

Measuring Macprudential Policy Credibility Using Machine Learning

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Outline

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Background:

1. Since the Global Financial Crisis in 2007/2008, **macroprudential policy has been proven to help maintain macroeconomic and financial stability.**
2. Central Bank credibility is defined as a commitment to follow well articulated and transparent rules and policy goals (Bordo & Siklos, 2015). **Macroprudential policy credibility should also be taken into account for the overall Bank Indonesia's credibility.**
3. Bank Indonesia used **semiannual survey to stakeholders** for measuring policy credibility,
4. Previous research has shown evidence that **news data and machine learning** can be used to measure Bank Indonesia's monetary policy credibility (Zulen et al., 2020).



Goals:

Utilizing **news data** and **machine learning** to measure **unbiased and timelier public perception on Bank Indonesia's macroprudential policy** in 4 aspects: Formulation, Effectiveness, Coordination, and Communication.



Literature Study:

1. Zulen, A. A., Wibisono, O., Widjanarti, A. (2020). Developing Machine Learning Technique for Measuring Central Bank Credibility. 2020 Data for Policy Conference.
2. Bordo, M. D., & Siklos, P. L. (2015). Central bank credibility: an historical and quantitative exploration (No. w20824). National Bureau of Economic Research.
3. Borio, C. (2011). Implementing the macroprudential approach to financial regulation and supervision. In The financial crisis and the regulation of finance. Edward Elgar Publishing.

2.

Framework & Scope

Aspect Scope

Formulation:

Perception regarding macroprudential policy formulation

Effectiveness:

Perception regarding the effectiveness of macroprudential policy

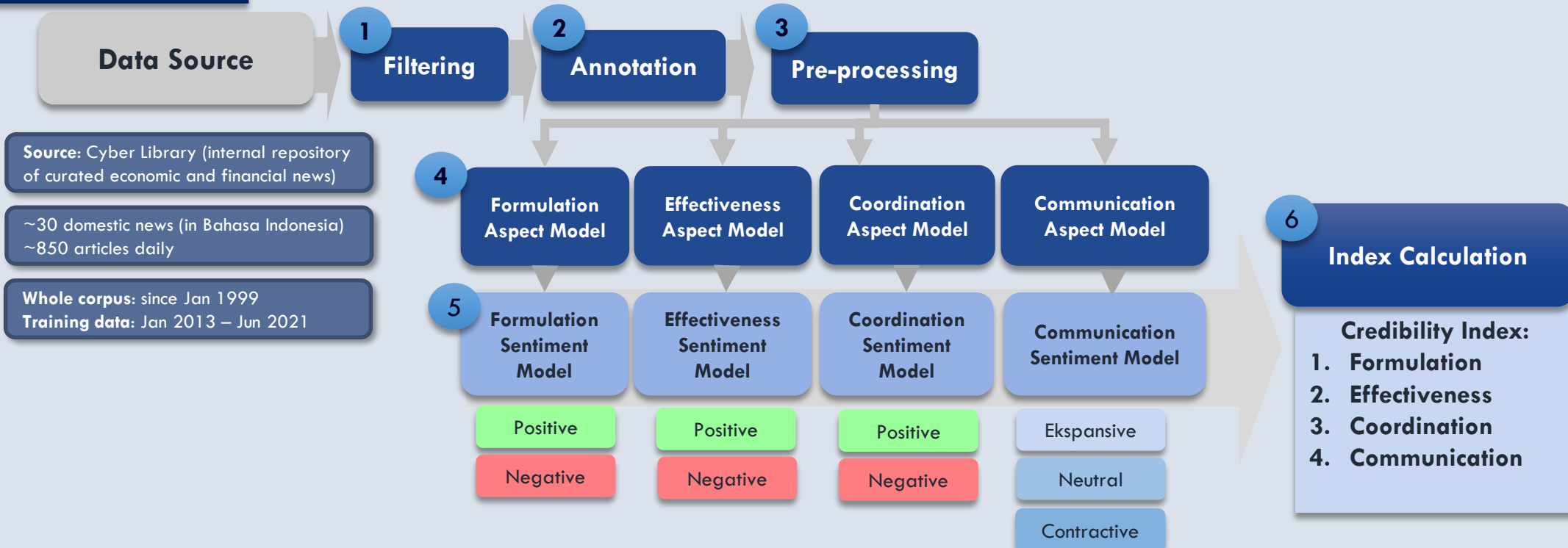
Coordination:

Perception regarding Bank Indonesia's coordination with other authorities

Communication:

