIs and Changes in the Repo Rate at Various Horizons (reduced sample and unaugmented data)

FGI	Repo _{t+m} – Repo _t					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI (Henry)	0.36	0.51	0.56	0.55	0.57	0.54
FGI (Loughran)	0.12	0.24	0.25	0.25	0.26	0.26
FGI (Christensen)	0.39	0.47	0.54	0.54	0.53	0.52
Reid and Du Plessis (2010) FGI	0.54	0.61	0.61	0.60	0.58	0.55

Notes: The Pearson correlation method was used with pairwise complete observations.

Source: Author’s calculations.

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