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Stellenbosch Economic Working Papers: WP04/2020

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March 2020

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

DEPARTMENT OF ECONOMICS
UNIVERSITY OF STELLENBOSCH

SOUTH AFRICA

A WORKING PAPER OF THE DEPARTMENT OF ECONOMICS AND THE
BUREAU FOR ECONOMIC RESEARCH AT THE UNIVERSITY OF STELLENBOSCH

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

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Abstract

The expansion of central bank communications and the increased use thereof as a policy tool to manage expectations have led to an area of research, semantic modelling, that analyses the words and phrases used by central banks. We use text-mining and text-analysis techniques on South African Reserve Bank monetary policy committee statements to construct an index measuring the stance of monetary policy: a *forward guidance indicator* (FGI). We show that, after controlling for market expectations, FGIs provide significant predictive power for future changes in the repurchase interest rate (the primary monetary policy instrument). Furthermore, we show that FGIs are primarily driven by inflation expectations, which highlights the strong link between the SARB's communication strategy and its inflation targeting mandate. In fact, we observe a systematic anti-inflation bias in the communicated stance of monetary policy—both absolutely and asymmetrically. The results are, however, sensitive to the selection of the dictionary used to analyse the text.

Keywords: *Monetary policy, Text analysis, Forward guidance, Inflation targeting*
JEL classification: C43, C53, E42, E47, E52, E58

1. Introduction

In response to the global financial crisis of 2008-2009 the communication tool of central banks expanded to include so-called *forward guidance* (Cœuré 2017, 814).[1] In the context of conventional monetary policy, forward guidance is the provision of explicit information to provide a credible

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[1]In fact, over the last few decades, all central banks have changed how they communicate to financial markets and the broader public. Historically, central banks chose to keep public announcements to a minimum because of the perceived benefits to keeping markets guessing (Mishkin 2004, 1). However, since the 1990's there has been a movement towards greater transparency and openness (Stein 2014, 1). A primary argument for greater transparency is the notion that independent central banks should be more accountable to the public (Blinder et al. 2008, 912). In doing so, central banks place substantial emphasis on improving their communication to enhance the public's confidence in the bank's ability to adhere to its mandate (Weidmann 2018, 2). This objective 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).

signal on the expected path 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).[2] Consequently, semantic modelling methods can translate a central bank's communication about future monetary policy into an index—what we refer to as a *forward guidance indicator* (FGI).

This paper adopts a text-mining technique to measure and interpret the South African Reserve Bank's communication on future monetary policy decisions. This forward guidance indicator can be used to identify the direction and the magnitude in which the SARB intend to influence markets. The index also enables one to evaluate how consistent and effective the central bank has communicated its monetary policy since the adoption of its inflation-targeting mandate in 2000. As the first paper to use such an indicator to empirically evaluate SARB policy decisions, our paper contributes to the South African monetary policy literature and, more generally, to central bank communication in an emerging market context.

Most recent studies focus on central banks that practice qualitative forward guidance.[3] Important contributions include those of Gürkaynak, Sack, and Swanson (2005), Campbell et al. (2012), Moessner (2013), Swanson and Williams (2014), and Swanson (2015; 2017). These studies use quantitative techniques to measure, or express on a numerical scale, the qualitative forward guidance of central banks. Even though there has been marked interest in measuring qualitative forward guidance in recent years, there is no standard approach to quantifying it. Early research, such as that by Rosa and Verga (2007) for the European Central Bank and Reid and Du Plessis (2010) for the SARB, manually classify central bank statements as "dovish" (negative), neutral (zero) or "hawkish" (positive).[4] More recently, researchers analyse the words and phrases used

[2]Forward guidance is not confined to information about future interest rate trajectories, but it embodies all information about future monetary policy decisions (Weidmann 2018, 5).

[3]The form of forward guidance differs amongst central banks and can materialize in a qualitative or quantitative manner. *Quantitative* forward guidance includes the explicit publishing of expected future policy rates, whereas *qualitative* forward guidance provides suggestive (non-numerical) forecasts of policy rates communicated through the content of monetary policy statements and other material generated by central banks.

[4]Rosa and Verga (2007) formulated a glossary of words and phrases, which served as a guide to establish their index. Following Rosa and Verga (2007) and Ehrmann and Fratzscher (2007), Reid and Du Plessis (2010) subjectively construct a discrete index of monetary policy "inclination" (i.e., the likelihood of a policy change), based on the information content of the SARB's monetary policy statements that accompany each monetary policy committee (MPC) meeting. The primary objective of Reid and Du Plessis (2010) is to asses how successful the SARB's monetary policy committee has been in communicating to the public its policy since adopting an inflation targeting framework. As such, the index serves as an analytical tool to analyse the consistency of the SARB's communication. Other related papers include: Jansen and De Haan (2005); Musard-Gies (2006); Gerlach (2007); and Berger,

by central banks using semantic-modelling and other text-mining techniques.[5] One such method quantifies the sentiment of central bank communication by employing a "bag-of-words" measurement, which measures the number of occurrences of a dictionary of keywords or word associations in the text of a central bank statement. This methodology has been adopted by, amongst others, Heinemann and Ullrich (2007), Apel and Blix Grimaldi (2012), Christensen and Rising (2017), and Coco and Viegi (2019). This paper constructs a forward guidance indicator for the SARB based on the "bag-of-words" approach. Specifically, we implement a text analysis algorithm based on pre-constructed sentiment libraries to determine the number of "hawkish" (optimistic) and "dovish" (negative) terms, relating to the price stability mandate of the SARB, found in the statements released after each monetary policy committee (MPC) meeting. In turn, these estimates are combined to construct aggregate indices. We determined the usefulness of our FGIs by way of several applications, which primarily include whether the FGIs can systematically predict future changes in the policy rate over-and-above market expectations, and whether the FGIs can consistently be explained by market factors that are regarded as leading indicators of macroeconomic health—an indirect determinant of the policy rate.

The main empirical finding shows that, after controlling for market expectations, FGIs provide significant predictive power for future changes in the repurchase interest rate (the primary monetary policy instrument). The results also show that FGIs are primarily driven by the average of the inflation expectations of trade union officials, business people, and financial analysts. This result, in turn, highlights the strong link between the SARB's communication strategy and its inflation targeting mandate. However, in the event of large movements, business and consumer confidence indices prove to be important determinants of the FGIs. 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. These results are, however, sensitive to the selection of the dictionary used to analyse the

de Haan, and Sturm (2011). A detailed overview of the literature on central bank communication, forward guidance, and quantitative measures of forward guidance can be found in the thesis version of this article at: http://hdl.handle.net/10019.1/107163.