Perception regarding Bank Indonesia's communication on its' policy stance

Framework



Macroprudential keywords filter:

1. **Generic keywords** e.g: Policy mix, macroprudential, financial system stability
2. **Macroprudential policy instruments** e.g: Countercyclical Buffer / CCB, Loan to value (LTV), Financing to value (FTV), Macroprudential Intermediation Ratio (RIM), etc
3. **Credit and macroprudential indicators** e.g: Down payment, vehicle credit, property credit, green financing, prime lending rate, etc
4. **Other financial authorities:** Financial Services Authority (OJK), Indonesia Deposit Insurance Corporation (LPS), Financial System Stability Committee (KSSK).
5. **Others** e.g: Integrated Reporting, Government bond primary market.



Data Source

News with macroprudential
keywords and Bank Indonesia in
the text

9.060 News sentences (Jan 2013 – Jun 2021)

ID Berita	Tanggal Terbit	No. Kalimat	Kalimat	Formulasi			Efektivitas			Koordinasi			Ekspektasi		
cyberlib_2019-06-27_1898	27 Juni 2019	2	Head of Macroprudential Policy Department BI, Juda Agung explains, in three to four years from 2022 to 2023, they will need to push banking intermediation function to the level of 15-16% annually (year on year/yoy).	-	1	-	1	1	-	-	-	-	-	-	-
cyberlib_2019-06-27_1946	27 Juni 2019	1	Bank Indonesia (BI) affirms accommodative macroprudential policy in the next three to four years.	1	1	1	1	1	-	-	-	-	-	-1	-1
cyberlib_2019-06-28_1068	27 Juni 2019	11	Based on Bank Indonesia data, during quarter 1/2019, the share of ownership through mortgage reaches 74.20%, higher than cash or gradual payment with 17,30% cash of 8,50%.	-	1	-	-	1	-	-	-	-	-	-	1
cyberlib_2019-06-28_1352	27 Juni 2019	12	He also shared his experience in the business world with hundreds of millennials in the Macroprudential Policy discussion held by Bank Indonesia.	-1	1	-	-	1	1	-	-	-	-	-	1

Sentences with macroprudential
keywords

- Sample of filtered sentences are annotated with positive (1), negative (-1), neutral (0), or not relevant (-) labels for each credibility aspect. One sentence can contain more than 1 aspect.
- Annotation are done by authors and domain experts within BI, using guidelines provided (incl. examples).
- Every sentence is annotated by 2/3 persons. The label are decided by the majority labels (or decided in annotator forum).

Sentences	Credibility Aspect	Label
Bank Indonesia has taken various anticipative measures to maintain macroeconomy and financial system stability and support sustainability of growth through monetary and macroprudential policy.	Formulation	Positive
Bank Indonesia policy to tighten rules of mortgage receive criticism from property developer.	Formulation	Negative
With the rising consumption, relaxation of Loan-to-value ratio that will be applied on 1 August 2018, will help the growth of credit to its highest level to 12% this year.	Effectiveness	Positive
According to Paramadina University Rector, Prof Firmanzah Ph.D, Bank Indonesia macroprudential policy is not effective yet to support financial system stability.	Effectiveness	Negative
According to hendar, BI is preparing MOU with OJK. The purpose is to prevent data supply interference after the separation of macroprudential and microprudential function.	Coordination	Positive
Real Estate Company Union assess that there needs to be synchronization of loan-to-value ratio relaxation with the taxation system.	Coordination	Negative
Indonesia Credit Default Swap (CDS) can rise and Rupiah exchange rate will face turbulency and volatility that trigger vulnerability in the market. This will force BI to face it with monetary and macroprudential tightening.	Communication/ Expectation	Contractive
Bank Indonesia will hold its loan to value policy on the property sector because it's considered an effective measures to reduce speculation and control credit risk.	Communication/ Expectation	Neutral
BI also predicted will loosen its macroprudential activity in the near future.	Communication/ Expectation	Accommodative

