A forward guidance indicator for the South African Reserve Bank:

Implementing a text analysis algorithm

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Evolution of Central Bank communication

Four major shifts over the past few decades

1. From opacity to transparency
2. From surprising markets to explaining actions
3. Emphasis on public trust and engagement

} credibility & accountability

4. The explicit use of communication as a policy tool (**forward guidance**)

Forward guidance

- Forward guidance is now an instrument of monetary policy
  - **quantitative** vs. **qualitative**[1]
- Forward guidance is and will remain about prediction, not commitment
  - **Odyssean** (explicit/commitment) vs. **Delphic** (implied/less-binding)

[1] Most studies focus on central banks that practice qualitative forward guidance: Gürkaynak, Sack, and Swanson (2005); Campbell et al. (2012); Moessner (2013); Swanson and Williams (2014); and Swanson (2015; 2017).

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- Forward guidance is and will remain about prediction, not commitment
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- A **forward guidance indicator** (FGI) is based on the idea that communication on the stance of monetary policy can be translated into a sentiment index
  - Identify the direction and magnitude in which they intend to influence markets (inflation expectations/interest rates)
  - Evaluate how consistent and effective the central bank has communicated its monetary policy

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Forward Guidance Indicators: FGI (Reid and Du Plessis)

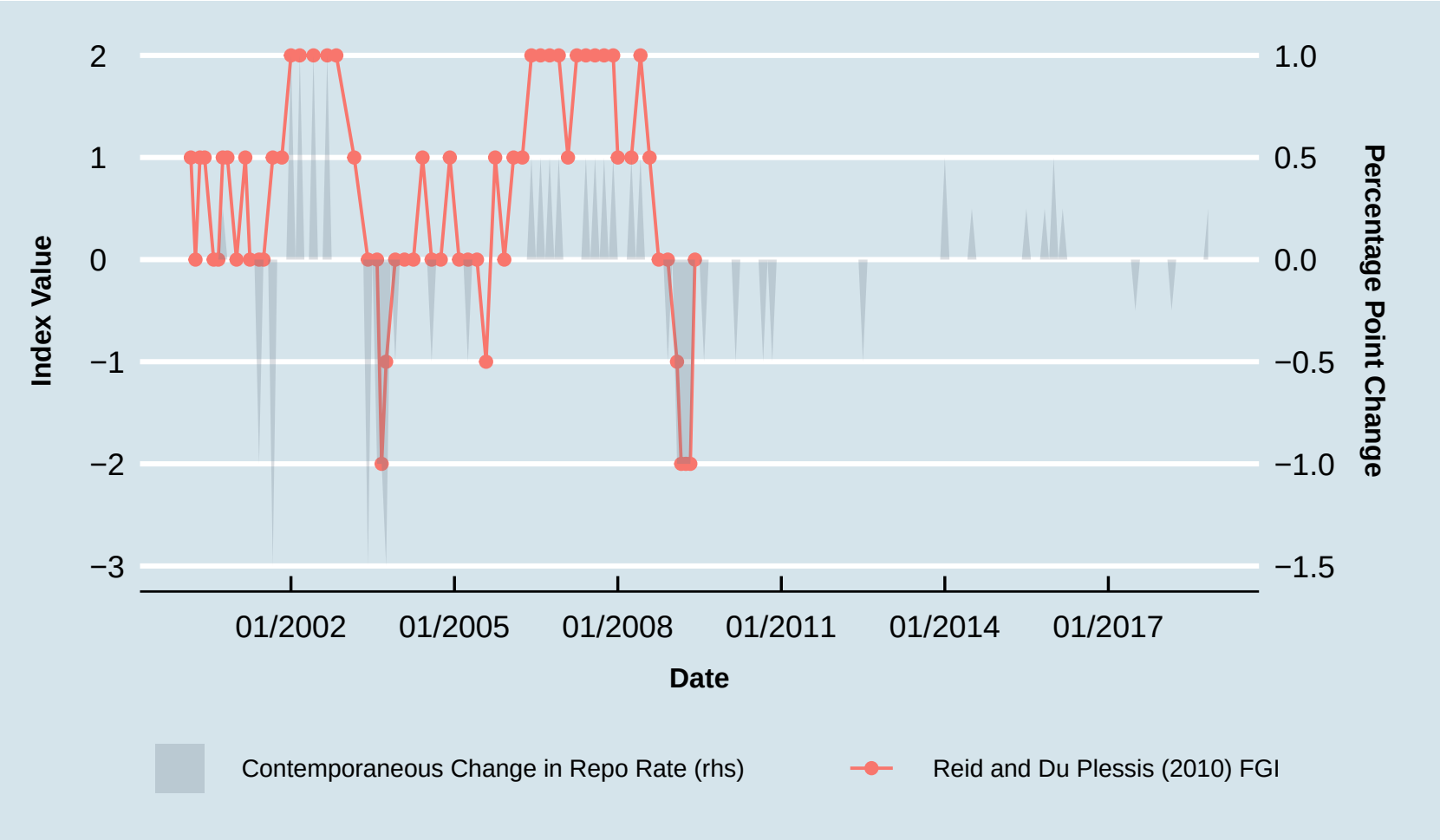


Figure: FGI of Reid and Du Plessis (2010) for the Period of 01/2000 to 06/2009

Key Aims

- Construct FGIs from the hawkish/neutral/dovish tone of SARB MPC statements using a text-mining technique
- Determine whether FGIs have predictive power for future changes in the repo rate
- Determine whether FGIs respond systematically to macro-fundamentals

Main findings I

- FGIs provide significant explanatory power for future changes in the repurchase interest rate (the primary monetary policy instrument)
- FGIs are primarily driven by the average of the inflation expectations of trade union officials, business people, and financial analysts

  $\Rightarrow$ highlights the strong link between the SARB's communication strategy and its inflation mandate
- Business and consumer confidence indices can be important determinants of the FGIs
- The selection of the dictionary/lexicon used to analyse the text and construct the index matters.

Main findings II

- We find evidence of asymmetries when we decompose the FGIs into their negative and positive components
