

# High-Frequency Indicators for Financial Stability – A Methodology Utilizing Big Data in Payment System Data

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## STRATEGIC ENVIRONMENT

- The 2008 GFC highlighted the need for central banks to expand their mandates to include financial system stability.
- The COVID-19 pandemic showed that traditional, lagged data sources are inadequate for capturing rapid economic changes.
- There is increasing recognition of the importance of granular and high-frequency data for timely economic and financial insights, improving risk management (Borio, 2020; Carstens, 2020).
- Digitalization of financial services has introduced new prompt and accurate data, potentially enhancing the analysis of economic and financial system stability.
- Advanced methodologies like AI and machine learning are essential for analyzing high-frequency transactional data (Philippon, 2016).

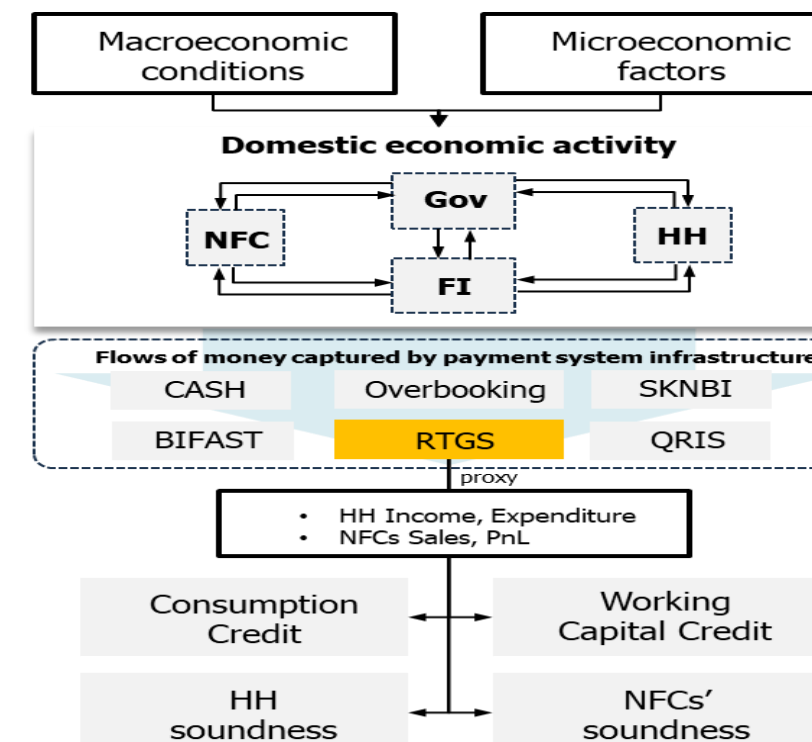


## RESEARCH QUESTIONS

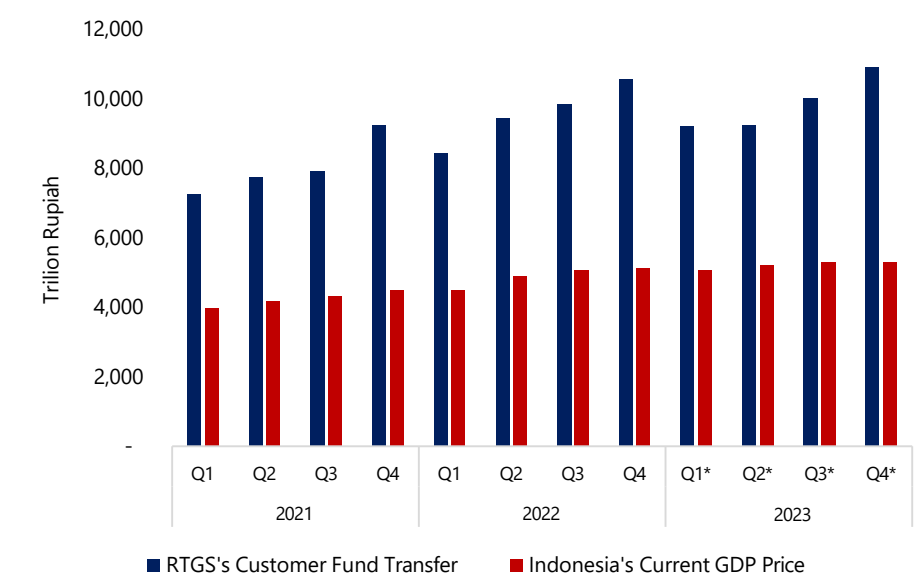
1. How can central banks further enrich their payment systems data to support policy making for financial stability?
2. How can the resulting indicator from enriched payment systems data complement existing indicators on financial intermediations and financial sector soundness?



