# Determinant Factors of 10-year Local Currency Sovereign Bonds Yield: Indonesia Case

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## Contents

# 1 Introduction

Indonesian government regularly issue Rupiah-denominated sovereign bonds (conventional and sharia bonds) in primary market to finance deficit of national budget. In 2021, issuance target for the sovereign bonds is around 80-85% of total deficit financing which amount to IDR1,006 Trillions or equivalent to USD72 Billions.[1] As per 2 September 2021, total outstanding of local currency sovereign bonds is IDR4,539 Trillions or equivalent to USD318 Billions.[2]

The government sells the sovereign bonds through auction which conducted every Tuesday. Announcement will be released three days before the auction day (T-3). During 2-hour auction, investors (both individuals and institutions) can put their bidding in multiple prices through primary dealers and auction winners will pay their bonds based on their proposed volumes and yields. In addition to the multiple price (competitive) mechanism, the government also offer sovereign bonds to several non-competitive participants such as Indonesia Central Bank (Bank Indonesia) and Indonesia Deposit Insurance Corporation (Lembaga Penjamin Simpanan). This non-competitive buying may also be conducted by primary dealers to complement their competitive bidding purchase. Non-competitive buyers will pay their bonds based on weighted average yield (WAY) from the winning competitive bidding.

There are several benchmark series offered in the auction. These series represent various maturity time. For conventional bonds, tenors of benchmark series in 2021 are ranging from 5, 10, 15 and 20 year. Meanwhile, benchmark tenors of sharia bonds cover 2, 4, 13 and 25 year.

Since 2021, yield of 10-year sovereign bonds become one of macroeconomic assumptions in national budget, replacing treasury bills of tenor 3-month (Surat Perbendaharaan Negara). This replacement is because the yield of 10-year sovereign bonds deemed as having larger and more significant portion in nation's cost of borrowing compared to the T-bills. Moreover, 10-year yield is also reflecting longterm economy condition and its movement is commonly used as a sign in predicting economic health of one country. The yield is also used by corporations as a reference when issuing their local currency bonds or lending money.

During period of 2014-2018, Indonesia is said to have higher average of 10-year sovereign bonds yield compared to its ASEAN-5 peers (Thailand, Philippines, Malaysia, Vietnam) as well as several other emerging countries with similar credit rating like Mexico, Columbia and India (Muktiyanto and Aulia 2019). This condition make Indonesia pays more expensive debt compared to these countries. As corporate use the yield as their benchmark rate, the impact of costly debt is also spilled over in the national economy.

Considering the important functions of the 10-year sovereign bonds yield in Indonesia's economy, this study will analyze several variables that determine the yield and quantify their impact using Ordinary Least Squared (OLS) model. This paper will be delivered in several sections. First, we will explain our research's purpose in Section 2. Section 3 will provide background knowledge from prior studies related to the topic. Section 4 will briefly explain variables of interest as well as conducting exploratory data analysis (EDA) by visualizing data to check any interesting patterns or characteristics. Section 5 and section 6 will cover research methodology and result of analysis consecutively.

# 2 Motivation

This paper provides two new values to existing literature. First, it employs exploratory data analysis (EDA) approach in the beginning of analysis to gain better intuition of each explanatory variables. This approach is quite important especially for capturing particular data characteristic, i.e. non-linearity, before we can proceed to a confirmatory step. Disregarding the data characteristic will result in inappropriate data modeling. Second, this is the first work which empirically study the impact of primary dealers' behavior on 10-year sovereign bonds yield in Indonesia.
The purpose of this work will be providing insights and policy recommendations for government in reducing

[1] Assumed exchange rate for conversion (IDR/USD) = 14,284.00
[2] ibid

sovereign bonds yield, particularly by aiming at significant determinant factors, which in turn help to optimize national's cost of borrowing.

# 3 Literature Review

Numerous researches have been conducted using various methodologies and scopes of study to find factors that affecting sovereign bonds yield. Dachroui et al (Dachraoui, Smida, and Sebri 2020) analyze role of capital flight as a driver of sovereign bond spreads in Latin American countries. They found that spreads are positively correlated with capital flight, inflation, government final consumption expenditure, unemployment rate, VIX and crisis, while economic growth, trade openness and governance index appear to have a negative effect (2020).

UST

CDS Kim et al. (2014) study role of default risk using credit default swaps as proxy in explaining spread of sovereign bonds yield. Their finding confirm that the variable contributes in determining the spread by 37%.

EXCHANGE RATE Gadanecz et al (Gadanecz, Miyajima, and Shu 2018) use exchange rate volatility and expected exchange rate as predictor variables of emerging market economies local currency sovereign bond yields. They conclude that the significant relationship between exchange rate and bonds yields. Permanasari et al. (2021) see negative significant relationship between exchange rate and government bond yield in Indonesia, while Saenong et al (Saenong et al. 2020) conclude that exchange rate has an effect on bond yields only in the short run.

FOREIGN (Gadanecz, Miyajima, and Shu 2018) Moreover, they also found that foreign ownership in local currency sovereign bonds market plays important role as stabilizing force of exchange rate volatility.

Other studies such as„„also confirm this.