[5]Some 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. 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.

text and construct the index. Studying the language specifically used by the SARB in the South African context therefore becomes important when applying semantic modelling methods.

In addition to our core findings, a range of additional robustness checks are performed to test for non-linear effects. Specifically, we find evidence of asymmetries when we decompose the FGIs into their 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. Overall, we observe a systematic anti-inflation bias in the communicated stance of monetary policy—both absolutely and asymmetrically.

The remainder of the paper is organized as follows. Section 2 outlines the sentiment libraries, the text analysis algorithm, and the formula used to derive the FGI indices. Section 3 details the applications used to determine the performance and usefulness of our FGIs, and presents the results. Section 4 examines the robustness of our results by considering alternative model specifications. Section 5 concludes.

2. Methodology

2.1. The Dictionary Approach

The nature of a FGI is to assume 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.[6] 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 of certain words or phrases in a text is

[6]Text-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 refered to as computational linguistics or natural language processing.

a good indicator of the sentiment conveyed in the particular text. In this regard, we adopt a "bag-of-words" (or "dictionary") approach.

The dictionary approach is based on a pre-defined list of words and/or phrases (i.e., a lexicon) that are underpinned by general theory (e.g., linguistic, financial, and economic), which makes it easily scalable. The dictionary approach has three clear advantages compared to manual classification – as adopted in Reid and Du Plessis (2010). 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, whereas manual classification can be influenced by how financial markets and the public perceive the prevailing signals (which are inferred by the tone of the statements). Thirdly, 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.

The dictionary approach does, however, 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 presence of certain redundant words or the absence of keywords can distort the FGI, since trivial or no matches will occur between the dictionary and the content of the statement. Lastly, the dictionary approach does not explicitly account for context, since it purely matches words in the library (i.e., sentiment vectors). That said, a computer-enabled approach does potentially extract meaning from the text that human readers 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.

2.2. Text Data

The SARB uses multiple channels to communicate 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. We further restrict our sample to meetings which were exclusively held under an inflation targeting (IT) regime, which was introduced by the SARB in February 2000. The full sample of MPC statements includes the period from 02/03/2000 to 22/11/2018. A

particular problem associated with the use of MPC statements, regardless of the sample, is the fact that the intervals between meetings fluctuate. This predicament is likewise echoed by Reid and Du Plessis (2010). However, the majority of meetings are 8 or 9 weeks apart.[7] 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 refered to as the *unaugmented* textual data and the dataset without any missing datapoints will be refered to as the *augmented* textual data.

2.3. Text Analysis Algorithm

A preliminary step in our text-mining procedure is to dissect the MPC documents into "tokens".[8] 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:[9]

> *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:[10]

[7]We 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.

[8]The 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.

[9]This example was taken from Bholat et al. (2015).

[10]Stemming, which entails "cutting" off affixes and counting stems, is also widely used in practice. For example,

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.[11]

This paper employs three different pre-existing lexicons to derive the sentiment from our list of tokens, namely:[12]

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 use in a financial or economic context. These financial dictionaries account for the fact that the connotations of certain words and 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:

$$FGI_t = 2 \cdot \frac{(H_t - D_t)}{H_t + D_t}, \tag{1}$$

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: (1) it can result in errors (overstemming and understemming); and, (2) it can prove difficult to infer sentiment from a particular stem that has been derived from a set of distinct words which exhibit contrasting sentiment.

[11] Although case folding sometimes obscure the meaning of proper nouns, 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.

[12] Owing 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.

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.[13] 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, in Section 3.1, we conduct an informal exploratory data analysis on the relationship between the FGI and policy rate changes. Secondly, in Section 3.2, a more formal approach is adopted, where we make use of a regression analysis.

3. Forward Guidance Indicators (FGIs)

3.1. Exploratory Data Analysis

The respective FGIs and the associated policy rate changes at MPC meetings are illustrated in Figure 1 to Figure 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 4, to exhibit how our FGIs compare to the only existing FGI for the SARB.

[13] An 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.