- We find that FGIs can be either cardinal in nature or ordinal in nature.
- We observe a systematic anti-inflation bias in the communicated stance of monetary policy—both absolutely and asymmetrically.
- Out-of-sample forecasts show that FGIs have weak predictive power.

  Our overall interpretation of the findings is that MPC statements reflect relevant information on the current inflationary stance and policy decisions of the SARB, but, since forecasts are conditional on current information, they provide unreliable forward guidance (i.e., information on the future path of the policy rate)
- Given this finding, MPC statements should emphasize the conditional nature of the SARB's stance, and what this conditionality implies for the future path of the policy rate.

Text-mining and Central Bank communication

Quantifying the sentiment (dovish/hawkish) of central bank communication:

- Manual coding dovish/neutral/hawkish (e.g. Jansen and De Haan (2005); Rosa and Verga (2007); **Reid and Du Plessis (2010)**; Berger, De Haan and Sturm (2011))
- **Bag of Words/Dictionary** (e.g. Heinemann and Ulrich (2007); Apel and Blix Grimaldi (2012); Christensen and Rising (2017))[2]
- Supervised machine learning
  - Support vector machines (e.g., Tobback, Nardelli, and Martens (2017); **Coco and Viegi (2019)**)
  - Semantic orientation/Naïve Bayes (e.g., Moniz and de Jong (2014))

[2]Method can be extended to include phrases (Word Associations/n-grams), which account for word order and grammar, and to some degree, context.

- We adopt a "dictionary" ("bag-of-words") approach.
  - 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).
- Advantages compared to manual classification:
  1. Largely overcomes the subjectivity associated with the manual classification of statements
  2. Not reliant on real-time classification
- Disadvantages:
  1. Words in the dictionary are selected by the researcher, which imposes an element of subjectivity on the data;
  2. Dictionary approach does not explicitly account for context, since it purely matches words in the library (i.e., sentiment vectors)
  3. Presence of certain redundant words or the absence of keywords can heavily distort the FGI

Data

Text Data

- SARB statements published after each MPC meeting ($\approx$ 8-9 weeks)
- IT regime: 02/03/2000 to 22/11/2018
- Assume the content of the text persists until new information arrives.

Economic Data

1. Repo rate (monthly)
2. Inflation expectations (quarterly)
3. Business/Consumer confidence (quarterly)
4. ICE USD LIBOR (3m) (monthly)
5. US Interest Rate Swap (1y) (monthly)
6. SA Interest Rate Swap (2y) (monthly)
7. Inflation rate (monthly y-o-y)

- Quarterly frequency data held constant pending new information.