VIX Izadi et al (Izadi and Hassan 2018) focus on local fundamental, global factors, volatility as determinant factors of yield spreads using empirical data of 24 developed countries in North America, Europe and Pacific Rim regions in period of January, 2010 until March, 2015. Their finding include significant and positively correlation between equity market volatility (VIX) and yield speads in all observed regions. Their study also show strong relationship between fixed income and stock markets particularly in developed countries.

PRIMARY DEALERS Other researches took different angle by studying primary dealers system and its impact on bonds yield (Tchuindjo 2015), (Endo 2020), , , . Tchuindjo (2015) provide several mathematical models to understand the impact of primary dealers' profit taking trading on bonds yields during when-issued period.

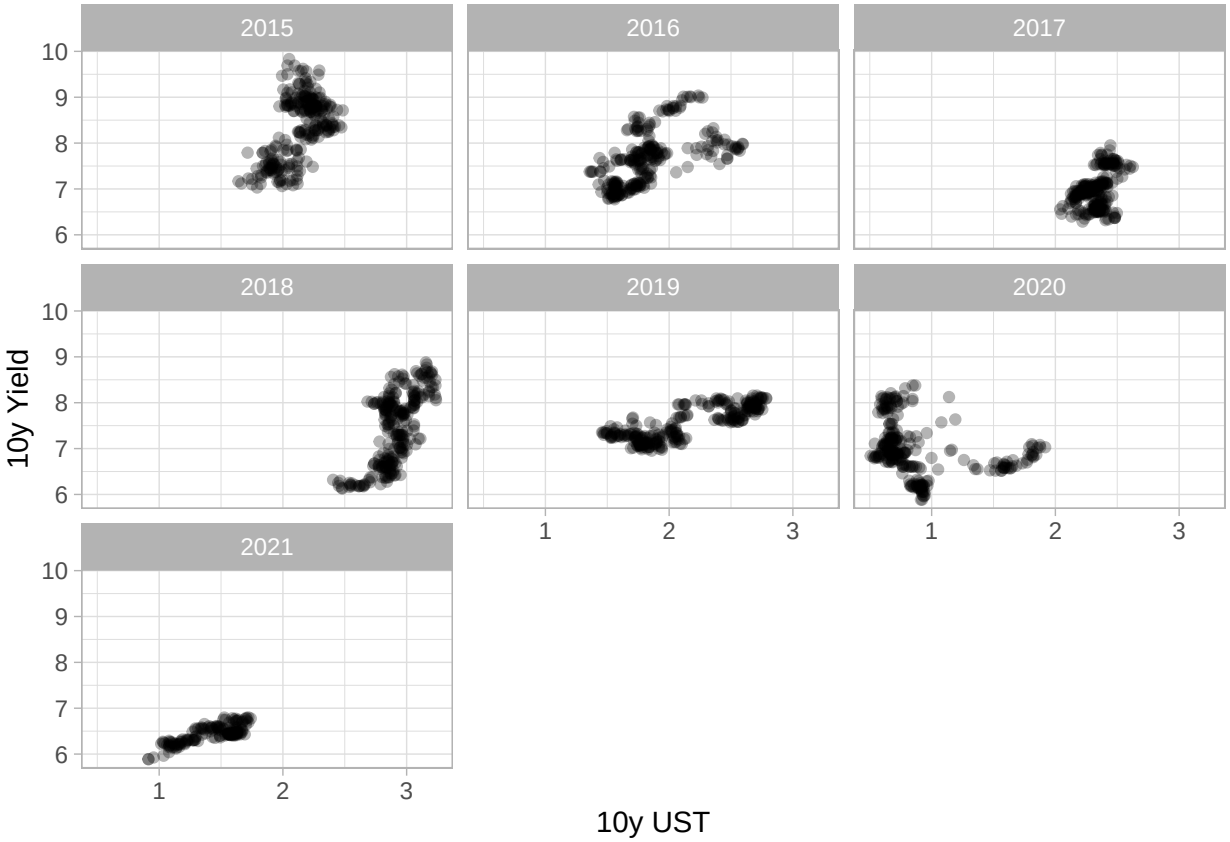
Based on these literature, this paper will study relationship and impact of 10-year US Treasury (UST) yield, 5-year Credit Default Swap (CDS), foreign share in sovereign bonds ownership (%), central bank's policy rate, exchange rate, volatility index (VIX) as well as primary dealers' behavior on 10-year sovereign bonds yield.

