

Sentiment Comparison of Monetary Policy Releases from Inflation Targeting Regimes

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Introduction, Research Inquiries and Preview of Results

Conduction of monetary policy has changed over the last decade

- Monetary Policy rate as main instrument
- Forward guidance, balance sheet policies, etc have been added as new instruments
- Communication and transparency complement these tools, recently it started as being used as a tool by itself

- Do information sentiments in central bank press releases help guide policy expectations?
- What kind of relationships, if any, do central bank policy statements have?

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- What kind of relationships, if any, do central bank policy statements have?
- We answer these questions by analyzing the monetary policy statements of a group of inflation targeting countries.
 - Structure, length
 - Reading Difficulty
 - Sentiment/Bias and predictability

Preview of Results

- Structure
 - Press releases have similar structure: Sentence length, word length
 - Press releases length is slowly converging
- Reading Difficulty
 - Most press releases require at least some degree of college education to be able to understand them
- Sentiment/Bias and predictability
 - Press releases give enough information to anticipate movements in their MPRs
 - They tend to move together, with periods where the comovement is stronger

- Analyzing Central Bank Communication
 - Hansen and McMahon (2016, 2017), Nardelli, et al. (2017), Lee, et al. (2018), Kawamura et al. (2019)
 - There are only a handful of studies of monetary policy communication from a multi-country perspective. Among them: Armelius et al (2019), Benchimol (2019)
- Examining the Impact of Central Bank Communication
 - Tetlock, et al. (2008), Henry and Madeley (2010), Rosa (2011), Gonzalez and Tadler (2020)

Scope of the Study

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1. We analyze the monetary policy press releases for a group of IT countries
 - Adopted IT by Jan-2005
 - Publish press releases at least by 2009
 - Press releases are published/translated in English
 - In total we study the monetary statements of 18 countries
2. Using linguistic techniques
 - Length of documents, sentences and words
 - Various reading difficulty measures
 - Latent Dirichlet Allocation (LDA)
 - Text Scoring algorithms and Sentiment Analysis
 - Statistical analysis (Cross correlograms, PCA)

Scope of the Study: Included Countries

Country	Year adopted inflation targeting	Press release available in.... since		Informative since
		Native	English	
Australia	Jun-93	Jan-90	Jan-90	Nov-07
Brazil	Jun-99	Mar-06	Mar-06	Apr-11
Canada	Feb-91	Jun-97	Jun-97	Jan-01
Chile	Sep-99	Sep-97	Sep-97	Jan-00
Hungary	Jun-01	Dec-01	Jan-03	Dec-01
Iceland	Mar-01	Mar-01	Mar-02	Jan-09
Indonesia	Jul-05	Aug-05	Aug-05	Aug-05
Israel	Jun-97	Nov-97	Jun-99	Nov-97
New Zealand	Dec-89	Jan-06	Jan-06	Jan-06
Norway	Mar-01	Jan-99	Jan-99	Oct-03
Peru	Jan-02	Jan-02	Jan-02	Jan-02
Philippines	Jan-02	-	Dec-01	Dec-01
Poland	Jun-05	Feb-98	Jan-01	Jul-98
Romania	Aug-05	Jul-05	Jul-05	Jul-05
South Africa	Feb-00	Jan-00	Jan-00	Jan-00
South Korea	Apr-98	Jan-99	Dec-99	Jan-99
Sweden	Jan-93	Jan-96	Jan-96	Nov-98
Thailand	May-00	Apr-00	Sep-00	Jul-00

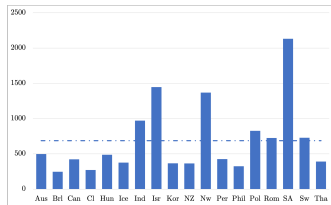
Linguistic Analysis: Structure and Reading Difficulty

Use of simple measures gives important information regarding the structure of press releases

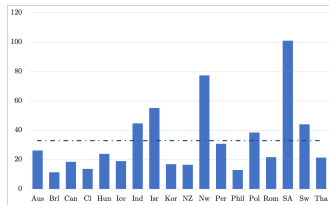
- Length of press releases
 - Number of words
 - Number of sentences
- Words per sentence
- Word length (measured in syllables)