Methodology

- Two preliminary steps required in text mining procedure
  1. Dissect the MPC documents into "tokens" – representing the text of each document in the corpus as a list of numbers, symbols, signs, words, and phrases.
  2. Reduce the dimensionality of the list of tokens:
     - Removing all punctuation, special characters, and rare words
     - Removing stopwords such as articles and prepositions e.g., "it", "the", and "a"
     - Case folding: converting all alphabetic tokens to lowercase

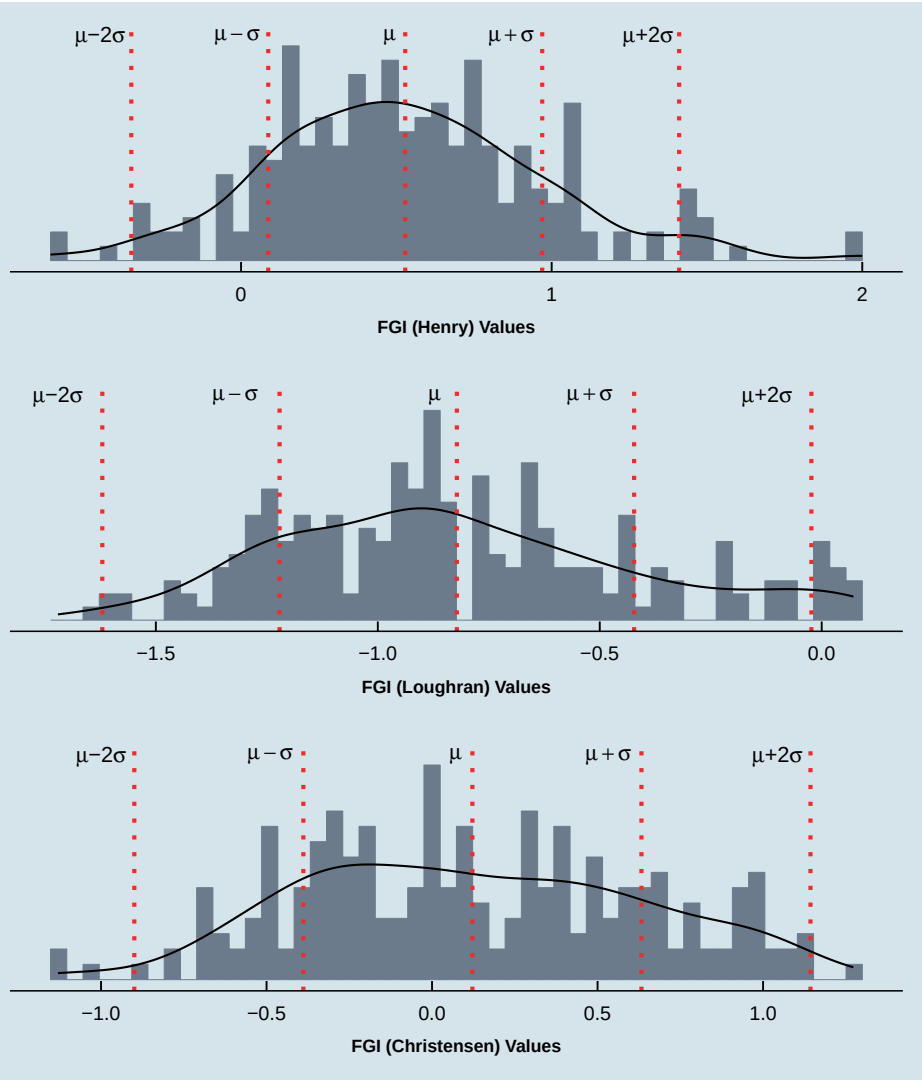
Methodology

- We test three different pre-existing lexicons to derive the sentiment from our list of tokens, namely:
  1. Henry (Henry 2008)
  2. Loughran (Loughran and McDonald 2011)
  3. Christensen (Christensen and Rising 2017)

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

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.

Forward Guidance Indicators: Distribution of Values



negative (85), positive (105)

negative (2355), positive (354)

negative (108), positive (87)

Figure: FGI (Henry), FGI (Loughran), and FGI (Christensen)

Forward Guidance Indicators: FGI (Henry)