# 4 Description of Explanatory Variables

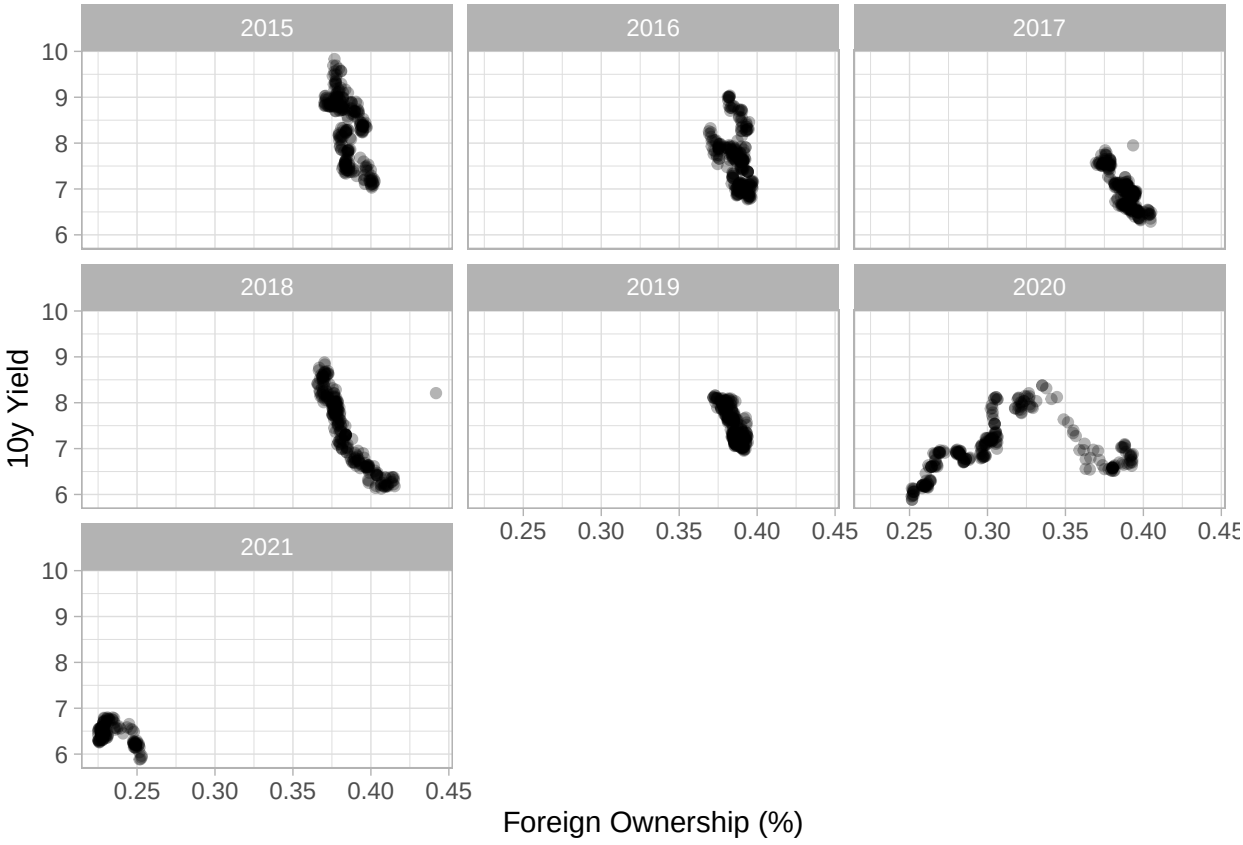
As yield is described as expected return in exchange of risks taken by investors, we will group the explanatory variables based on their related risk categories as follow:

## 4.1 External Risk

### 4.1.1 10-year US Treasury

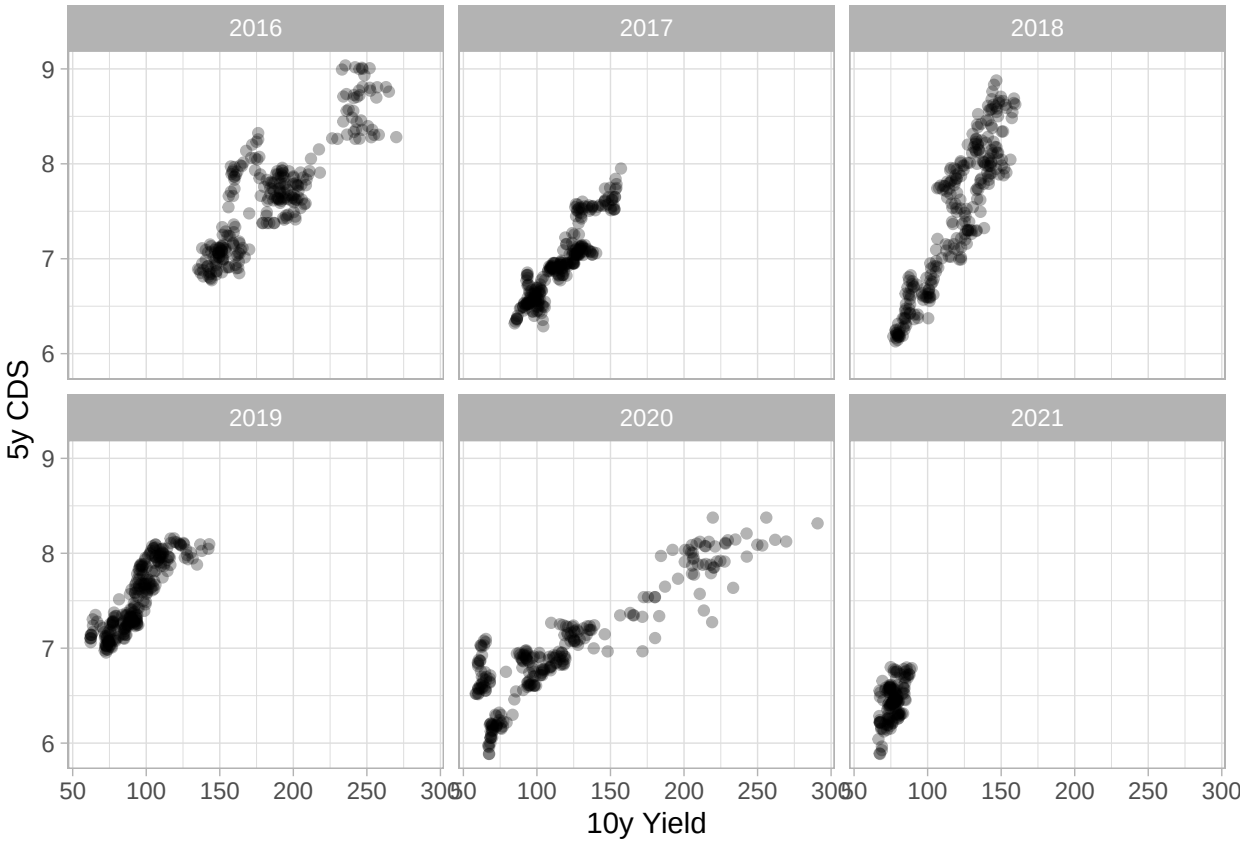


#### 4.1.2 Foreign Ownership




### 4.2 Default Risk (5-year Credit Default Swap)

A credit default swap (CDS) is a derivative contract that allows the investor to hedge against the default of a borrower. This provides a market-based measure of the credit-risk premium. CDS spreads indicate that the credit risk that investors perceive is significant. (**codogno?**)




### 4.3 Financial Market Risk (Volatility Index)

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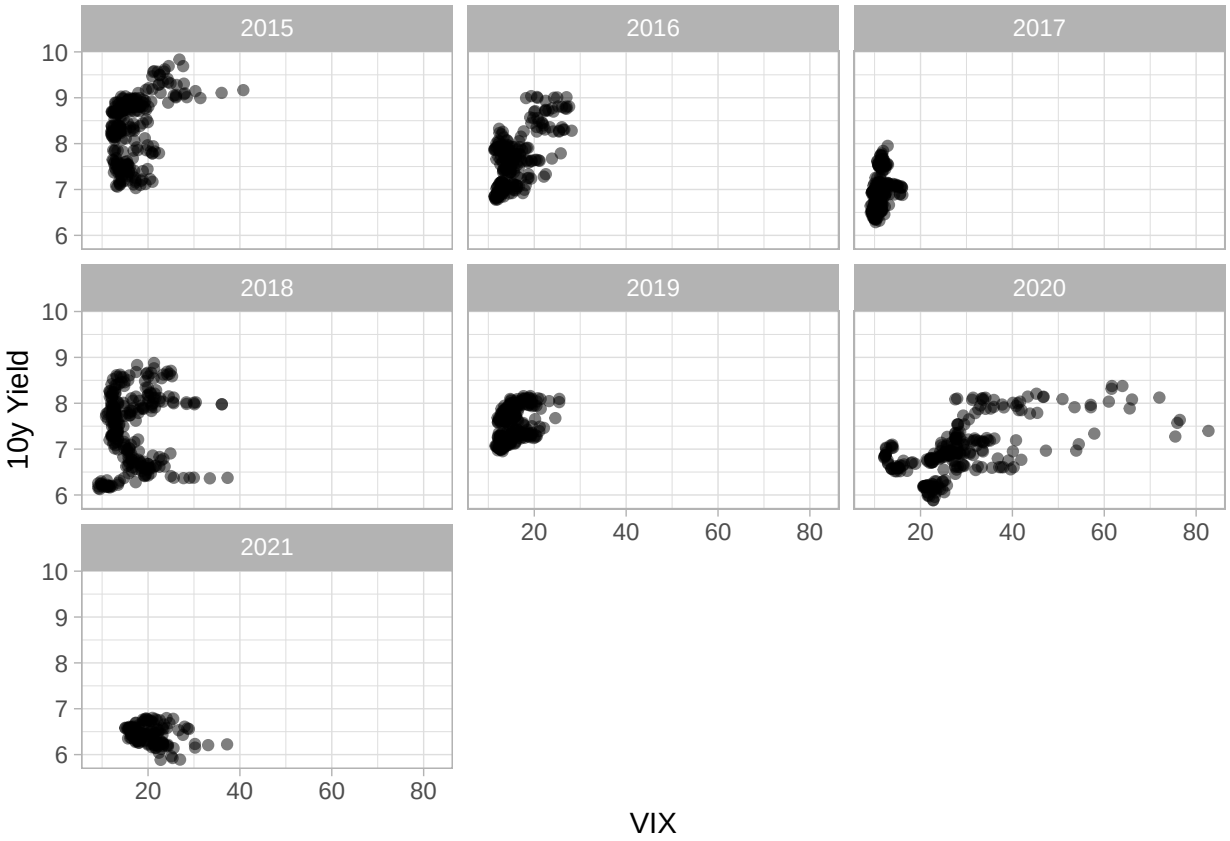
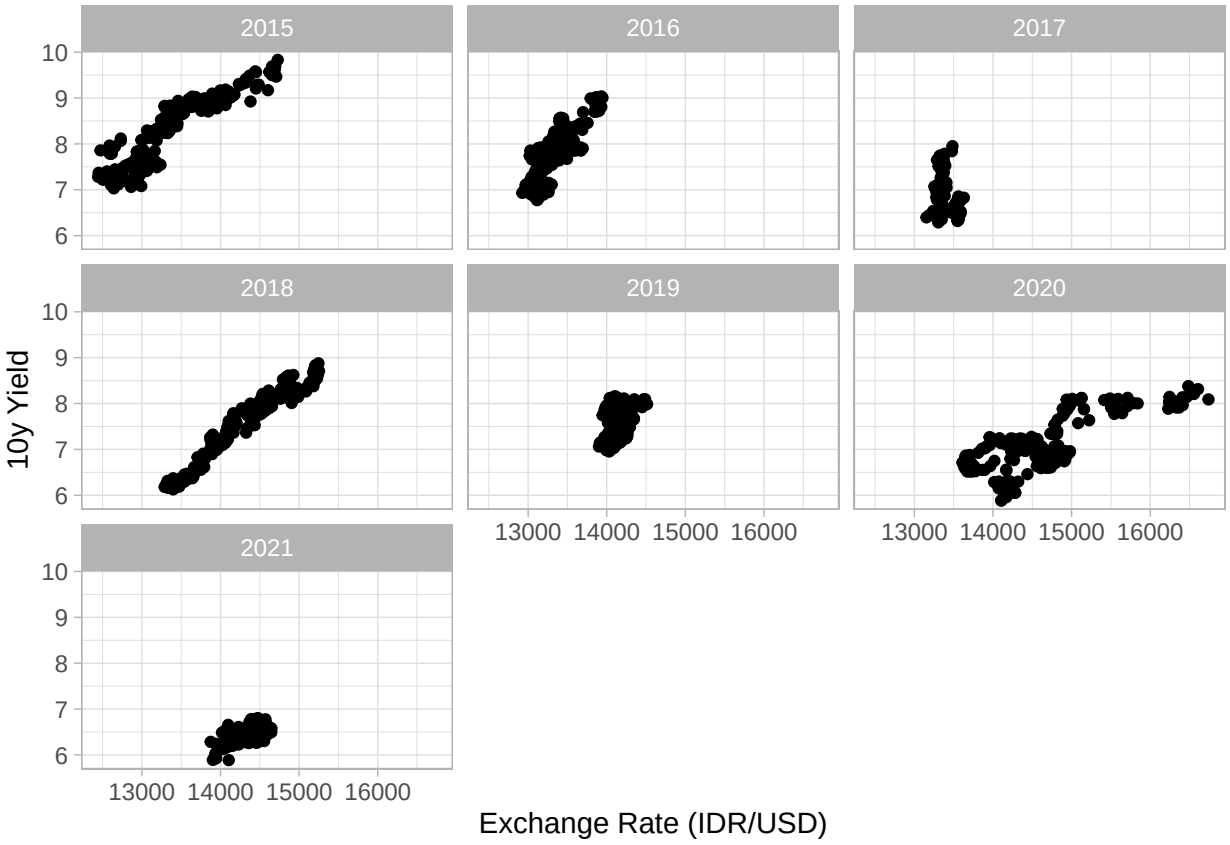