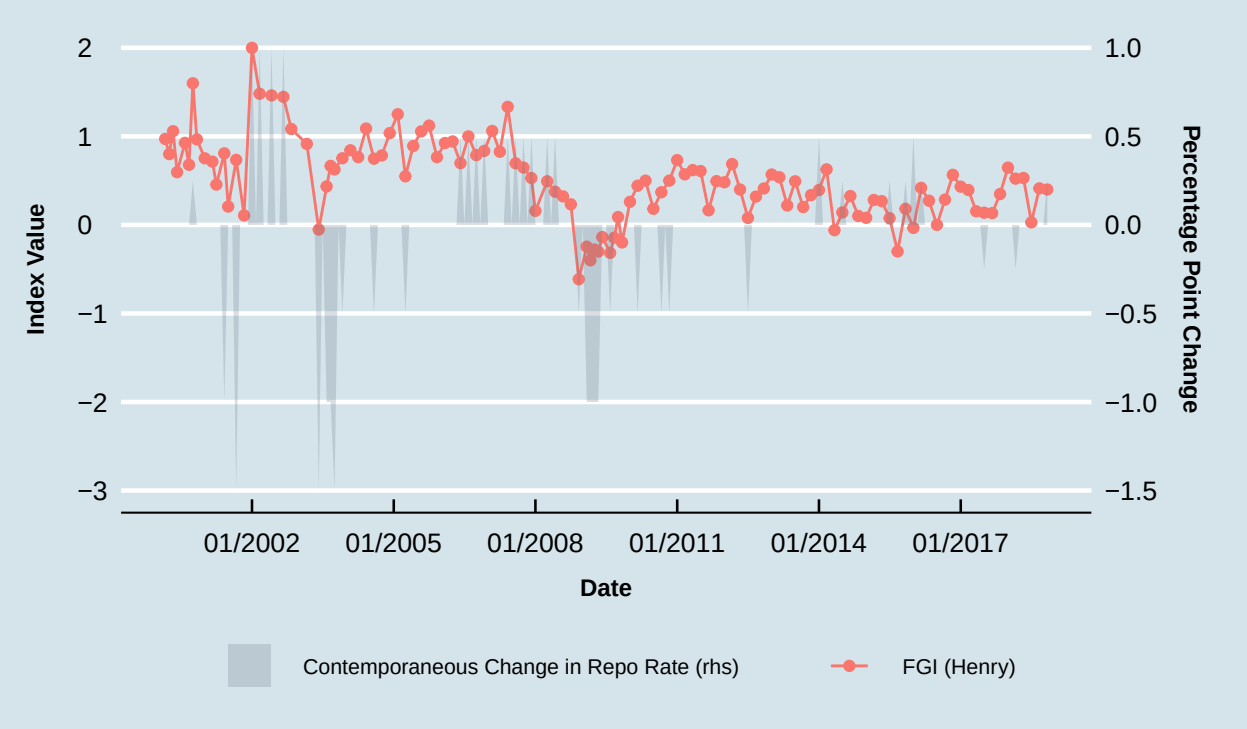

Figure 1: FGI (Henry) for the Period of 03/2000 to 11/2018

In Figure 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 (an implicit anti-inflation bias). 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.

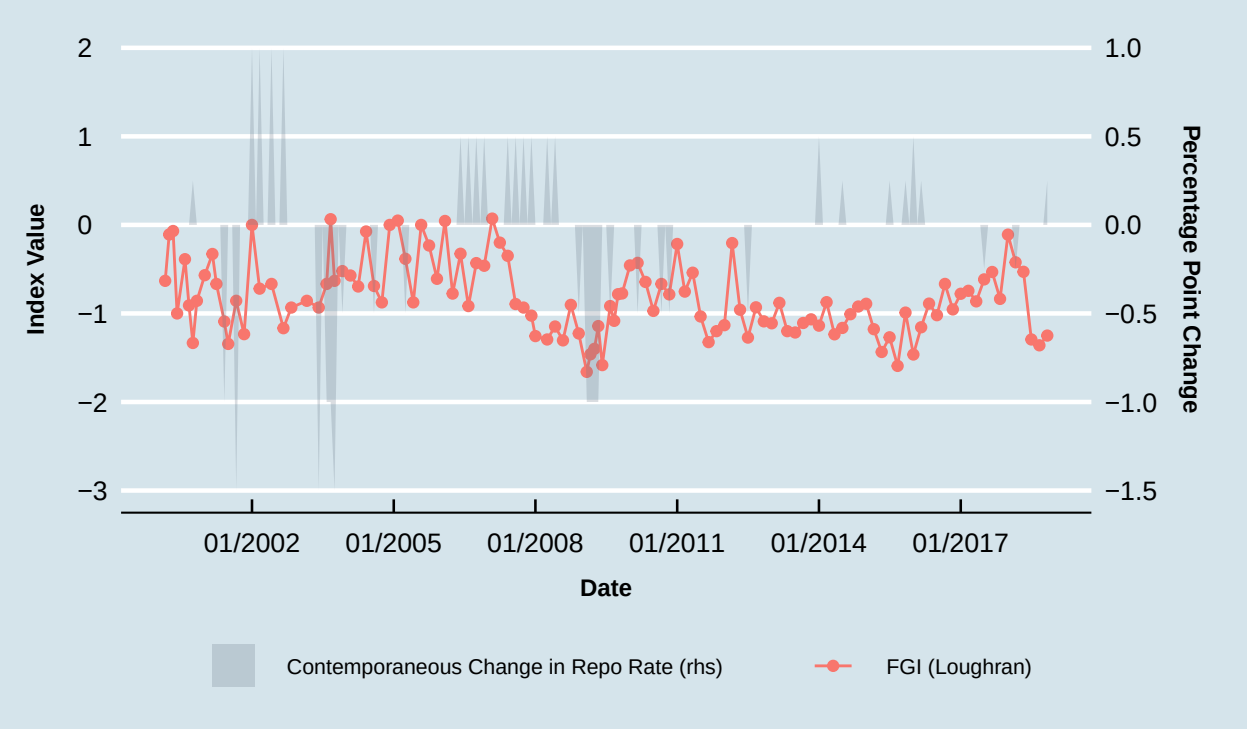

Figure 2: FGI (Loughran)for the Period of 03/2000 to 11/2018

It is evident from Figure 2 that FGI (Loughran) exhibits a rather weak association with changes in the repo rate, which suggests that the FGI cannot predict future repo rate changes. In Figure 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, can 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 containing 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.

