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DYNAMIC LINKAGES AMONG GOVERNMENT BONDS YIELD (SBN-DOMESTIC), MARKET INDEX (IHSG), US TREASURY BOND YIELD, SP500 AND EXCHANGE RATE (IDR/USD)- EFFECT OF PANDEMIC-COVID19 BY VECTOR ERROR CORRECTION MODEL (VECM) APPROACH: EVIDENCE FROM INDONESIA

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ABSTRACT

This study empirically examines the dynamic linkages among yield SBN-Domestic and IDX-Composite to the shocks of US Treasury bonds, SP500, and IDR/USD. Analysis applying VECM. IRF, VD, and Granger causality. testing proved that in the long run, during the pandemic-covid19 period, the SBN-Domestic experienced a significant change to all shocks, but the biggest changes were on SBN3Y and SBN5Y. This was due to the fact that during the Covid-19 pandemic, SBN3Y and SBN5Y were considered high risk. IDX-Composite was significantly changed for SP500 during the pandemic-covid19 period. The variance decomposition test proved that in the long run, SP500 has the highest variance contribution.

Keywords: Dynamic linkages, SBN-Domestics, IDX-Composite, VECM, Shock

1.0 INTRODUCTION

Financial market integration has become a very important thing to know, especially when there are economic, trade, and investment relations between countries. Eiteman et al (2010) said that market integration is a condition where stock prices in various capital markets in the world have a very close relationship (closely correlated) with every capital market in the world. Another definition of market integration is described by Click & Plummer (2005), which says that from the point of view of investors who have portfolios, market integration shows that two different markets have the same direction of movement and are correlated. Financial market integration at one time will lead to smaller portfolio diversification opportunities. The co-movement between financial markets to the shocks will lead to contagion and ultimately higher levels of correlation, thereby reducing opportunities for diversification (Hyde, Bredin, & Nguyen, 2010). In line with the statement above, a literature study from Panda & Nanda (2016) says that if the returns from two or more stock markets in several different countries are not correlated and stable, then it will provide potential profits from diversification, or in other words, if the correlation co-movement between stock markets is low, it will provide benefits for investors who diversify between global stock markets. This reduced opportunity for diversification is due to the high correlation so that when shocks occur in a country's financial markets, they will be transmitted (contagious) quickly to financial markets in other countries in the world that are integrated with each other. The latest

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empirical study from Caporale, Gil-Alana, & You (2021) says that financial integration can be divided into two types, namely regional integration and global integration.

There are several empirical studies that analyze the impact of financial shocks on other macroeconomic variables. Greene (2008), Gujarati (2008), and Hamilton (2001) say that response is a concept of a combined impact between various parameters that come directly, indirectly, and dynamically (not instantly). Dynamic linkages occur due to indirect impacts, interdependencies between variables, and between times on shocks of other transmitting variables (Wen et al, 2014). Referring to a research article conducted by Koskita & Laopodis (2019) explains that dynamic linkages in time series data are divided into two types, namely short-run and long-run dynamic linkages obtained by the cointegration test, These dynamic linkages are obtained by constructing a vector autoregressive (VAR) model or vector error correction model (VECM) and Engle's (2002) dynamic condition correlation generalized autoregressive conditional heteroskedasticity (DCC-GARCH) specification. Nautuyal & Kavidayal (2018) in their research used the VECM model to explain dynamic alliance linkages between stock markets in the US, UK, Japan, Germany, India, China, Malaysia, and Korea. Panda & Nanda (2016) in their research used the VECM model with the analysis methods of cointegration test, variance decomposition test, and granger causality to test dynamic linkages between stock markets in South America and Central America. Mohanasundaram & Karthikeyan (2015) tested the cointegration and interdependence of stock markets in African countries, India against the US using the VAR model. Chen et al (2020) conducted research on dynamic linkages in the bitcoin market during the Covid-19 pandemic by using the VAR model to determine bitcoin's dynamic interdependencies, this analysis was carried out by cointegration tests. Aimprasittichai et al (2015) in their research concluded that the shock that occurred in the American stock market would quickly be transmitted to other countries stock markets in an easily recognizable way, but there were no foreign stock markets that could significantly affect the movement and behavior of the American stock market. This situation proves that there is a dominance of the American stock market over the stock markets of other countries in the world.