## RTGS AS PROXY OF ECONOMIC ACTIVITY



The large size of RTGS's customer fund transfers highlights its significant role in Indonesia's economy.





## Role of Central Banks in Financial Stability

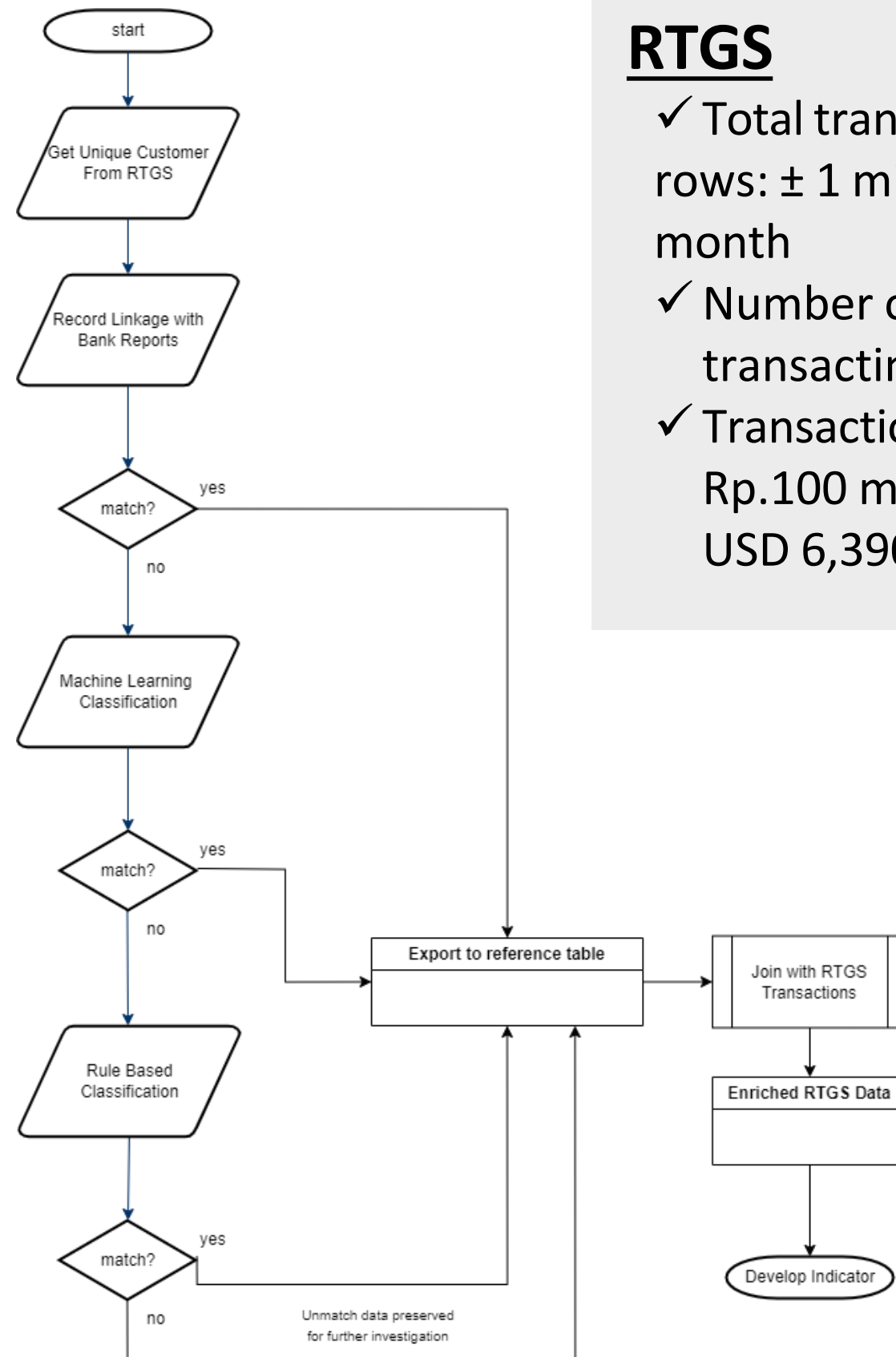
- Central banks are uniquely positioned to contribute to maintaining financial stability, due to their role as monetary authority and financial sector regulator.
- Systemic risk in the financial system manifests in two principal forms: time series risk (procyclicality) and cross section risk (interconnection and common exposure)
- The flexibility and real-time nature of big data enable the extraction of timely economic signals, application of new statistical methodologies, and enhancement of financial stability assessments (Tissot, 2019).