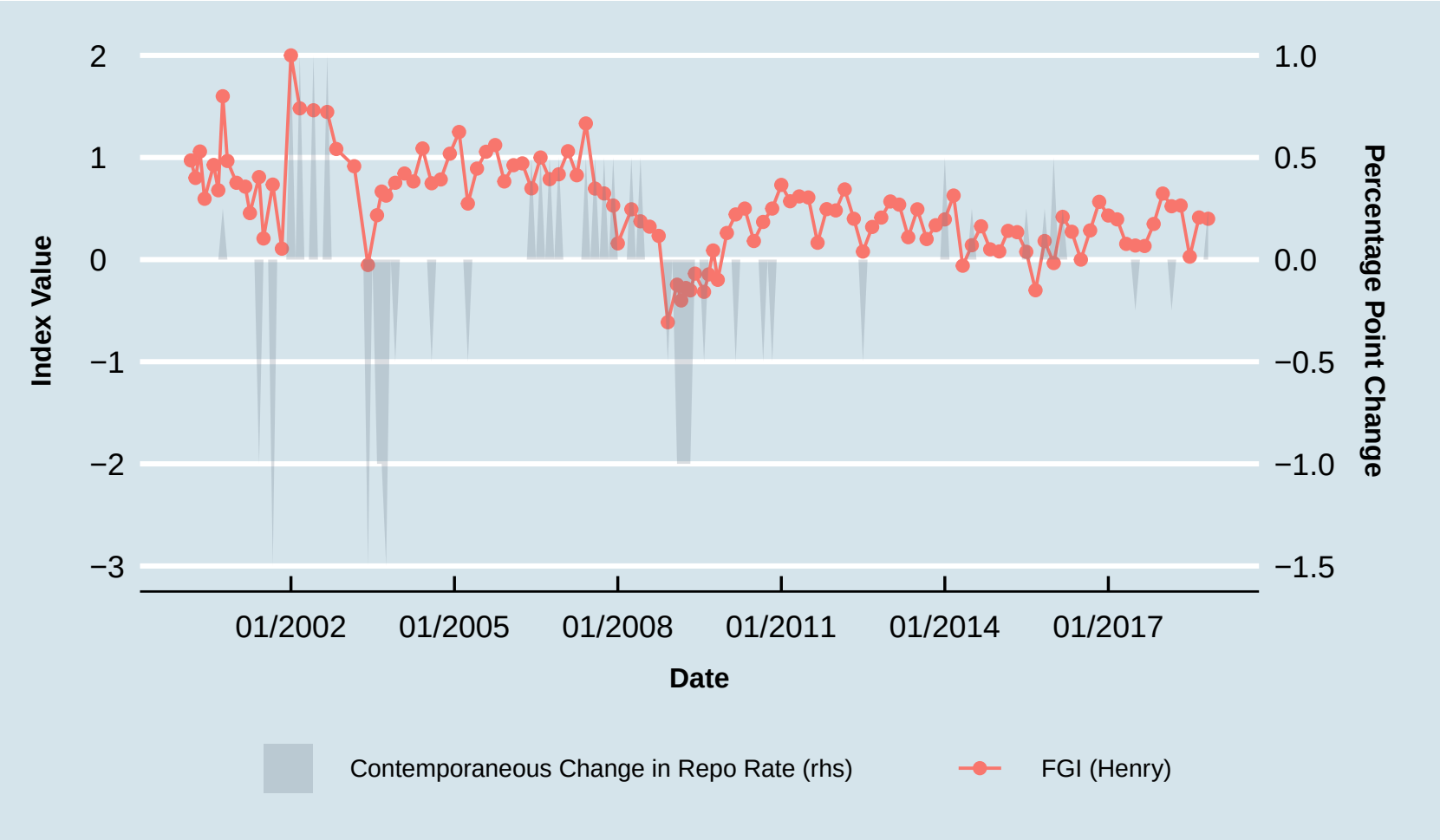


Figure: FGI (Henry) for the Period of 03/2000 to 11/2018

Forward Guidance Indicators: FGI (Loughran)