Related to the findings above, other empirical findings were obtained from Caporale, Gil-Alana, & You (2019) who found that there was cointegration between ASEAN 5 and the United States, but there were almost no linkages between ASEAN 5 and China, but there is a relationship between Indonesia and China. These empirical findings are in line with the empirical findings by Vo & Tran (2020) which say that the volatility that occurs in the US capital market will be responded to significantly by the ASEAN capital market, in his research proving that there is cointegration in the ASEAN equity market and the existence of external market effects. such as the United States (US) and China towards the ASEAN equity market. Paucar (2020). In his research, he concluded that by using the VAR model, it was proven that the US markets significantly influenced the Columbian Stock Market. The dynamic linkages between regional and global economic and financial systems on bond yields have been studied by Bredin, Hyde, & Reilly (2010) who said that bond yields (bond returns) are largely determined by domestic monetary policy (inflation expectations). the study was conducted using samples from the UK, US, and Germany. Contrasts with the findings of research conducted by Dhingra & Patel (2021), which examines Financial Linkages and Interdependences in BRICS countries using the Government 10-year bond yield variable and the results of the research reveal that based on the results of the Johansen

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176

cointegration analysis test there is a long-term relationship between BRICS countries while the short-run relationship is not significant. These findings are in line with empirical findings in research conducted by Bianconi, Yoshino, & Sousa (2012) who conducted research on the Behavior of stocks and bonds in BRIC countries against US Financial Stress in the period January 2003 - July 2010. The results of the study revealed that in the long run deviations that occur in the BRIC stock market and government bonds are more influenced by US financial stress than deviations originating from BRIC countries. The correlation between stock and bond returns with US financial stress in Brazil and Russia is negative and significant. Much earlier Wang (2013) had examined dynamic linkages in the stock market in East Asian countries during the 2007-2009 global financial crisis using the VAR model approach, the results of the study said that during the global financial crisis period, The financial markets in East Asia have very strong dynamic linkages, the South Korea and Japan capital markets have strong linkages to shocks originating from the US, whereas in the period after the global financial crisis, all countries in East Asia have low linkages to shocks that occurred in the United States. In this study, to examine the dynamic linkages between variables during the research period, the authors adopted the empirical method developed by Koskita and Laopodis (2019), Laopodis (2012), and Laopodis (2010). VECM model would be analyzed by using explaining of impulse response functions (IRF), variance decomposition (VD and Granger causality.

Based on the results of the several studies described above, what has caught the attention of Indonesia is the lack of research examining the existence of dynamic linkages between the yields of domestic government bonds (SBN), not only on the 10-year tenor but on various tenors. (SBN20Y, SBN15Y, SBN10Y, SBN5Y, SBN3Y) and IDX Composite (IHSG)during the pre-pandemic-covid19 and during the pandemic-covid19 shocks that occurred in the US as the world's largest economic power, which was reflected in changes in yieldsUS government benchmark bond (T-Bond10Y), exchange rate (IDR/USD) and SP500 index price.

2.0 HYPOTHESES DEVELOPMENT

H1: There is a change in the dynamic linkages between SBN-Domestics yields (SBN20Y, SBN15Y, SBN10Y, SBN5Y, and SBN3Y) and the IHSG with treasury bond yields (T-Bond10Y) in the period before the covid19 pandemic and during the covid19 pandemic.

H2: There is a change in the dynamic linkages betweenSBN-Domestics yields (SBN20Y, SBN15Y, SBN10Y, SBN5Y, and SBN3Y) and the IHSG with the SP 500 index in the period before the Covid-19 pandemic and during the Covid-19 pandemic.

H3: There is a change in the dynamic linkages betweenSBN-Domestics yields (SBN20Y, SBN15Y, SBN10Y, SBN5Y, and SBN3Y) and the IHSG at the IDR/USD exchange rate before the pandemic-covid19 and during the pandemic-covid19.

3.0 RESEARCH DESIGN

3.1 Sample and Data

This research was conducted in Indonesia. Indonesia is one of the countries that are members of the G20 countries and is one of the representative countries for developing countries (emerging markets) in the world. As one of the emerging market countries, it is suspected that there is a correlation that creates dynamic linkages between the Indonesian financial market and US financial market. Daily data series yields of government bonds were collected from wolrdgovernmentbonds.com, while the daily series of variables SP500 and Exchange rate IDR/USD were collected from investing.com from January -02-2018 to December -31-2021 (984 observations). Data was divided into two periods, namely: January 2018-Feb 2020 is named become pre pandemic-covid19 period, while Maret-9-2020 -December -31-2022 is named the pandemic-covid-19 period.