2015
2016
2017
2018
2019
2020
2021
10y Yield
VIX
10
9
8
7
6
20
40
60
80

## 4.4 Macroeconomic Risk (Exchange Rate USD/IDR)




## 4.5 System Risk (Primary Dealers Behavior)

Primary dealers system in Indonesia has been established since 2007. The system is expected to run several functions, such as intermediary between debt managers and investors in primary market, bookmakers and bonds distributors, liquidity provider between primary and secondary market, promoter of continuous market and efficient price discovery, and adviser to government (Arnone and Iden 2003).

In 2021, there are 20 primary dealers of conventional bonds comprise of 16 conventional banks and 4 securities companies. For sharia bonds, there are also 20 primary dealers consist of 13 conventional banks, 3 Islamic banks and 4 securities companies. Primary dealers are required to participate in every auction and to bid for a minimum quantity of the total offering amount. They can bid both on behalf of their customers and for their own accounts. As primary dealers can participate in competitive bidding in primary market as well as buy and sell in secondary market, they have direct contribution on forming yield of sovereign bonds.

Tchuindjo (2015) writes that primary dealers will make bilateral contracts for the offered securities during pre-sale period or known as when-issued market. Mercer et al. (2013) argue that traders in the when-issued market can "discover" the ultimate auction price. In addition, many primary dealers are believed to often short in the when-issued market Nyborg and Strebulaev (2004). This condition makes primary dealers to assign lower values to the auctioned securities (Tchuindjo 2015), which also means higher yields demanded.

Thus, our analysis will be based on assumption that primary dealers' strategic behavior in the auctions can affect sovereign bonds yield. We will use dummy variables of "auction days" and "non-auction days" to observe if there is any different pattern in yields movement from these time categories. Auction days is described as days started from auction announcement (T-3) until day of auction (T).

In the graph below, we will check the pattern of 10-year yield movement and the dummy categories.

From figure 1, volatility in non auction days (post auction) is also tend to be higher than volatility in auction days.