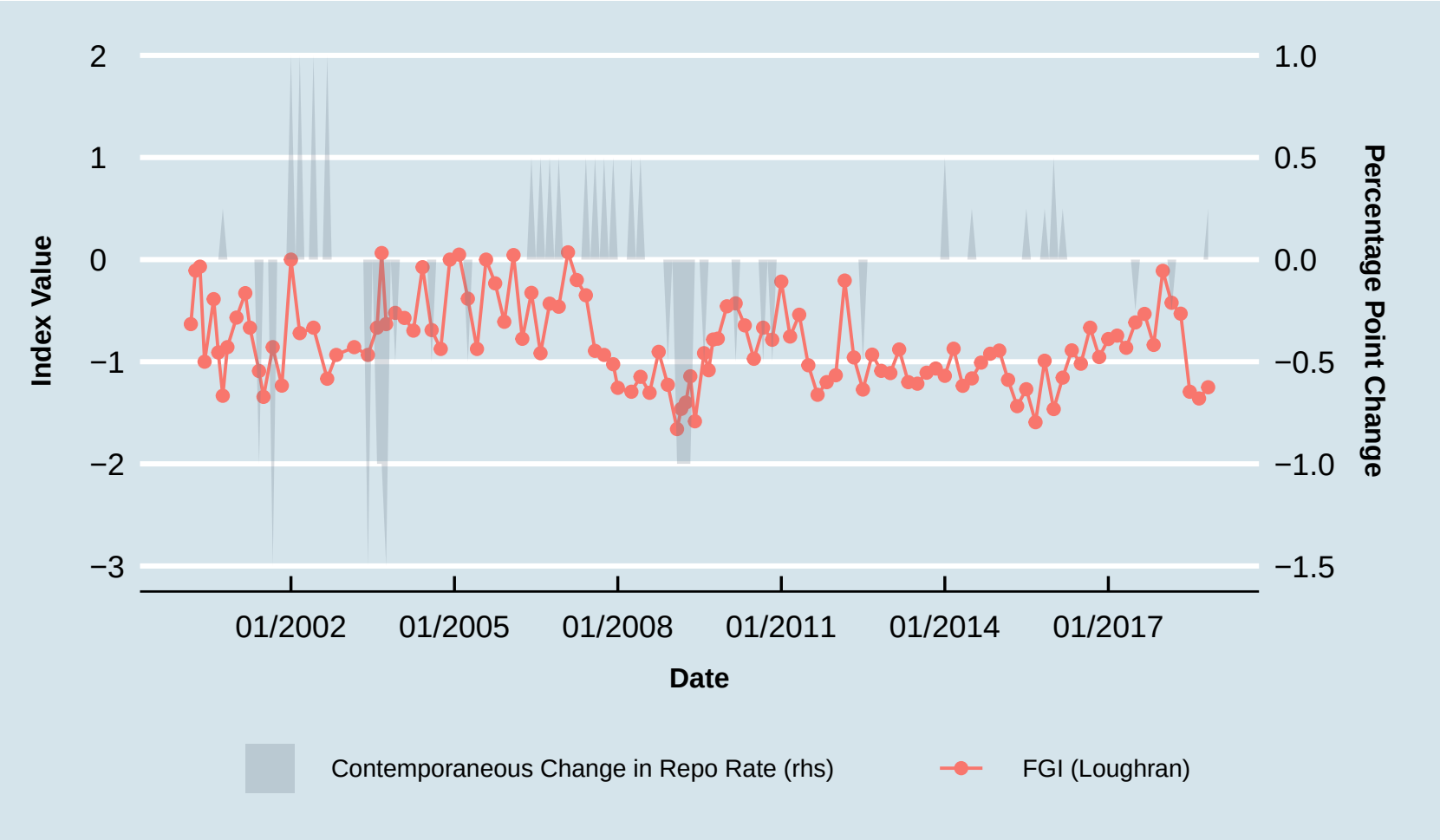


Figure: FGI (Loughran) for the Period of 03/2000 to 11/2018

Forward Guidance Indicators: FGI (Christensen)