Results: Structure Full Sample

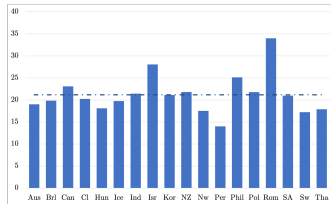
Total Words



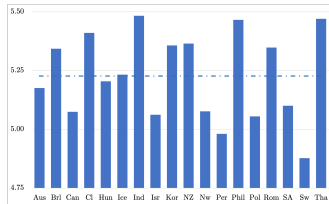
Number of Sentences



Words per Sentence

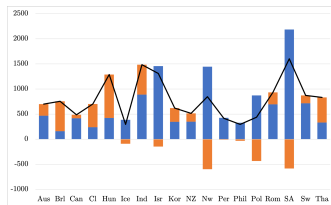


Word Length

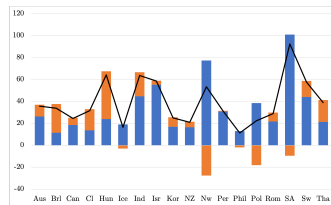


Results: Structure 2018-2019

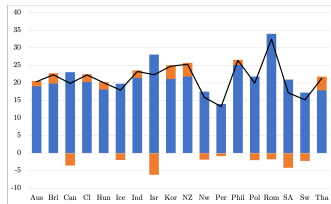
Total Words



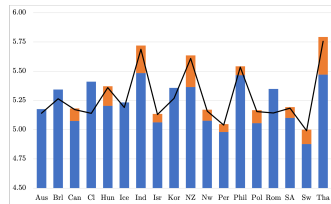
Number of Sentences



Words per Sentence



Word Length



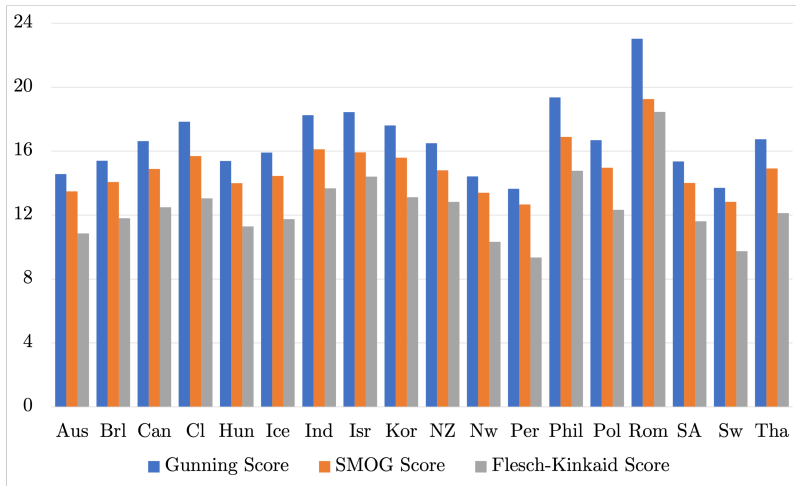
Beginning-Dec-17 2018-2019 change 2018-2019 level

Linguistic Analysis: Reading Difficulty

We calculate reading difficulty of indexes that measures the number of years in education required to read the statements

- **Gunning Score:** function of the ratio of complex words to the total number of words and the average size of sentences
- **SMOG Score:** function of the ratio of complex words to the total number of sentences
- **Flesch Score:** function of the average size of sentences and the average size of words

Results: Reading Difficulty



Linguistic Analysis: Sentiment Analysis

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Aim: measure the policy bias or sentiment of press releases

- Monetary policy press releases explain the context of monetary policy decision
- Bias is how contractionary/expansionary are the messages in the press releases
- We look to infer the policy response to the information given in the press releases

Dictionary Method: analyze press releases scoring each sentence with 1 for contractionary sentences, -1 for expansionary sentences or 0 for neutral sentences

$$SS_t = \sum_{i=1}^N \frac{\text{sentence score}_i}{N}$$

Sentiment Analysis: Example

Sentence Example 1

'**global** economic **growth** continues to **improve**'

- Source: Reserve Bank of New Zealand's February 8, 2018 Policy Statement
- Bias: Contractionary
- Sentence Score: +1

Sentence Example 2

'but the near-term **outlook** for the **global economy** is the **weakest** for many years'