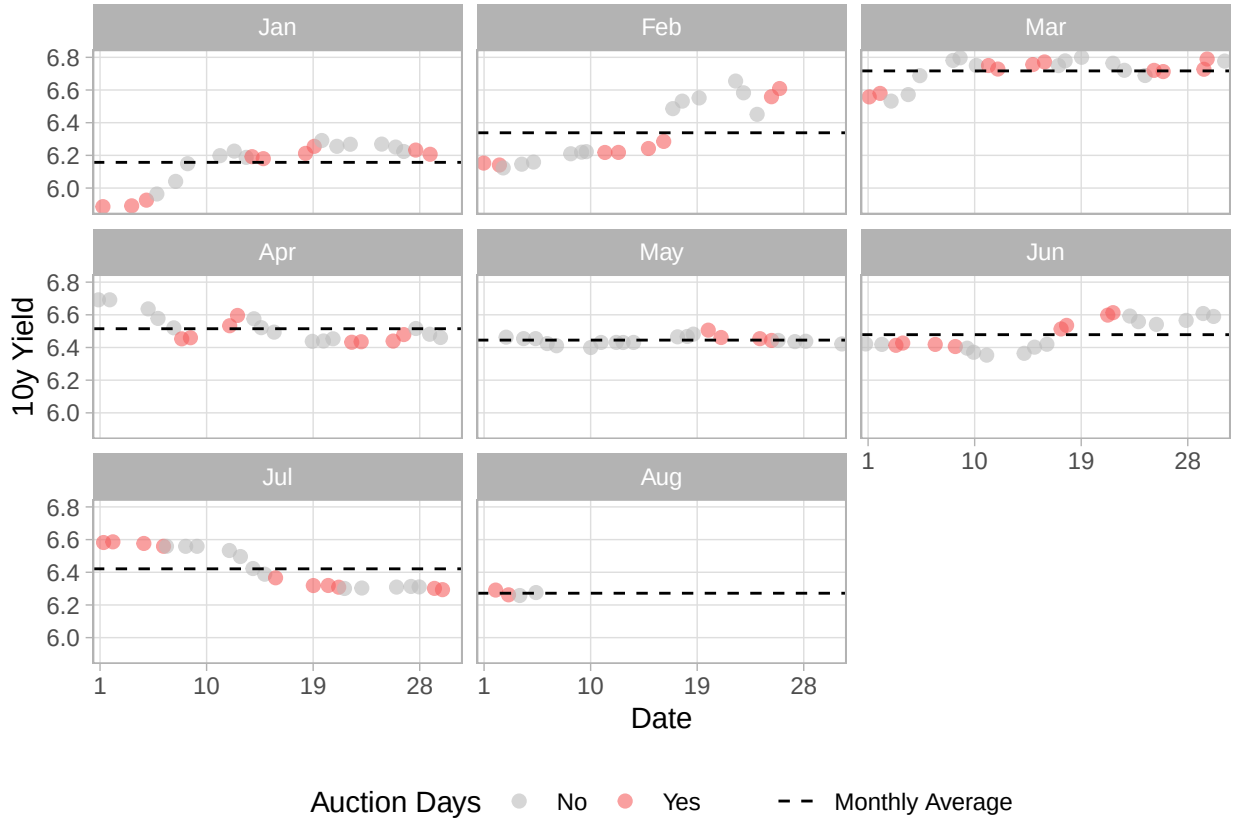



Figure 1: 10-year Yield's Movement during Auction Days during January-August 2021[3]

# 5 Research Methodology

In selecting determinant factors of 10-year sovereign bonds, we are influenced by several variables used in studies conducted by .....

Regarding these researches and the result of exploratory data analysis conducted in previous section, we can write down relationship between variables in OLS model as follow:

$$\begin{aligned} yield\_10y = &\alpha + \beta_1 ust\_10y + \beta_2 cds\_5y + \beta_3 foreign\_pct + \beta_4 policy\_rate + \beta_5 exchange\_rate \\ &+ \beta_6 vix^2 + \beta_7 auction\_days + \epsilon \end{aligned}$$

Summary statistic of the data is shown in table 1:

Dataset are covering period of 2 January 2015 until 5 August 2021. Analysis is conducted using R programming and R-Studio software.

[3]Full period of observation can be seen in the Appendix
[4]ibid


Figure 2: Boxplot of 10-year Yield's Movement during Auction Days during January-August 2021[4]


Figure 3: 10-year Yield's Movement during Auction Days from 2016-2021

Table 1:

| Statistic | N | Mean | St. Dev. | Min | Pctl(25) | Pctl(75) | Max |
|---|---|---|---|---|---|---|---|
| 10y Yield | 1,371 | 7.165 | 0.612 | 5.886 | 6.673 | 7.650 | 8.878 |
| 5y CDS | 1,371 | 115.163 | 38.156 | 58 | 85.3 | 137.6 | 291 |
| 10y UST | 1,371 | 1.961 | 0.731 | 0.507 | 1.534 | 2.518 | 3.237 |
| Policy Rate | 1,371 | 4.776 | 0.754 | 3.500 | 4.250 | 5.250 | 6.000 |
| Foreign Pct | 1,371 | 0.354 | 0.056 | 0.225 | 0.324 | 0.389 | 0.442 |
| VIX | 1,371 | 17.796 | 8.562 | 9.140 | 12.420 | 20.740 | 82.690 |
| Exchange Rate | 1,371 | 14,006.420 | 625.921 | 12,926 | 13,400 | 14,417.5 | 16,741 |