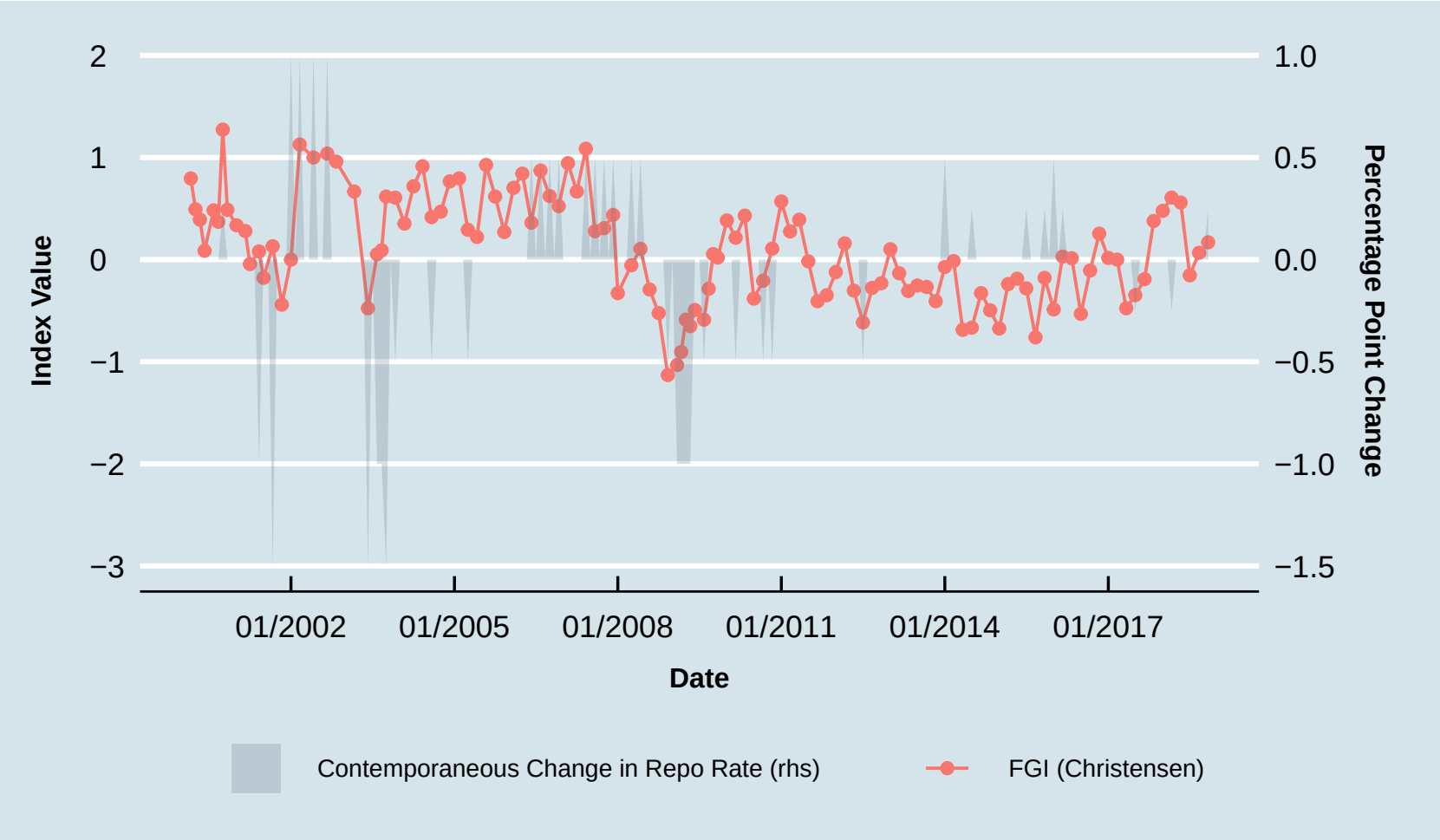


Figure: FGI (Christensen) for the Period of 03/2000 to 11/2018

Results

Table: 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

Table: 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

Results: Application 1

Application 1: Predictability of FGI on Policy Rate Changes

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

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 *elsewhere*), and ϵ_t is the error term.

Results: Application 1

Table: Application 1 (Henry)

Variable	**$Repo_{t+m} - Repo_t$**					
	$m = 1$	$m = 2$	$m = 3$	$m = 4$	$m = 5$	$m = 6$
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.

Results: Application 2

Application 2: Systematic Response of FGI to Economic Variables

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

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.

Results: Application 2

Table: 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: Application 3

Application 3: Nature of the FGI (Non-linearities)

$$\begin{aligned}(Repo_{t+m} - Repo_t) &= \beta_1 D_{-2} + \beta_2 D_{-1} + \beta_3 D_0 + \beta_4 D_1 + \beta_5 D_2 \\ &+ \beta_6 DomExp_t + \beta_7 TechDum_t + \epsilon_t \ , \end{aligned} \tag{4}$$

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.

Wald Test Null Hypothesis (Ordinal vs. Cardinal)

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

Results: Application 3

Table: 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^{**}	-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.

Results: Application 3 (contd)

Table: 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	Not reject	Not Reject	Not reject	Not reject	Not reject	Not reject
Christensen	Not reject	Reject	Reject	Reject	Reject	Reject

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

Concluding Remarks

- FGIs, whilst controlling for domestic market's expectations of future short-term interest rates, represent a **useful tool to explain and predict future changes in the repo rate**.
- FGIs are primarily **driven by inflation expectations** (an average of trade union officials, business people, and financial analysts).
- **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.
- **Non-linearities are lexicon-dependent**, but clear **anti-inflation bias from the SARB**
- Strong exogenous component during the financial crisis (Coco & Viegi, 2019), but **FGIs are robust to regime changes within IT** (not shown)
- Would a sentiment library tailored for South Africa be beneficial?

Questions?

Thank You!

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