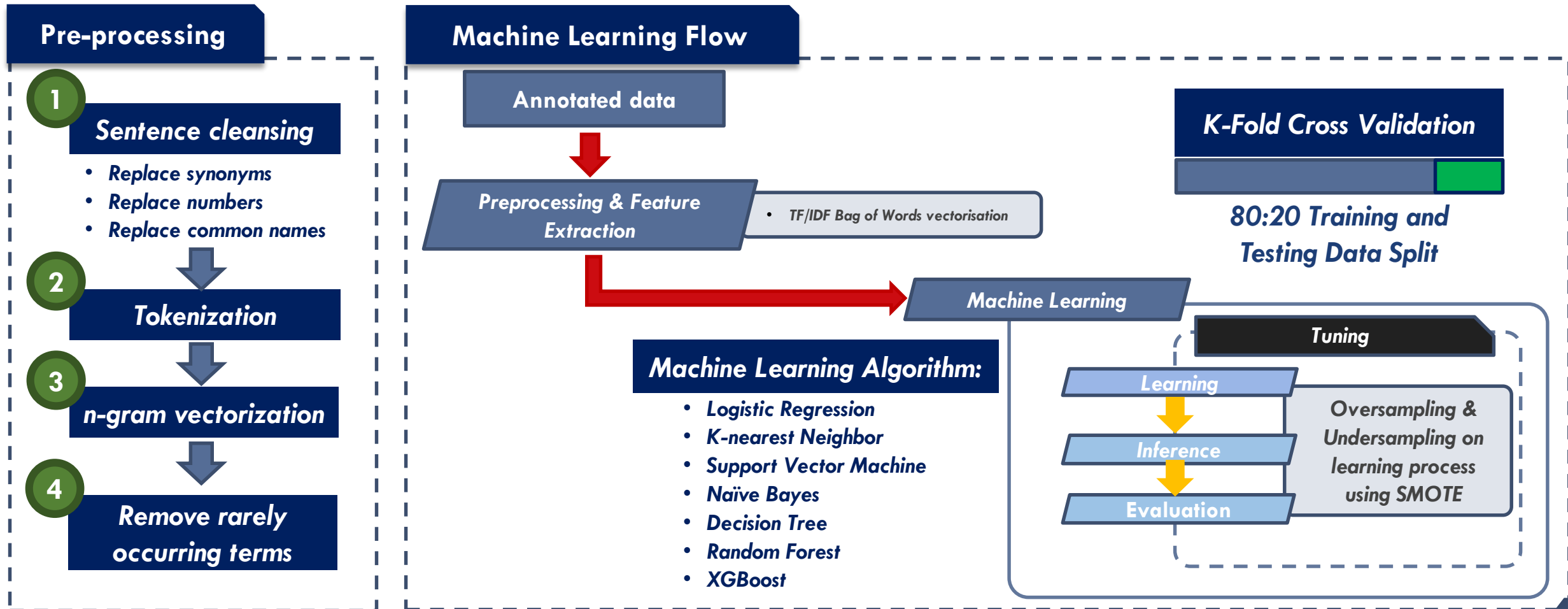
Total Annotated Sentences: 5,030

Aspect	Positive	Negative	Neutral	Irrelevant
Formulation	642 (12,8%)	70 (1,4%)	-	4.318 (85,8%)
Effectiveness	387 (7,7%)	76 (1,5%)	-	4.567 (90,8%)
Coordination	433 (8,6%)	30 (0,6%)	-	4.567 (90,8%)
Communication	72 (1,4%)	585 (11,6%)	25 (0,5%)	4.348 (86,4%)

3. Methodology: Preprocessing & Feature Extraction



All the sentences are pre-processed to change the sentence from **text (*unstructured*)** form to **structured TF-IDF Vector** that can be further processed using machine learning.



After performing a horse race of 7 machine learning algorithms, we obtained the best model combination for each credibility aspects (using F1-score as evaluation metric)

Model Evaluation

Credibility Aspect	Best Model Combination	F1 Score Details	
		Phase 1 Aspect Relevancy	Phase 2 Sentiment Prediction
Formulation	XGBoost & Decision Tree	66,15%	69,99%
Effectiveness	Logistics Reg. & XGBoost	66,87%	75,81%
Coordination	Logistics Reg. & SVM	70,64%	67,49%
Communication	Logistics Reg. & Logistics Reg.	77,13%	76,32%

Average F1 Score:
Phase 1: 70.19%
Phase 2: 72.40%

Index Calculation

Formulation, Effectiveness, and Coordination aspects formula:

$$Index_{aspect\ k,t} = \frac{\#positive_{k,t} - \#negative_{k,t}}{\#positive_{k,t} + \#negative_{k,t}}$$