# 6 Analysis

In particular, the results suggest that improved macroeconomic fundamentals, such as higher net foreign assets (in terms of GDP or imports), lower fiscal deficits, and lower ratios of debt service to exports and debt to GDP, help to lower sovereign spreads (**arora?**)

a. UST vs Yield While the dramatic rise in capital flows to emerging markets has been induced primarily by the implementation of sound macroeconomic policies and wide structural reforms in these countries, it has also been driven by changing conditions in industrial countries that have encouraged investors to diversify their portfolios into developing country assets. Interest rate spreads (the differences between yields on sovereign bonds of developing countries and U.S. treasury securities of comparable maturities), which are a proxy for country risk, have tended to move in the same direction as the changes in U.S. interest rates (**arora?**)

b. CDS vs Yield

Sovereign CDS spreads are used as an indicator of foreign currency sovereign creditworthiness. Lower sovereign CDS spreads are expected to lower local currency sovereign bond yields (**gadanecz?**)

c. Foreign Ownership vs Yield

d. Bank Indo Rate vs Yield

e. Exchange rate (JISDOR) vs Yield Investors are exposed to gains and losses from exchange rate movements on their holdings of local currency sovereign bond. exchange rate risk can represent an important channel of transmission of market sentiment, uncertainty and default risk to local currency bond yield Exchange rate risk tends to affect liquidity conditions in both foreign exchange and domestic bond markets, which tend to be relatively low in many EMEs even in tranquil times. The direction of the causality runs from exchange rate volatility to local currency sovereign bond yields. This is especially the case in Asia and eastern Europe. In these two regions, local currency sovereign bond markets are relatively liquid and foreign participation relatively large.

The sensitivity of EME local currency sovereign bond yields to exchange rate volatility increases after the global financial crisis, and further after the taper tantrum in mid-2013 (**gadanecz?**)

f. Volatility index (VIX) vs Yield It is a measure of market expectations of near-term volatility conveyed by S&P500 stock index option prices and considered as a forward-looking measure of investor risk. Hartelius et al. (2008) highlights the strong dependence of emerging market returns to the VIX, which should be positively related to changes in emerging market spreads since more risk aversion increases spreads. An attractive feature of this index is that it can be considered as exogenous for emerging economies (Siklos, 2011). (**hajer?**)

This result could be explained by the fact that as investors become more risk-averse and seek safer assets, the expected growth in volatility encourages them to liquidate their positions in risky assets in favor of safer ones, thus increasing sovereign spreads. (**hajer?**)

Intended to capture changes in investor sentiment which may be related to expected changes in U.S. monetary policy. It may also pick up the effects of other market-related events, such as the flight to quality effects during the Asian crisis. (**arora?**)

As historical data demonstrates a strong negative correlation of volatility to the stock market returns – that is, when stock returns go down, volatility rises and vice versa.(investopedia)

# 7 Conclusion

factors that steadily affect the yield? (foreign and insurance/pension fund are steadily associated with yield movement. Foreign has strongly negative correlation until 2019, while insurance/pension has strongly positive correlation)

pandemic effect? i.e. holding spending for investing in safe instrument? (need to check ownership of domestic banks, mutual funds, insurance, individual investors)

shifting power (bonds ownership) foreign to domestic participant (Do central bank/domestic banks become more dominant)? (Quantitative easing of Bank Indonesia and mandatory purchase of domestic banks can push down the yield)

# 8 Timeline

Chapter 1 + Data collection/conversion from excel tables 31 Aug 2021,

Chapter 2 1 Sep - 25 Oct 2021,

Chapter 3 26 Oct - 1 Nov 2021,

Conclusion, Bibliography, cleaning Code, creating slides 2 - 5 Nov 2021

Several studies indicates the relationship between bonds yield and foreign ownership (i.e. . . . . ). We will observe the relationship between these two variables through visualization approach.

As we can see from the plot, in 2015 and 2016 foreign ownership seems to have no strong relationship with the yield. Different situation happened in 2017-2019 where the changes in foreign ownership seems to strong-negatively affect the bonds yield movement.

To mention, 2017 is the year when Indonesia got investment grade rating from S&P, following FITCH and Moody's in previous years. It means that broader category of foreign investment entities (i.e. pension funds and insurance) can enter the country's market since Indonesia's rating has fulfilled their criteria of investment (yunianto, 2018).

Particularly In 2020, the pattern is quite anomaly in which increase from 0.25-0.33% in foreign ownership seems to raise the yield from 6 up to 8.5%. The yield stumbles afterwards with the increase of foreign ownership up to 40%.

In January-August 2021, the relationship looks non-linear with no obvious pattern. The ownership drops below 25% but interestingly yield decreases further (6-7%).