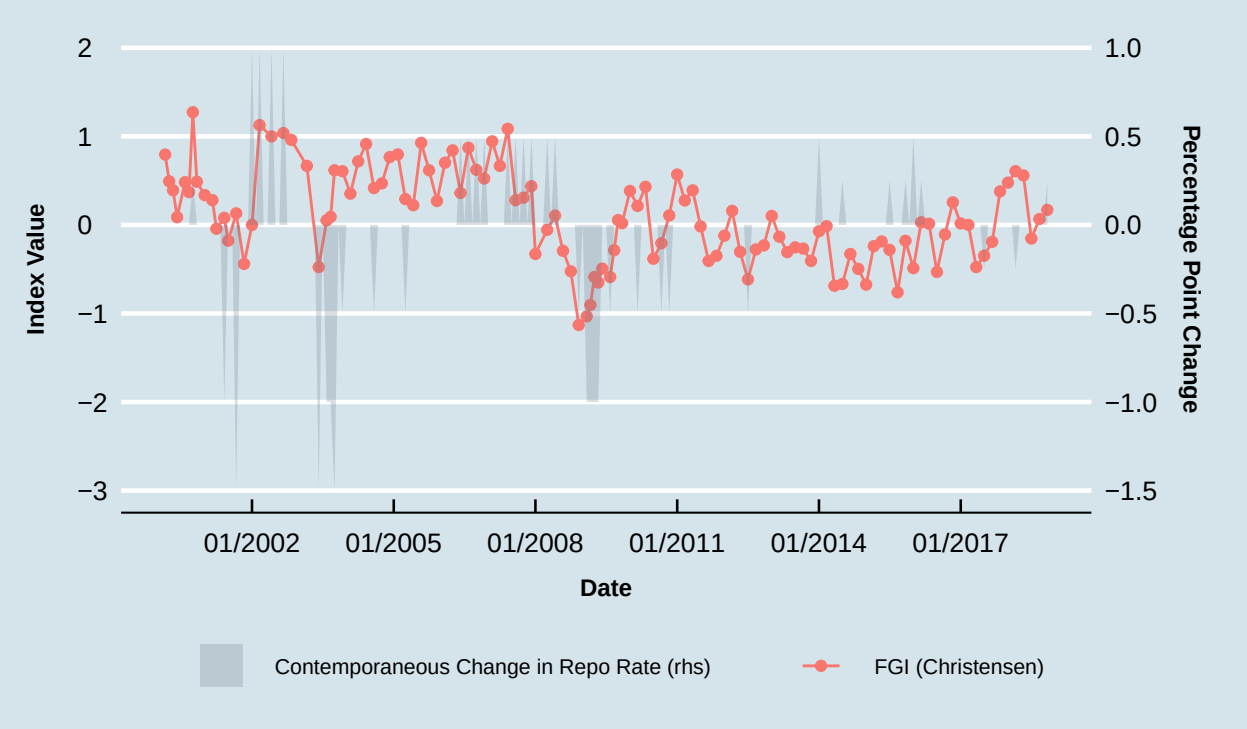

Figure 3: FGI (Christensen) for the Period of 03/2000 to 11/2018

In Figure 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.

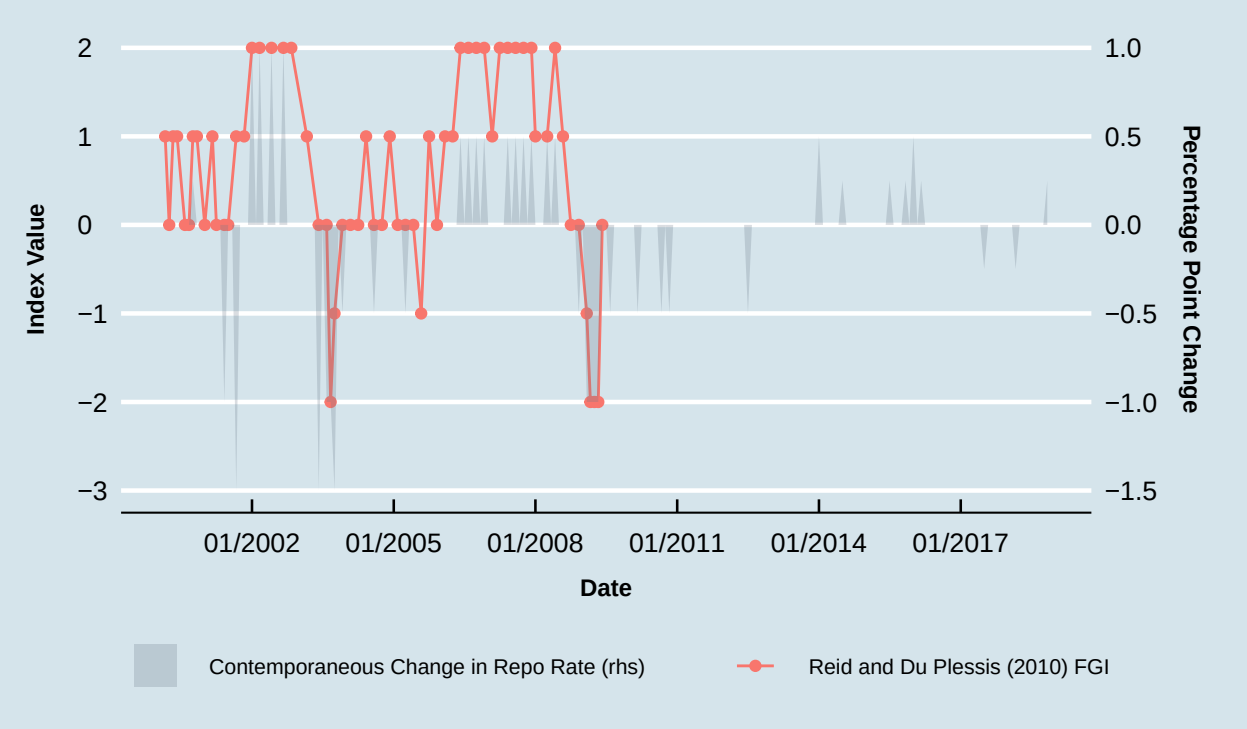

Figure 4: Reid and Du Plessis (2010) FGI for the Period of 03/2000 to 11/2018

It is noticeable from Figure 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 wholes. In contrast, the algorithm underlying the preceding FGIs cannot perform this process with the same accuracy.

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 do not specify, a priori, a specific lag/lead, but 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 1 and Table 2, respectively.

Table 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.

It is evident from Table 1 that all the FGIs, except FGI (Loughran), display moderate correlations 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 2: Correlation Between FGIs and Changes in the Repo Rate at Various Horizons

FGI	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m=1$	$m=2$	$m=3$	$m=4$	$m=5$	$m=6$
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.

It is evident from Table 2 that FGI (Henry) and FGI (Christensen) display lower correlations 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 $m = 4$, and decrease thereafter. In addition, we find that the correlations are overall stable for both the level of and the changes in the repo rate. That said, the correlation of the FGIs are generally weaker, with the exception being that of Reid and Du Plessis (2010).[14]

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.

[14]The 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).