Communication aspect formula:

$$Index_{Communication,t} = 1 - |P_t - Tone_t|$$

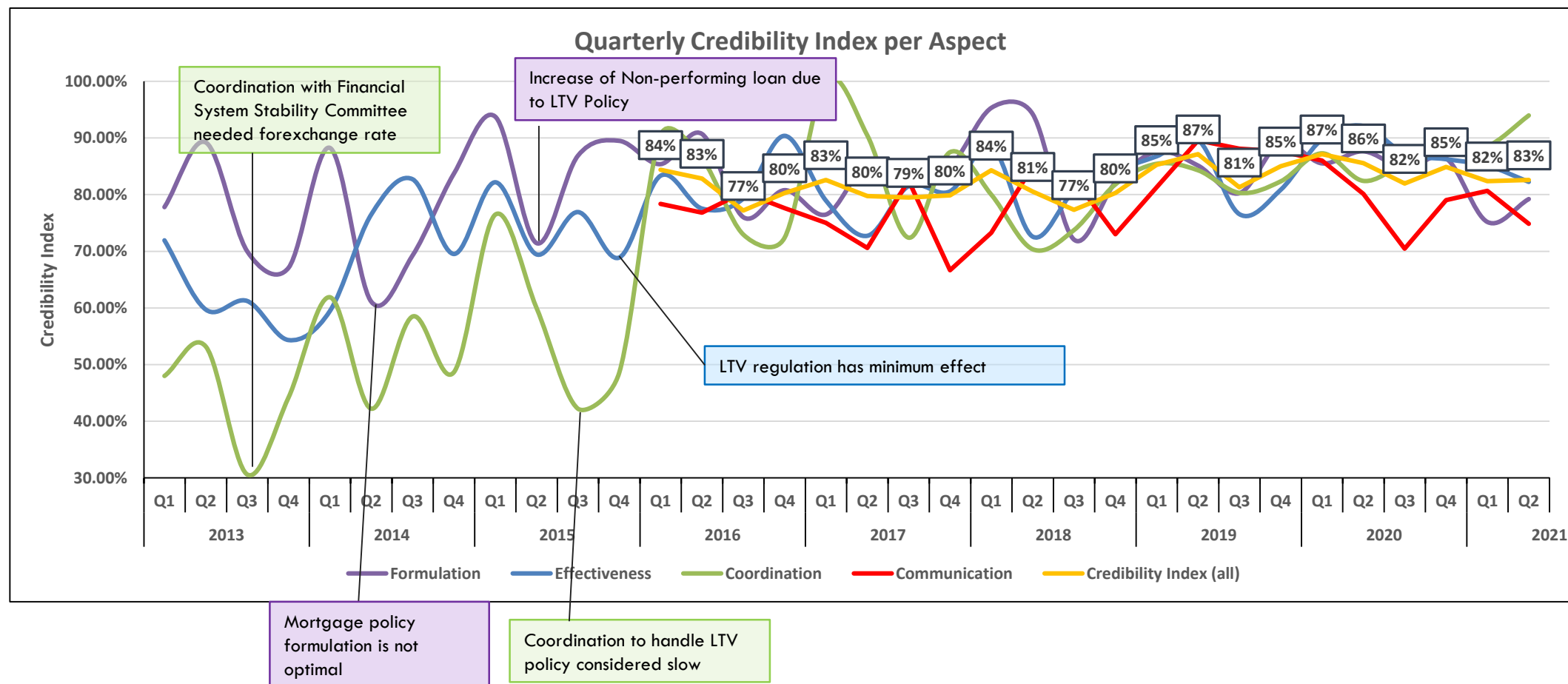
P_t = Macroprudential
policy stance in the
press release

Tone = Index
Expectation

$$Index_{Expectation,t} = \frac{\#Contractive_t - \#Expansive_t}{\#Contractive + \#Neutral_t + \#Expansive_t}$$

$$Credibility\ Index_t = \frac{1}{4} (Index_{formulation,t} + Index_{effectiveness,t} + Index_{coordination,t} + Index_{communication,t})$$

- Earlier index from 2013 to 2016 has fewer news therefore the indexes are more volatile.
- Since 2016, Bank Indonesia started to communicate macroprudential policy more intensively in its Board of Governors meeting press release. Thus, the overall index is more stable and positive with overall average of 82% . Communication of macroprudential policy to the general public affect the sentiment or tone of news positively, as captured in this macroprudential policy credibility index.



Conclusion

1. Based on our previous study of measuring monetary policy credibility, we develop a measurement of macroprudential policy credibility using news data and machine learning.
2. The aspect relevancy models have an average F1 score of 70.19% while the sentiment models have an average F1 score of 72.40%.
3. Bank Indonesia starts to communicate macroprudential policy forward guidance more intensively starting in 2016, and the result is captured in the index with the 4 aspects of the index become more stable and positive starting in 2016.

Future Works

1. Data collection and annotation of more recent data.
2. Expansion of macroprudential and policy mix keywords.
3. Econometric analysis (econometric effect of the indexes on macro indicators).

THANK YOU!