We may assume that the anomaly in 2020 and 2021 are due to Covid19 pandemic that occurred since early 2020. The government is increasing its funding to sustain the economy. The decrease in foreign portion could be because foreigners sell their bonds more than their buying (net sell), or another reason is because their portion is deluged by domestic participants (i.e. central bank), thus we will track the pattern of domestic ownership in these years to check our assumption.

```
##
## Call:
## lm(formula = domestic_10y ~ cds_5y + ust_10y + foreign + rate +
##     con_bank, data = yield_factors)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.44899 -0.15056 -0.03247  0.17758  0.75192
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.477e+00  9.800e-02   15.07   <2e-16 ***
## cds_5y      1.171e-02  2.492e-04   47.01   <2e-16 ***
## ust_10y     3.056e-01  1.252e-02   24.40   <2e-16 ***
## foreign     1.082e-03  7.989e-05   13.55   <2e-16 ***
## rate        4.955e-01  1.382e-02   35.85   <2e-16 ***
## con_bank    6.016e-04  3.615e-05   16.64   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2404 on 1368 degrees of freedom
##   (338 observations deleted due to missingness)
## Multiple R-squared:  0.8461, Adjusted R-squared:  0.8456
## F-statistic:  1504 on 5 and 1368 DF,  p-value: < 2.2e-16

## `geom_smooth()` using method = 'gam'
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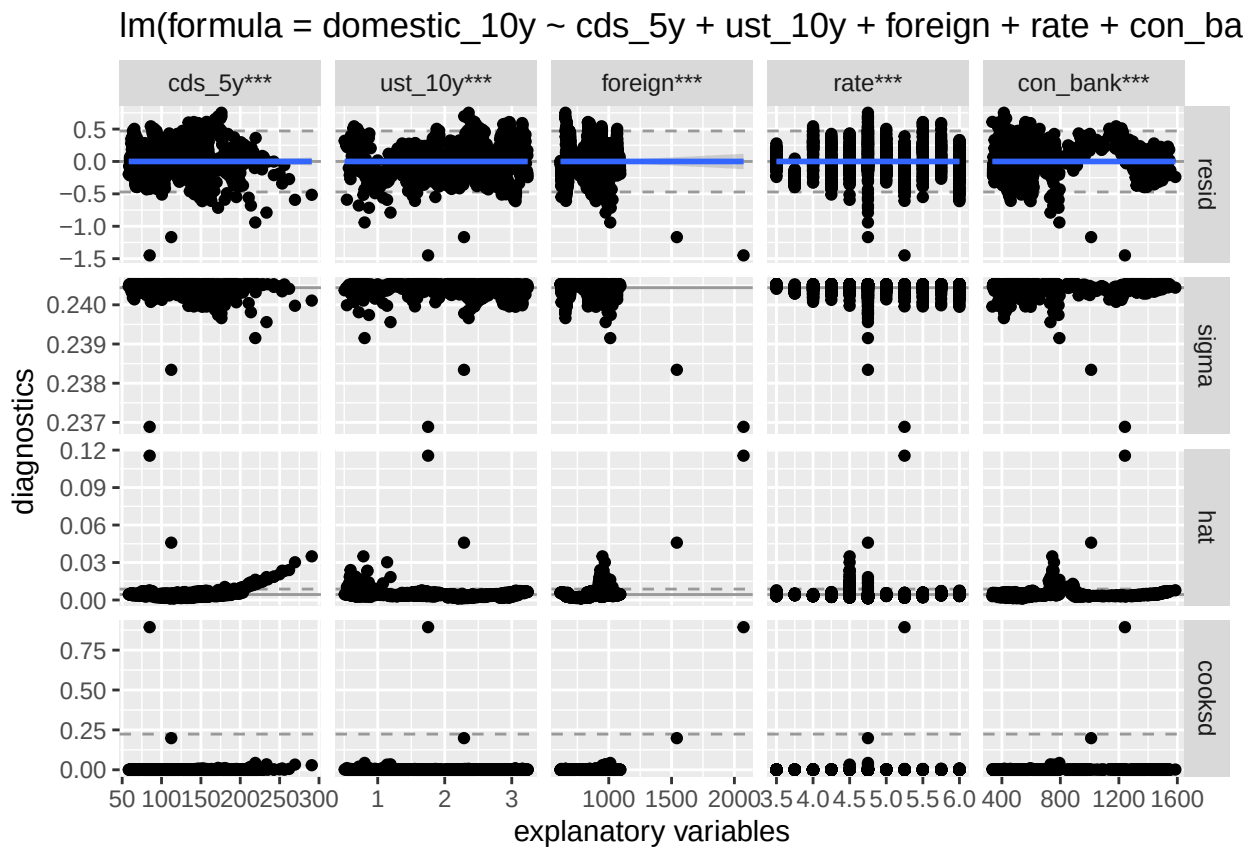


As shown in the plot, proportion of Bank Indonesia and Conventional Bank are getting bigger in 2020-2021, while proportion of foreign holders is diluted. This is can be seen as a result of implementation of new regulation on 1 May 2020 that mandate banks to reserve government bonds. This regulation has an impact on reducing bonds yield further in these two consecutive years.

Another noticeable change is proportion of individual in the bonds ownership that is growing started from mid of 2020 up to 2021. We may argue that people who prefer to hold their spending is channelling their excess money to investment, especially in a safe instrument like government bonds.

### 8.1 Policy Rate

From plot above, the movement of domestic 10y yield is parallel with movement of policy rate. The median spread in 2016 until 2018 is quite the same (around 2.5) while median spread of 2019 is the lowest. In 2020 and 2021, the differences between 10y yield and policy rate are increase with median spread is about 3. The range of spread in 2020 is also the widest compared to other observed years.

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