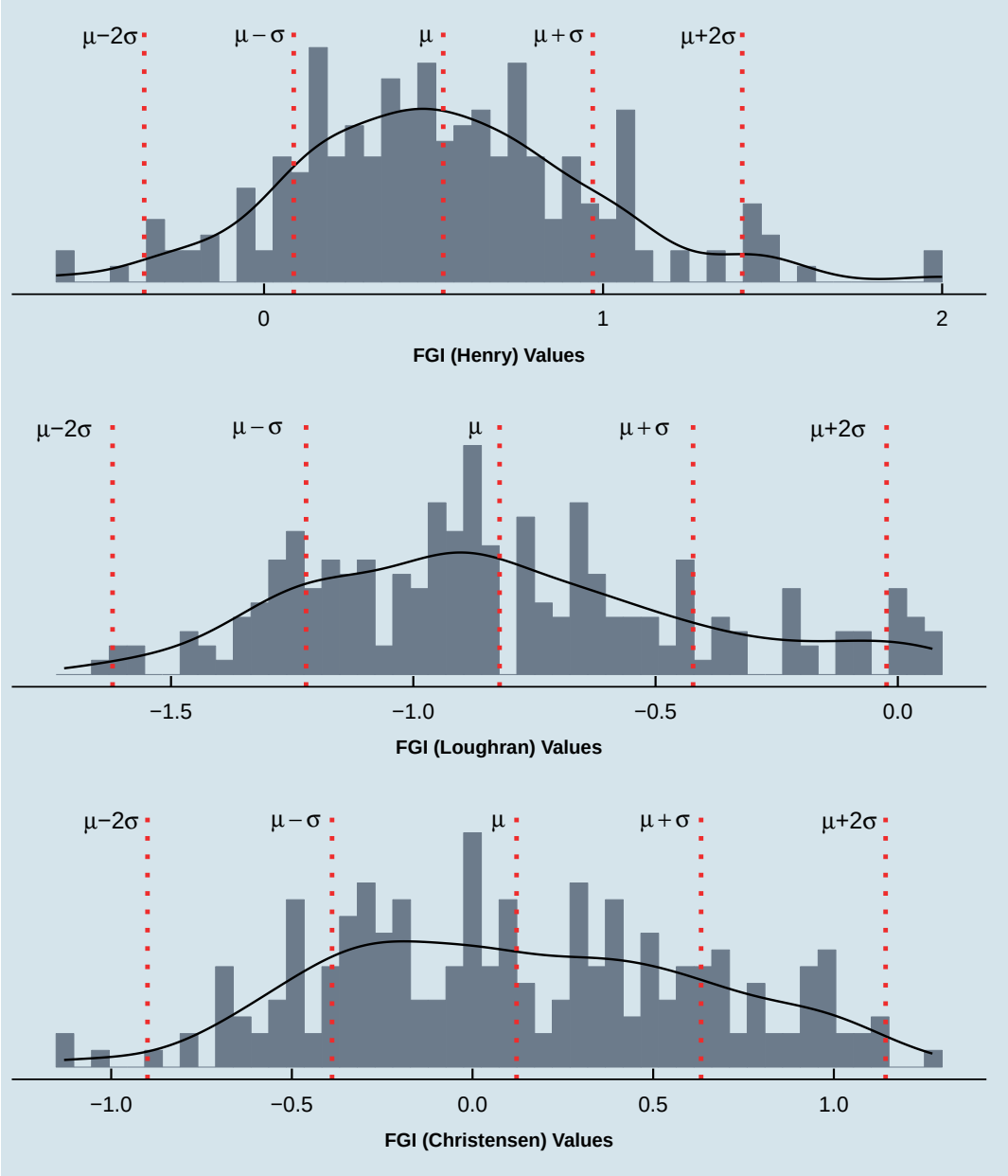

Figure 5: The Distribution of Index Values for FGI (Henry), FGI (Loughran), and FGI (Christensen).

3.2. Regression Analysis

In the preceding section, our informal analysis indicated that the FGIs display association with the future level of the repo rate and future changes in the repo rate. In turn, this suggests that the FGIs can predict the repo rate. And if the FGIs can predict future policy rate changes, they should be driven by macroeconomic fundamentals relevant to the SARB's mandate. In this section, we therefore use standard OLS regression analysis to investigate, first, the predictive power of the

FGIs, and, second, its information capacity regarding macroeconomic fundamentals. We omit the FGI (Loughran) from the following analyses owing to its poor performance.[15]

A range of economic variables are used in our empirical analysis. The relevant variables are tabulated in Table 3, together with their respective definitions and sources. The rationale for using the respective variables are deferred to the relevant applications. 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.

Table 3: 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 expectations 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 made since CPIX was discontinued in 2008.	Quarterly	SARB/BER
Business Confidence (BCI)	BER South Africa composite business confidence index. Target participants: 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 participants: households. Sample size: 2500 individuals.	Quarterly	Bloomberg

[15]The regression results for FGI (Loughran) are available upon request.

Table 3 (Continued)

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
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
Inflation			
Headline	The consumer price index (CPI) is 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

3.2.1. Application 1: Ability of the FGI to Predict Policy Rate Changes

The first application explores the ability of the FGI to predict 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.[16] 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:

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

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 ($09/2001 = 1$; $0 \quad elsewhere$), and ϵ_t is the error term.

The results associated with the regression in Eq. 2 for the horizons $m = 1, \ldots, 6$ (that is, the change in the repo rate between time t and $t + m$) are presented for the two retained dictionaries in Table 4 and Table 5, respectively. Here, 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.

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

Table 4: Results for Application 1 (Henry Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.14^{***}	0.31^{***}	0.40^{***}	0.48^{***}	0.53^{***}	0.50^{***}
	(0.05)	(0.07)	(0.09)	(0.11)	(0.12)	(0.14)
DomExp	0.12^{***}	0.25^{***}	0.41^{***}	0.58^{***}	0.73^{***}	0.87^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
TechDum	-0.01	-0.02	-0.01	1.00	1.01	2.05^{**}
	(0.30)	(0.43)	(0.57)	(0.69)	(0.80)	(0.90)
Constant	-0.12^{***}	-0.25^{***}	-0.35^{***}	-0.44^{***}	-0.52^{***}	-0.55^{***}
	(0.03)	(0.04)	(0.06)	(0.07)	(0.08)	(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: Authors' calculations.

Table 5: Results for Application 1 (Christensen Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.10**	0.21***	0.30***	0.35***	0.36***	0.35***
	(0.04)	(0.06)	(0.08)	(0.09)	(0.11)	(0.12)
DomExp	0.13***	0.27***	0.43***	0.59***	0.75***	0.89***
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
TechDum	0.02	0.04	0.07	1.09	1.12	2.15**
	(0.30)	(0.44)	(0.57)	(0.70)	(0.81)	(0.91)
Constant	−0.05**	−0.11***	−0.17***	−0.23***	−0.28***	−0.33***
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(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: Authors' calculations.

It is evident from Table 4 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 percentage point (pp) increase in the repo rate within the next two months and a 0.5 pp increase within the next 6 months. Although the size of the FGI coefficent 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 increases with the length of the horizon. The estimates suggest that a 1 pp increase in domestic market expectations of future short-term interest rates will be associated with a 0.25 pp and 0.87 pp 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, 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 those 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 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 markets' expectations of future short-term interest rates.