## Application of AI and Big Data in Financial Stability Analysis

- AI enhances decision-making processes through advanced predictive analytics, enabling central banks to forecast economic trends more accurately and make better-informed policy decisions (Ghandour, 2021).
- Sulistiawati et al. (2022) utilized big data analytics on payment system data to identify publicly listed large non-financial corporations to monitor their transactions.

## STATE OF RTGS DATA IN INDONESIA

Legacy systems like BI-RTGS in Indonesia were **originally developed** to **ensure uninterrupted payment system** activities rather than to meet the **needs of economic analysis**. Therefore, **further process** are needed to **enrich** the granular information in RTGS Transaction.



## RTGS

- ✓ Total transaction rows: ± 1 million rows per month
- ✓ Number of banks transacting: 117 banks
- ✓ Transaction amount ≥ Rp.100 million or ≥ USD 6,390



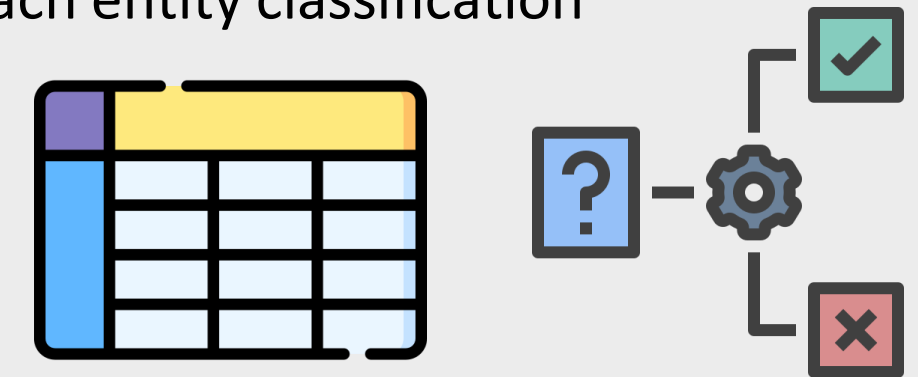
## BANK REPORTS

- ✓ 10 millions Accounts
- ✓ 50 Banks
- ✓ Customer Information\*
  - ✓ Entity Classification
  - ✓ Gender
  - ✓ Domicile
  - ✓ Birth Year
  - ✓ CASA
  - ✓ etc