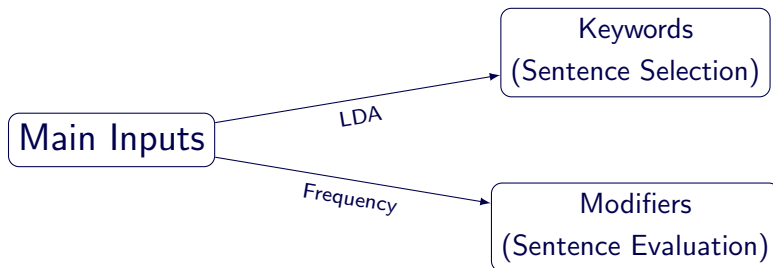
- Source: Reserve Bank of Australia's February 3, 2009 Policy Statement
- Policy Bias: Expansionary
- Sentence score: -1

Linguistic Analysis: Sentiment Analysis

Aim: measure the bias or sentiment of press releases

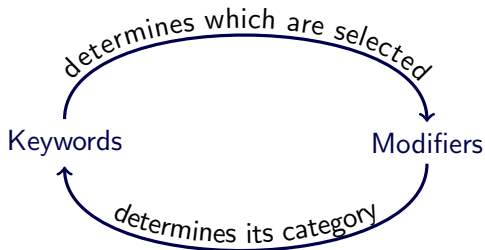
Dictionary Method: analyze press releases scoring each sentence with 1 for contractionary sentences, -1 for expansionary sentences or 0 for neutral sentences

- We look for the presence of most representative words of the press releases



Dictionary Method Procedure

The selection of keywords and modifiers is not independent from one another



Dictionary Method Procedure: Words Selection

- **Keywords** Chosen using Latent Dirichlet Allocation (LDA)
 - Introduced in Blei (2003)
 - It assumes that texts are formed by a distribution of unobserved topics and each topic is formed by a distribution of words
 - LDA produces groups of words that belong together in a topic
- **Modifiers** Chosen using Frequency Analysis
 - Modifiers determine whether a sentence is contractionary, expansionary or neutral
 - We combine all press releases together and keep those that:
 - are nouns, verbs, or adjectives
 - appear more than 10 times
 - have significant meaning when combined with the keywords

- Keywords Classification:
 1. Leaning towards contractionary (expansionary) policy with positive (negative) modifiers: hawkish key
 2. Leaning towards expansionary (contractionary) policy with positive (negative) modifiers: dovish key

Dictionary Method Procedure: Example

Sentence Example 1

'global economic growth continues to improve'
hawkish positive

- Source: Reserve Bank of New Zealand's February 8, 2018 Policy Statement
- Sentence Score: +1 (hawkish keyword and more positive than negative modifiers)

Sentence Example 2

'but the near-term outlook for the global economy is the weakest for many years'
hawkish hawkish negative

- Source: Reserve Bank of Australia's February 3, 2009 Policy Statement
- Sentence score: -1 (hawkish keywords and more negative than positive modifiers)

- Do information sentiments in central bank press releases help guide policy expectations?
- What kind of relationships, if any, do central bank policy statements have?