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

The second application entails regressing the FGIs on macroeconomic variables that are linked to 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 – 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:

$$FGI_t = \alpha + \beta_1 BCI_t + \beta_2 CCI_t + \beta_3 InflExp_t + \beta_4 IntExp_t + \beta_5 FinDum_t + \epsilon_t, \qquad (3)$$

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

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 6) 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 6: Results for Application 2

Variable	**Model**	
	Henry FGI	Christensen FGI
Business Confidence	0.02***	0.02***
	(0.00)	(0.00)
Consumer Confidence	−0.00	0.01***
	(0.00)	(0.00)
Inflation Expectations	0.12***	0.17***
	(0.03)	(0.03)
US Short-Term Interest Rate Expectations	0.11	0.19*
	(0.09)	(0.10)
Financial Crisis Dummy	−0.61***	−0.90***
	(0.14)	(0.16)
Constant	−1.21***	−1.88***
	(0.20)	(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: Authors' calculations.

Table 6 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 pp 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 the financial crisis dummy variable is significant and substantial in size for both FGIs. The 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 have 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.

Overall, it is clear that the FGIs exhibit some correlation with changes in the repo rate for horizons up to six months. Moreover, we find that a unit change (approximately 2 standard deviations) in our FGIs predicts 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 targeting 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 3.1 and Section 3.2, 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 might produce more fruitful results compared to the libraries employed in this paper.

4. 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 to 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 strongly to macroeconomic conditions – which indirectly determines the FGI – that are *highly* favourable (unfavourable) compared to *less* favourable (unfavourable) conditions. 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 FGIs are ordinal or cardinal in nature, which involves creating a dummy variable for each index value and testing their joint equality. Finally, we allow for different regimes under which the SARB may have explicitly targeted different points within the inflation target band of 3% to 6%.

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

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

$$(Repo_{t+m} - Repo_t) = \alpha + \beta_1 FGI_t + \beta_2 FGI_t^2 + \beta_3 DomExp_t + \beta_4 TechDum_t + \epsilon_t, \qquad (4)$$

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 ($09/2001 = 1\ ;\ 0 \quad elsewhere$), and ϵ_t is the error term.

The results associated with the regression in Eq. 4 are presented in Table 7 and Table 8.

Table 7: Results for Application 3 (Henry Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.08	0.25^{*}	0.39^{**}	0.38^{*}	0.27	0.10
	(0.09)	(0.14)	(0.18)	(0.22)	(0.25)	(0.28)
FGI Squared	0.05	0.05	0.01	0.08	0.21	0.32
	(0.07)	(0.10)	(0.13)	(0.15)	(0.18)	(0.20)
DomExp	0.13^{***}	0.26^{***}	0.41^{***}	0.58^{***}	0.74^{***}	0.89^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
TechDum	0.00	-0.01	-0.01	1.01	1.05	2.11^{**}
	(0.30)	(0.43)	(0.57)	(0.69)	(0.80)	(0.90)
Constant	-0.11^{***}	-0.24^{***}	-0.34^{***}	-0.43^{***}	-0.48^{***}	-0.49^{***}
	(0.03)	(0.05)	(0.06)	(0.08)	(0.09)	(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: Authors' calculations.

Table 8: Results for Application 3 (Christensen Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.08*	0.21***	0.28***	0.30***	0.29**	0.23*
	(0.05)	(0.07)	(0.09)	(0.10)	(0.12)	(0.14)
FGI Squared	0.04	0.01	0.08	0.14	0.25	0.41*
	(0.07)	(0.10)	(0.14)	(0.17)	(0.19)	(0.22)
DomExp	0.13***	0.27***	0.43***	0.61***	0.78***	0.93***
	(0.02)	(0.04)	(0.05)	(0.06)	(0.06)	(0.07)
TechDum	0.03	0.05	0.09	1.13	1.19	2.25**
	(0.30)	(0.44)	(0.57)	(0.70)	(0.81)	(0.90)
Constant	−0.06**	−0.12***	−0.19***	−0.27***	−0.35***	−0.43***
	(0.03)	(0.04)	(0.05)	(0.07)	(0.08)	(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: Authors' calculations.

It is evident from Table 7 and Table 8 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 coefficeint 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.

4.2. Robustness Measure 2: Asymmetric Effects in Sentiment

4.2.1. 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 effects of the two components differ significantly:

$$(Repo_{t+m} - Repo_t) = \beta_1 \underbrace{2 \cdot \frac{H_t}{H_t + D_t}}_{\substack{\text{Positive} \\ \text{Component}}} + \beta_2 \underbrace{2 \cdot \frac{D_t}{H_t + D_t}}_{\substack{\text{Negative} \\ \text{Component}}} + \beta_3 DomExp_t + \beta_4 TechDum_t + \epsilon_t, \quad (5)$$

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 ($09/2001 = 1$; $0 \quad elsewhere$), and ϵ_t is the error term.

In contrast to the preceding regressions, a regression constant is not included in Eq. 5 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. 5 are presented in Table 9 and Table 10.

Table 9: Results for Application 4 (Henry Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI Positive Component	0.08^{**}	0.19^{***}	0.23^{***}	0.26^{***}	0.28^{***}	0.23^{**}
	(0.04)	(0.05)	(0.07)	(0.08)	(0.09)	(0.11)
FGI Negative Component.	-0.20^{***}	-0.44^{***}	-0.58^{***}	-0.70^{***}	-0.79^{***}	-0.77^{***}
	(0.06)	(0.08)	(0.11)	(0.13)	(0.16)	(0.18)
DomExp	0.12^{***}	0.25^{***}	0.41^{***}	0.58^{***}	0.73^{***}	0.87^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
TechDum	-0.01	-0.02	-0.01	1.00	1.01	2.05^{**}
	(0.30)	(0.43)	(0.57)	(0.69)	(0.80)	(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: Authors' calculations.

Table 10: Results for Application 4 (Christensen Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI Positive Component	0.07^{*}	0.15^{***}	0.21^{***}	0.23^{**}	0.22^{**}	0.19
	(0.04)	(0.06)	(0.07)	(0.09)	(0.10)	(0.12)
FGI Negative Component	-0.12^{***}	-0.27^{***}	-0.38^{***}	-0.46^{***}	-0.50^{***}	-0.52^{***}
	(0.04)	(0.06)	(0.08)	(0.10)	(0.12)	(0.13)
DomExp	0.13^{***}	0.27^{***}	0.43^{***}	0.59^{***}	0.75^{***}	0.89^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
TechDum	0.02	0.04	0.07	1.09	1.12	2.15^{**}
	(0.30)	(0.44)	(0.57)	(0.70)	(0.81)	(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: Authors' calculations.