## Rule Based

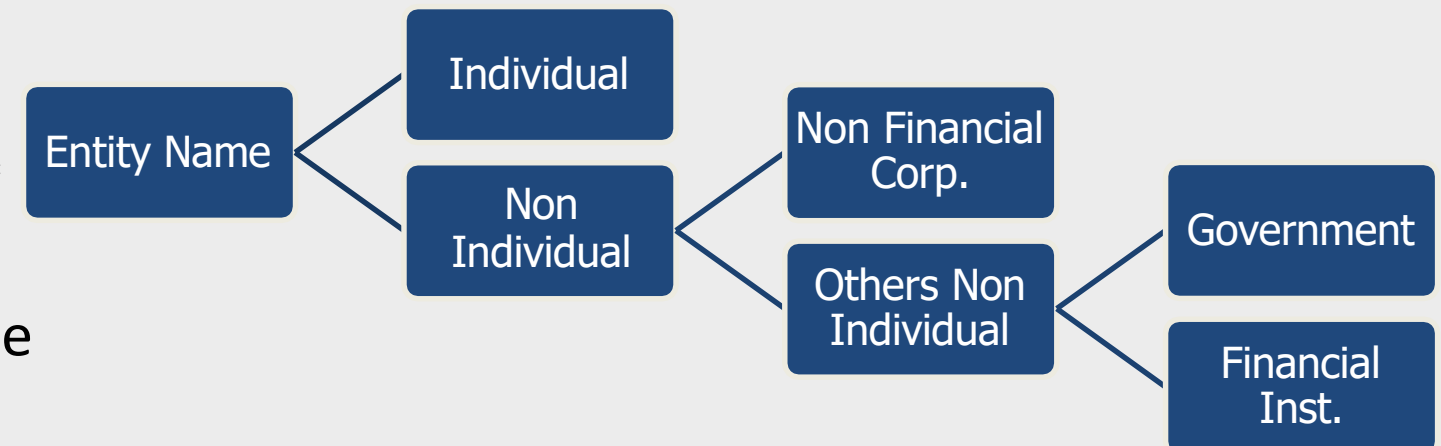
- ✓ Remainders unmatched entity then processed with rulebased classification based on majority countvectorizer from each entity classification



## MACHINE LEARNING



- ✓ Word Tokenization
- ✓ Count Vectorizer
- ✓ Supervised Classification\*\*
  - ✓ **Logistic Regression**
  - ✓ Support Vector Machine
  - ✓ Naïve Bayes



### Notes:

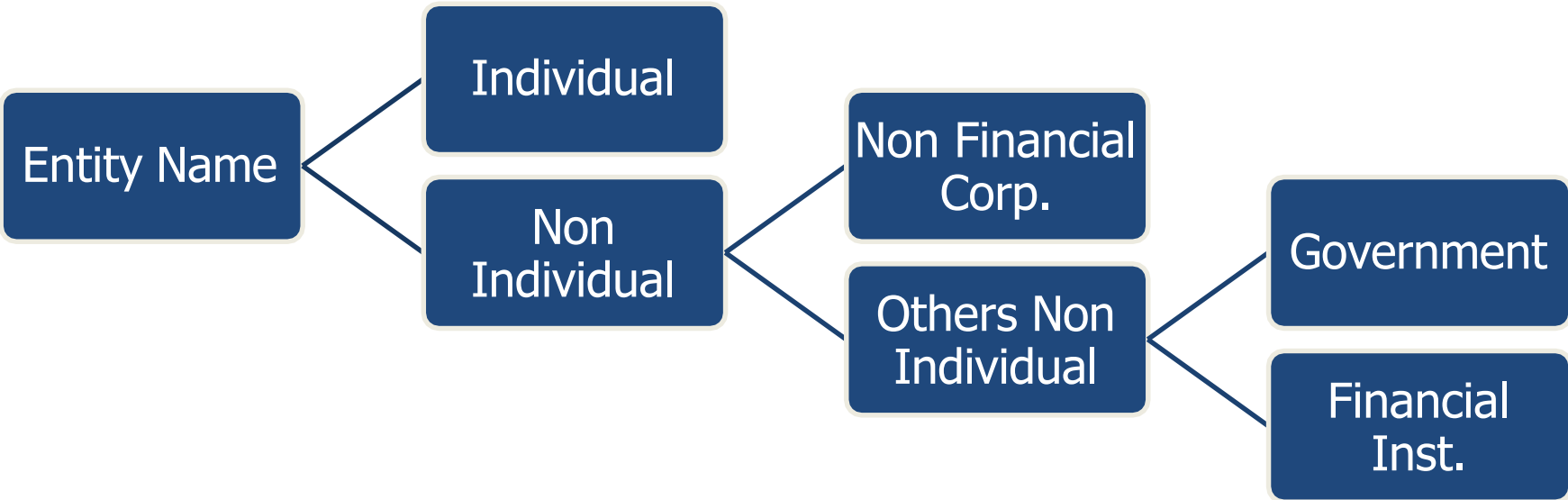
\*) Only consistent classification between banks are used to train the model