Sentiment Score Comparison

Principal Component



Variance Explained



Cross-correlation: MPR & Sent Index

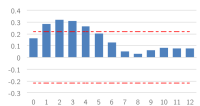
Australia



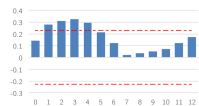
Brazil



Canada



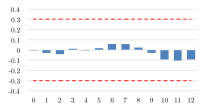
Chile



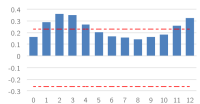
Hungary



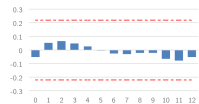
Iceland



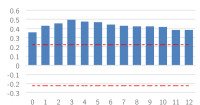
Indonesia



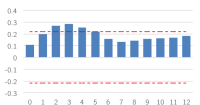
Israel



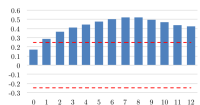
Korea



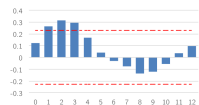
NZ



Norway

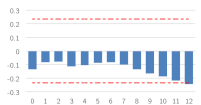


Peru

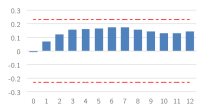


Cross-correlation: MPR & Sent Index

The Philippines



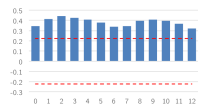
Poland



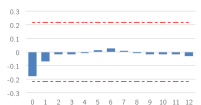
Romania



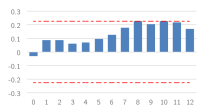
South Africa



Sweden



Thailand



- We collect the monetary policy press releases from 18 countries and analyze them using different linguistic techniques: structure, reading difficulty and sentiment analysis
 - Press releases in most countries have similar structure
 - Press releases in most countries require several years of education to be understood
 - Information given in press releases anticipates the movements of MPRs in most countries

Keywords Selection

Country	Number of Topics	Keywords
Australia	23	business_commodity_price, condition, confidence, credit, demand, economic, economy, employment, exchange_rate, expansion, expect, expected, expectation, expectations, financial_market, global, growth, household, housing, housing_market, inflation, international, investment, lending, market, pressure, price, prospect, recovery, spending, stance, trade, trend, wage, world
Brazil	7	inflation, economy, recovery, inflation_projection, inflation_trajectory, inflation_prospect, expectation, economic_activity, disinflation, monetary_easing,
Canada	23	activity, anticipate, bank, condition, core_inflation, demand, deposit_rate, economy, global, grow, growth, inflation, price, supply, total_cpi, trade
Chile	2	inflation, growth, price
Hungary	28	activity, assessment, condition, consumer_price, core_inflation, cost, cost_shock, councils_assessment, demand, development, domestic, domestic_demand, economic_agent, economic_growth, economy, euro_area, financial_market, growth, household_consumption, hungarian_economy, inflation, inflation_expectation, inflation_target, inflationary_pressure, labour_market, market, output, price, price_stability, private_sector, wage, disinflationary_impact, reduction, risk, slowdown, unused_capacity
Iceland	27	appreciation, banks_forecast, capital_account, current_account, demand, domestic_demand, economic_activity, economic_development, economic_recovery, economy, exchange_rate, foreign_currency, foreign_exchange, growth, inflation, inflation_expectation, inflation_outlook, krona, labour_market, market, monetary_stance, output, output_growth, private_consumption, recovery, demand_pressure, disinflation, risk, slack, spare_capacity, uncertainty
Indonesia	24	banking_industry, banking_system, capital_adequacy, consumption, core_inflation, credit_expansion, credit_growth, current_account, demand, development, domestic_economic, economic, economic_growth, economic_recovery, economy, exchange_rate, financial_market, financial_system, foreign_capital, global_economic, global_economy, global_financial, growth, inflation, inflation_target, inflationary_pressure, inflow, investment, market, price, recovery, rupiah, surplus
Israel	5	growth, activity, government, interest, interest_rate, market, interest, inflation,
New Zealand	29	activity, annual_cpi, bank, capacity, commodity, commodity_price, confidence, construction_sector, consumption, cost, demand, depreciation, dollar, economic_activity, economy, employment, exchange_rate, export, export_commodity, export_price, firm, fuel, growth, headline_inflation, house_price, housing, housing_market, income, inflation, inflation_expectation, inflation_pressure, investment, market, ocr, oil, pace, price, rate, ocr, reconstruction, recovery, repair, resource, sentiment, spending, supply, tradables_inflation, trade, upside, view, import
Norway	17	inflation, growth, development, demand, policy_rate, activity, enterprise, economy, output, employment, money_market, price, loan, market, household, turbulence, risk,
Peru	28	credit, dollar, domestic, domestic_currency, domestic_demand, economic_activity, financial_system, food_product, foreign_currency, foreign_exchange, global_economic, growth, inflation, inflation_determinant, inflation_forecast, international_financial, market, price, recovery, supply_shock
Philippines	2	assessment, growth, inflation, inflation_outlook, price, pressure, risk
Poland	21	inflation, demand, inflation_expectation, growth, price, price_growth, interest, growth_rate, production, employment, deposit, loan, household, economy, growth, exchange_rate, economic_condition, wage, economy, activity, deposit_rate
Romania	23	banking_system, consumer_price, credit, credit_institution, current_account, development, domestic, economic, economic_growth, financial_stability, foreign_currency, foreign_exchange, global_economic, growth, inflation_expectation, inflation_report, lending, liquidity, loan, price
South Africa	14	bank, cpi_inflation, development, domestic, economy, employment, environment, exchange_rate, global, growth, inflation, international, price, rand, recovery, sentiment, upside_risk
South Korea	22	price, oil, expectation, stock, financial, export, surplus, demand, lending, market, consumer, housing, sentiment, inflation, consumption, recovery, petroleum, liquidity, expect, growth, recovery, resource_utilisation, swedish_economy
Sweden	19	assessment, demand, development, economic_activity, economic_development, economy, energy_price, growth, inflation, inflation_report, inflationary_pressure, market, price,
Thailand	2	recovery, economy, export, policy_rate, growth, expect, investment, outcome, risk