We notice from Table 9 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 10 (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 9. 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.

4.2.2. 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:

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

where σ is the standard deviation of the FGI in question (see Figure 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). In contrast, we use the mean (0.1219) for FGI (Christensen) since its values are normally distributed (see Figure 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 markets' expectations of future short-term interest rates. The subsequent regression model is, therefore, specified as follows:

$$\begin{aligned} (Repo_{t+m} - Repo_t) &= \beta_1 D_{-2} + \beta_2 D_{-1} + \beta_3 D_0 + \beta_4 D_1 + \beta_5 D_2 \\ &+ \beta_6 DomExp_t + \beta_7 TechDum_t + \epsilon_t \ , \end{aligned} \tag{6}$$

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 are presented in Table 11 and Table 12.

Table 11: Results for Application 5 (Henry Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
Dummy_{-2}	-0.39^{**}	-1.13^{***}	-1.44^{***}	-1.73^{***}	-1.86^{***}	-1.49^{***}
	(0.18)	(0.25)	(0.33)	(0.40)	(0.46)	(0.53)
Dummy_{-1}	-0.14^{**}	-0.27^{***}	-0.46^{***}	-0.58^{***}	-0.63^{***}	-0.70^{***}
	(0.06)	(0.09)	(0.12)	(0.15)	(0.18)	(0.20)
Dummy_{0}	-0.05^{**}	-0.09^{***}	-0.14^{***}	-0.20^{***}	-0.26^{***}	-0.32^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
Dummy_{1}	0.01	0.02	0.06	0.05	0.05	-0.04
	(0.06)	(0.08)	(0.11)	(0.13)	(0.15)	(0.17)
Dummy_{2}	0.23^{**}	0.46^{***}	0.58^{***}	0.71^{***}	0.83^{***}	0.86^{***}
	(0.09)	(0.13)	(0.16)	(0.20)	(0.23)	(0.26)
DomExp	0.11^{***}	0.22^{***}	0.37^{***}	0.53^{***}	0.68^{***}	0.84^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
TechDum	0.03	0.05	0.08	1.12^{*}	1.16	2.19^{**}
	(0.30)	(0.42)	(0.54)	(0.66)	(0.77)	(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}, Dummy_{0}, Dummy_{1}, and Dummy_{2} are dummy variables for each of the index values.

Source: Authors' calculations.

Table 12: Results for Application 5 (Christensen Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
Dummy_{-2}	-0.48^{***}	-1.22^{***}	-1.61^{***}	-1.71^{***}	-1.70^{***}	-1.45^{***}
	(0.16)	(0.22)	(0.29)	(0.36)	(0.42)	(0.48)
Dummy_{-1}	-0.03	-0.06	-0.14	-0.22^{*}	-0.28^{**}	-0.31^{**}
	(0.05)	(0.07)	(0.10)	(0.12)	(0.14)	(0.15)
Dummy_{0}	-0.06^{**}	-0.11^{***}	-0.17^{***}	-0.23^{***}	-0.29^{***}	-0.36^{***}
	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)	(0.08)
Dummy_{1}	0.06	0.12^{*}	0.19^{**}	0.20^{*}	0.19	0.18
	(0.05)	(0.07)	(0.09)	(0.11)	(0.13)	(0.14)
Dummy_{2}	-0.14	-0.27	-0.44	-0.64	-0.83	-1.02
	(0.30)	(0.42)	(0.55)	(0.68)	(0.79)	(0.89)
DomExp	0.12^{***}	0.23^{***}	0.39^{***}	0.56^{***}	0.73^{***}	0.89^{***}
	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)	(0.08)
TechDum	0.04	0.07	0.11	1.15^{*}	1.18	2.23^{**}
	(0.30)	(0.42)	(0.55)	(0.67)	(0.79)	(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}, Dummy_{0}, Dummy_{1}, and Dummy_{2} are dummy variables for each of the index values.

Source: Authors' calculations.

It is evident from Table 11 (Henry Library) and Table 12 (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 11, 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 11, we notice from Table 12 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 11: 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 12, similar to Table 11, 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 13 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 13: Wald 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: Authors' calculations.

4.3. Robustness Measure 3: SARB Explicitly Targeting Different Points in the Target Band

The third robustness 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 6, we depict both the core and headline inflation rate for the period 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 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.