\*\*) We build 3 models, to classify entity name





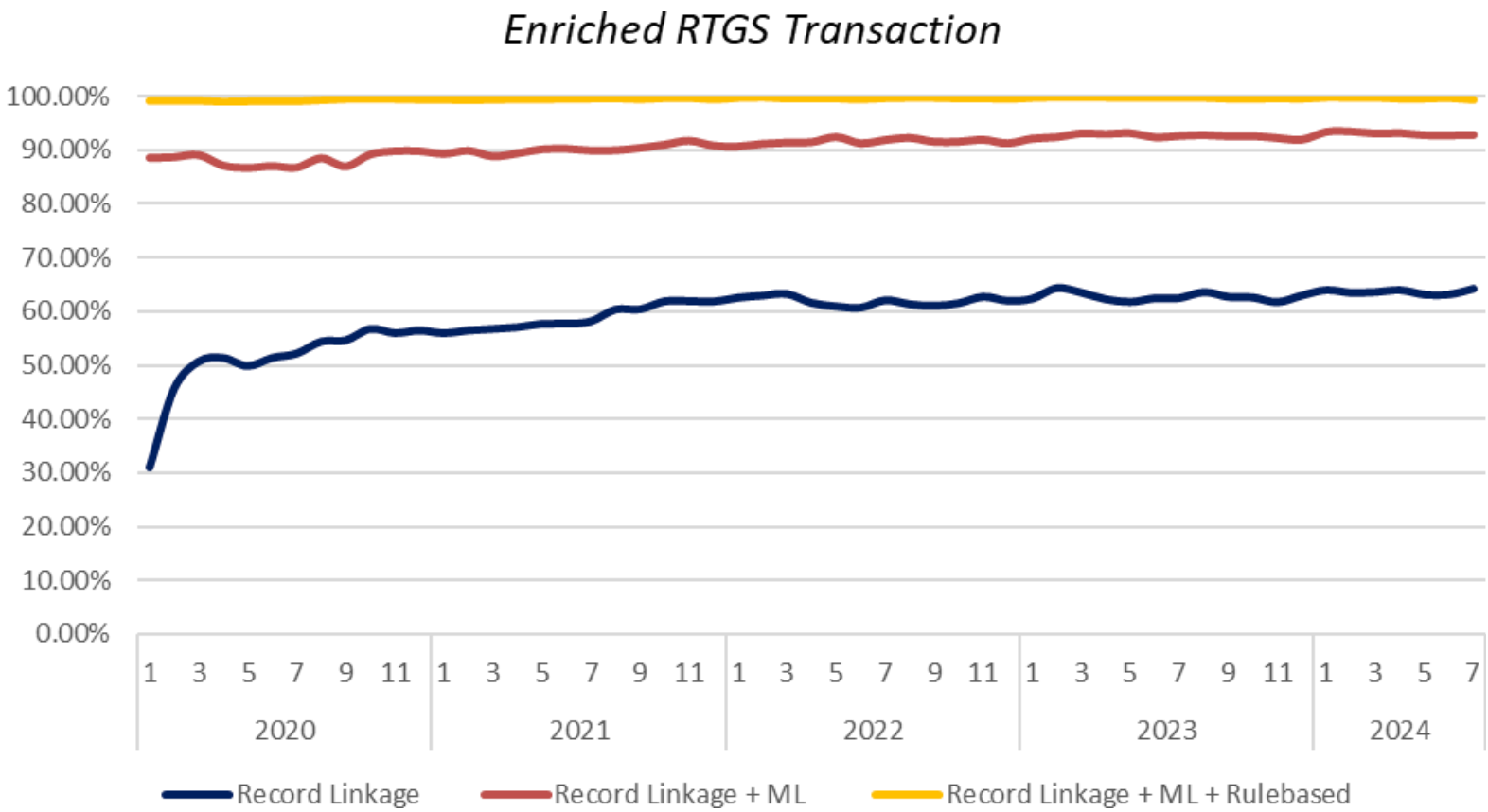
MODEL EVALUATION



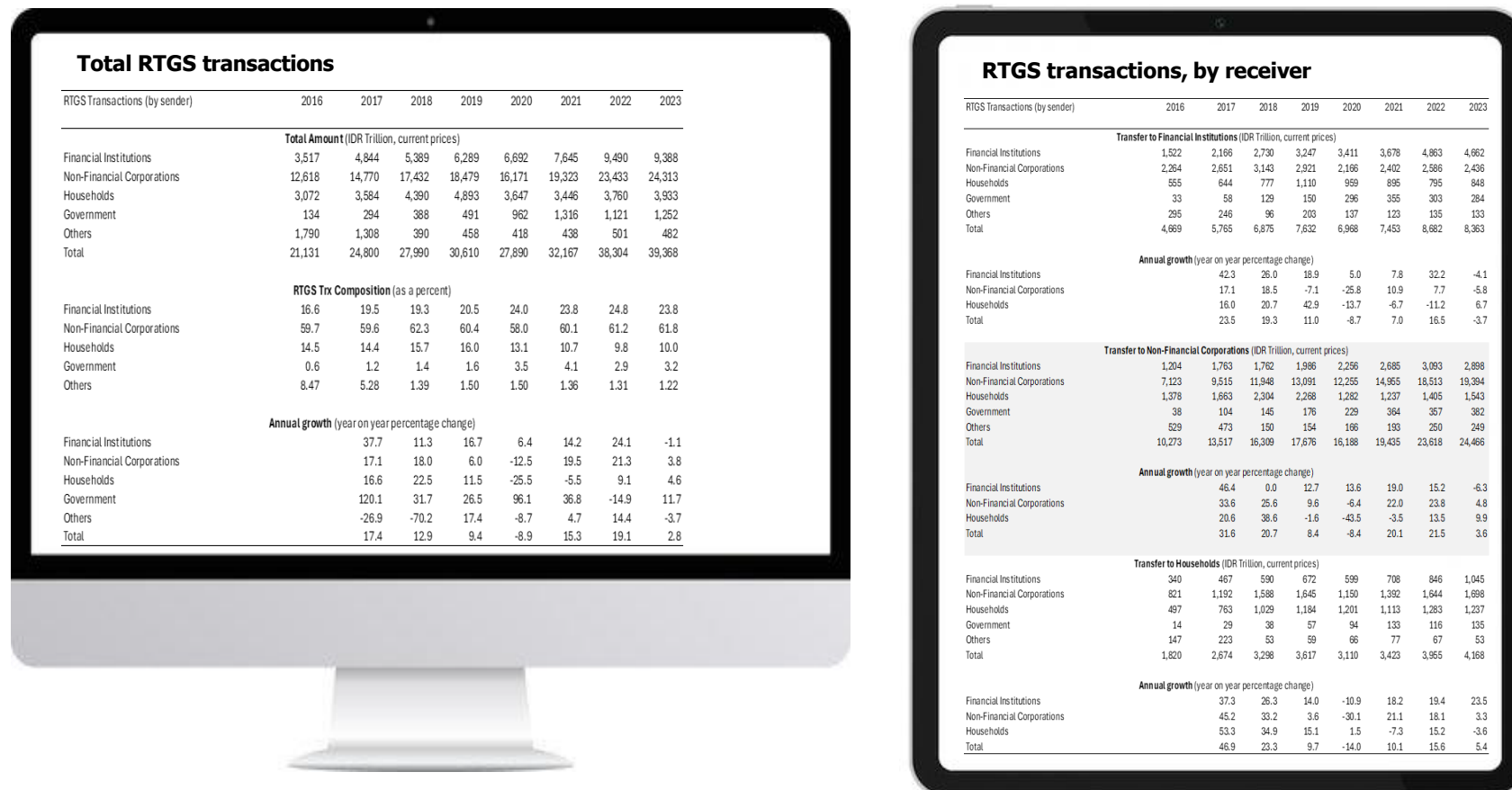
Algorithm	Klasifikasi	Train*				Test*			
		F1-Score	Precision	Recall	AUC	F1-Score	Precision	Recall	AUC
Logistic Regression	Perorangan	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97
	Perusahaan Non Finansial	0.72	0.82	0.76	0.83	0.66	0.79	0.72	0.72
	Institusi Keuangan / Pemerintah	0.98	0.98	0.98	0.99	0.96	0.96	0.96	0.98
SVM	Perorangan	0.99	0.98	0.98	0.98	0.98	0.96	0.96	0.96
	Perusahaan Non Finansial	0.83	0.77	0.66	0.62	0.77	0.76	0.65	0.61
	Institusi Keuangan / Pemerintah	0.97	0.92	0.92	0.02	0.97	0.91	0.91	0.91
Naïve Bayes	Perorangan	0.57	0.98	0.98	0.98	0.59	0.96	0.96	0.96
	Perusahaan Non Finansial	0.48	0.76	0.71	0.68	0.47	0.76	0.7	0.68
	Institusi Keuangan / Pemerintah	0.69	0.89	0.89	0.89	0.69	0.89	0.88	0.88