Results: Structure and Reading Difficulty

	Beginning of sample	Number of words (mean)	Full Sample		Word Length	Gunning Score	SMOG Score	Fleisch Score
			Number of Sentences (mean)	Words per Sentence (mean)				
Australia	Jan-90	497	26	19	5.2	15	13	10th-12 G
Brazil	Mar-03	246	11	20	5.3	15	14	College
Canada	Mar-99	423	19	23	5.1	17	15	College
Chile	Jan-01	272	14	20	5.4	18	16	College
Hungary	Jan-03	488	24	18	5.2	15	14	College
Iceland	Mar-09	377	19	20	5.2	16	14	College
Indonesia	Jul-05	970	45	21	5.5	18	16	College
Israel	Jun-99	1447	55	28	5.1	18	16	College
Korea	Jan-00	366	17	21	5.4	18	16	College
New Zealand	Dec-96	364	17	22	5.4	16	15	College
Norway	Oct-10	1368	77	18	5.1	14	13	10th-12 G
Peru	Feb-01	426	31	14	5.0	14	13	10th-12 G
Philippines	Dec-01	324	13	25	5.5	19	17	College
Poland	Jan-01	827	38	22	5.1	17	15	College
Romania	Oct-03	725	22	34	5.3	23	19	College grad
South Africa	Jul-14	2132	101	21	5.1	15	14	College
Sweden	Jun-98	728	44	17	4.9	14	13	10th-12 G
Thailand	May-00	391	21	18	5.5	17	15	College
Average		687	33	21	5	17	15	
Max		2132	101	34	5	23	19	

Results: Structure and Reading Difficulty

Jan 2018-Dec 2019									
	Number of words (mean)	Number of Sentences (mean)	Words per Sentence (mean)	Word Length	Gunning Score (years)		SMOG Score (years)		Fleisch Score
					Level	Change	Level	Change	
Australia	700	36	20	5.1	14	0.1	13	0.2	10th-12th G
Brazil	756	34	22	5.3	17	-1.8	15	-1.3	College
Canada	487	25	20	5.2	15	1.4	14	0.9	College
Chile	702	32	22	5.1	17	1.0	15	0.6	College
Hungary	1289	64	20	5.4	17	-1.6	15	-1.3	College
Iceland	296	16	18	5.2	15	0.9	14	0.6	College
Indonesia	1485	64	23	5.7	19	-1.2	17	-0.9	College grad
Israel	1311	59	22	5.1	17	1.9	15	1.0	College
Korea	619	25	25	5.3	18	-0.3	16	-0.3	College
New Zealand	514	21	25	5.6	19	-2.2	16	-1.5	College
Norway	848	53	16	5.2	14	0.4	13	0.3	10th-12th G
Peru	416	31	13	5.0	14	-0.5	13	-0.2	10th-12th G
Philippines	296	11	26	5.5	20	-0.8	17	-0.6	College
Poland	438	22	20	5.2	16	0.4	15	0.3	College
Romania	934	29	32	5.1	21	2.2	18	1.7	College
South Africa	1603	93	17	5.2	14	1.3	13	0.9	10th-12th G
Sweden	873	58	15	5.0	14	-0.1	13	-0.1	10th-12th G
Thailand	833	39	21	5.8	19	-2.1	16	-1.6	College
Average	800	40	21	5	17	0	15	0	
Max	1603	93	32	6	21	2	18	2	