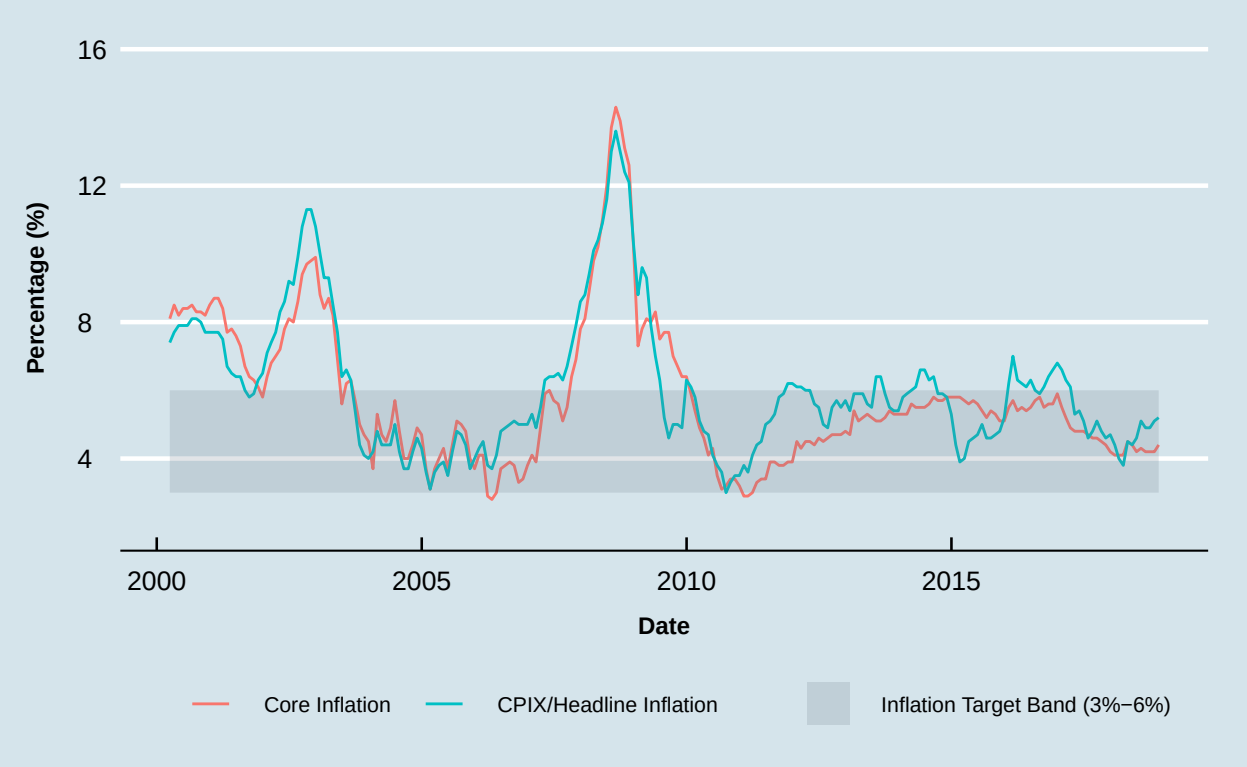

Figure 6: Core- and Headline Inflation for 03/2000 to 11/2018

Figure 6 illustrates that the SARB may have explicitly targeted the mid-point of the inflation target band during the approximate period from 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 were 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:

$$(Repo_{t+m} - Repo_t) = \alpha + \beta_1 FGI_t + \beta_2 DomExp_t + \beta_3 RegDum_t + \beta_4 TechDum_t + \epsilon_t, \qquad (7)$$

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 ($...t... = 1\ ;\ 0 \quad elsewhere$), $TechDum_t$ is the technical dummy variable

$(09/2001 = 1\ ;\ 0 \quad elsewhere)$, and ϵ_t is the error term.

The results associated with the regression in Eq. 7 are presented in Table 14 and Table 15.

Table 14: Results for Application 6 (Henry Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.15^{***}	0.33^{***}	0.42^{***}	0.50^{***}	0.54^{***}	0.49^{***}
	(0.05)	(0.07)	(0.09)	(0.11)	(0.13)	(0.14)
DomExp	0.12^{***}	0.26^{***}	0.42^{***}	0.58^{***}	0.73^{***}	0.87^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
RegDum	-0.03	-0.06	-0.07	-0.05	-0.04	0.04
	(0.05)	(0.07)	(0.09)	(0.11)	(0.13)	(0.15)
TechDum	-0.01	-0.04	-0.03	0.98	1.00	2.06^{**}
	(0.30)	(0.43)	(0.57)	(0.69)	(0.80)	(0.90)
Constant	-0.11^{***}	-0.24^{***}	-0.34^{***}	-0.44^{***}	-0.51^{***}	-0.55^{***}
	(0.03)	(0.05)	(0.06)	(0.07)	(0.09)	(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: Authors' calculations.

Table 15: Results for Application 6 (Christensen Library)

Variable	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
FGI	0.11^{**}	0.24^{***}	0.34^{***}	0.38^{***}	0.39^{***}	0.35^{***}
	(0.04)	(0.06)	(0.08)	(0.10)	(0.12)	(0.13)
DomExp	0.13^{***}	0.27^{***}	0.43^{***}	0.59^{***}	0.75^{***}	0.89^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
RegDum	-0.04	-0.09	-0.12	-0.10	-0.08	0.00
	(0.05)	(0.07)	(0.10)	(0.12)	(0.14)	(0.16)
TechDum	0.01	0.02	0.04	1.07	1.10	2.15^{**}
	(0.30)	(0.44)	(0.57)	(0.70)	(0.81)	(0.91)
Constant	-0.05^{*}	-0.09^{***}	-0.15^{***}	-0.21^{***}	-0.26^{***}	-0.33^{***}
	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(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: Authors' 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 Tables 4 and 5 (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.

In summary, we find there are asymmetries between the positive and negative components 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 3, 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.

5. Conclusion

Globally, the communication efforts of central banks grew considerably during and after the financial crisis of 2008-09. These efforts included the provision of so-called *forward guidance* for monetary policies. 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 committee's 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 empirically tested 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, no academic studies have used semantic-modelling and other text-mining techniques to quantify and evaluate forward guidance in South Africa. 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

and whether the FGI can consistently be explained by factors that are regarded to be leading indicators of macroeconomic performance, 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 useful tools to explain and predict future changes in the repo rate. Furthermore, our results indicate that our FGIs are primarily driven by the average of the inflation expectations of trade union officials, business people, and financial analysts. However, in the event of large movements, business and consumer confidence indices could be important determinants of the FGIs. 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 test for consistency and for apparent non-linearities in the FGIs. Our results indicated that our FGIs do not encompass any increasing/diminishing effects. However, we find evidence of asymmetries when we decompose the FGIs into their negative and positive components, which relate 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	
Publication of interest rate forecasts		
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 *et al.* (2008)		
Gersbach and Hahn (2011)		
Aesopian forward guidance		
—	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	
Publication of interest rate forecasts		
Rudebusch and Williams (2008)	—	Commitment, time-inconsistent
Ferrero and Secchi (2009)		
Laséen and Svensson (2011)		
Odyssean forward guidance		
Krugman (1998), Eggertsson and Woodford (2003), Werning (2011), Levin *et al.* (2010), Campbell *et al.* (2012), Carlstrom *et al.* (2012), Del Negro *et al.* (2012), English *et al.* (2013), Coenen and Warne (2013), Eggertsson and Mehrotra (2014), Da Costa (2014), De Graeve *et al.* (2014), Gavin *et al.* (2014), Haberis*et al.* (2014), Florez-Jimenez and Parra-Polnaia (2014), Kiley (2014), McKay *et al.* (2015), Harrison (2015), Boneva *et al.* (2015), and Gersbach *et al.* (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: Authors' 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
buttleneck	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
heathing 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 are based on the sample of 03/2000 to 06/2009, whereas the other results are based on the sample from 03/2000 to 11/2018.

Source: Authors' calculations.

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

FGI	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
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 are based on the sample of 03/2000 to 06/2009, whereas the other results are based on the sample from 03/2000 to 11/2018.

Source: Authors' 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: Authors' calculations.

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

FGI	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
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: Authors' 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: Authors' calculations.

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

FGI	$\mathbf{Repo_{t+m} - Repo_t}$					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
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: Authors' calculations.

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