HOW ML CLOSING THE GAP FOR UNMATCHED ACCOUNTS

Method	Matching Percentage
Record Linkage	64%
Record Linkage + ML	92%
Record Linkage + ML + Rulebased	99%



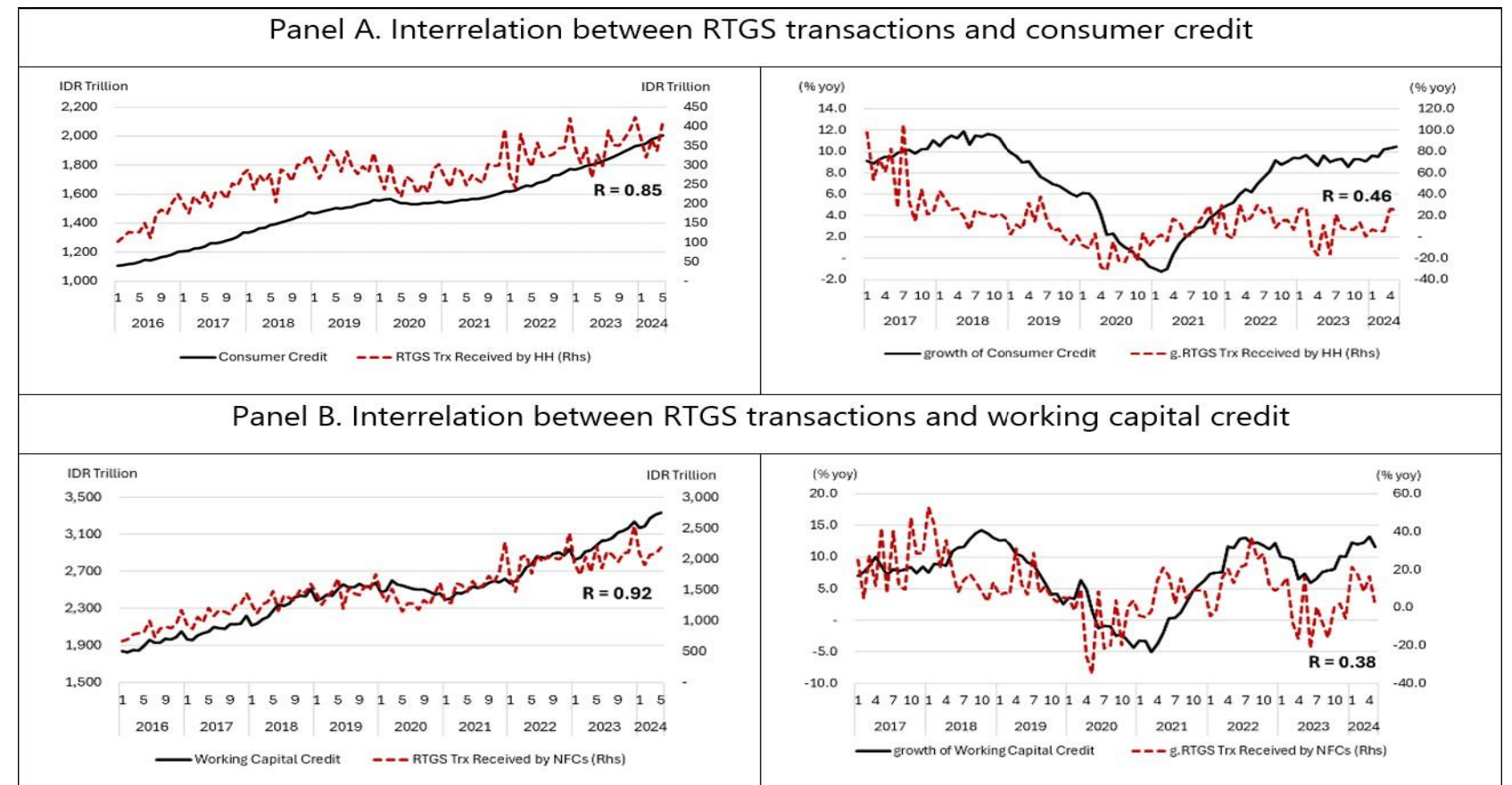
## Output #1. Enriched Statistics of RTGS transactions



### Usage:

- Generate statistics on RTGS transactions, which can be monitored on a monthly basis, as proxy of economic activities.
- Illustrate the RTGS flows undertaken by various economic agents.
- reveal the flow of money and liquidity across different sectors.

## Output #2. Analysis on RTGS data as proxy for Intermediation and Soundness



### Analysis:

- Examines the interrelatedness of RTGS transactions with intermediation and financial soundness indicators
- RTGS transactions exhibit a high correlation with both consumer and working capital credit
- RTGS transactions are more effective in reflecting the soundness of NFCs compared to households

## KEY FINDINGS:

1

The use of big data analytics and machine learning methodology can enrich payment system data, categorizing entity into individuals, financial institutions, non-financial corporations, and government, providing potentials for economic and financial analytics.

2

RTGS transactions hold significant potential as a proxy of credit demand. In the context of financial sector soundness, RTGS transactions provide strong correlation with NFCs soundness indicator. However, we found limited potential of RTGS transactions data to indicate household soundness.

## FUTURE WORK:

- Expanding data sources to include more payment systems
- Exploring interconnectedness within the payment system network
- Exploring more financial or economics variable to validate other enriched information such as regional analysis, entity interconnection, spending habit by demographics, etc





Data at your  
fingertips.



# THANK YOU

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