3.2 Stasionerity Test

Table1: ADF-test at data level of all variables during the pre- pandemic-covid 19 period

Variabels	t-Statistic (critical values):	**1%**	**ADF-test t-Statistic**	Prob*
	5%	**10%**		
LNSBN20Y	-3.442299	-2.866703 -2.569580	**-2.043357**	**0.2683**
LNSBN15Y	-3.442299	-2.866703 -2.569580	**-2.086103**	**0.2505**
LNSBN10Y	-3.442322	-2.866713 -2.569586	**-2.238839**	**0.1929**
LNSBN5Y	-3.442299	-2.866703 -2.569586	**-1.379612**	**0.5931**
LNSBN3Y	-3.442276	-2.866693 -2.569575	**-0.708734**	**0.8421**
LNIHSG	-3.442276	-2.866693 -2.569575	**-1.620109**	**0.4716**
LNT-Bond10Y	-3.442276	-2.866693 -2.569575	**1.436615**	**0.9992**
LNSP500	-3.442276	-2.866693 -2.569575	**-1.851730**	**0.3553**
LNIDR/USD	-3.442299	-2.866703 -2.569580	**-2.091646**	**0.2483**

Table 2: ADF-test at first difference all variables during pre- pandemic-covid19 period

Variabel	t-Statistic (critical values):	**1%**	**ADF-test t-Statistic**	Prob*
	5%	**10%**		
LNSBN20Y	-3.442299	-2.866703 -2.569580	**-17.46373**	**0.0000**
LNSBN15Y	-3.442299	-2.866703 -2.569580	**-16.46376**	**0.0000**
LNSBN10Y	-3.442322	-2.866713 -2.569586	**-15.60267**	**0.0000**
LNSBN5Y	-3.442299	-2.866703 -2.569580	**-16.71721**	**0.0000**
LNSBN3Y	-3.442299	-2.866703 -2.569580	**-22.07856**	**0.0000**
LNIHSG	-3.442299	-2.866703 -2.569580	**-22.11580**	**0.0000**
LNT-Bond10Y	-3.442299	-2.866703 -2.569580	**-22.93013**	**0.0000**
LNSP500	-3.442299	-2.866703 -2.569580	**-22.64972**	**0.0000**
LNIDR/USD	-3.442299	-2.866703 -2.569580	**-18.59765**	**0.0000**

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176

Table 3: ADF-test at data level of all variables during pandemic-covid 19 period

Variabel	t-Statistic (critical value): 1%	5%	10%	ADF-test t-Statistic	Prob*
LNSBN20Y	-3.444890	-2.867845	-2.570192	**-1.540826**	**0.5121**
LNSBN15Y	-3.444890	-2.867845	-2.570192	**-1.046724**	**0.7375**
LNSBN10Y	-3.444890	-2.867845	-2.570192	**-1.584811**	**0.4895**
LNSBN5Y	-3.444890	-2.867845	-2.570192	**-1.024752**	**0.7456**
LNSBN3Y	-3.444856	-2.867830	-2.570184	**-0.925917**	**0.7797**
LNIHSG	-3.444856	-2.867830	-2.570184	**-0.924108**	**0.7803**
LNT-Bond10Y	-3.444856	-2.867830	-2.570184	**-1.520339**	**0.5226**
LNSP500	-3.444991	-2.867889	-2.570216	**-0.712161**	**0.8411**
LNIDR/USD	-3.444890	-2.867845	-2.570192	**-2.090425**	**0.2488**

Tabel 4: ADF-test at first difference of all variables during pandemic-covid 19 periods

Variabel	t-Statistic (critical value): 1%	5%	10%	ADF-test t-Statistic	Prob*
LNSBN20Y	-3.444890	-2.867845	-2.570192	**-16.73743**	**0.0000**
LNSBN15Y	-3.444890	-2.867845	-2.570192	**-15.60921**	**0.0000**
LNSBN10Y	-3.444890	-2.867845	-2.570192	**-15.24770**	**0.0000**
LNSBN5Y	-3.444890	-2.867845	-2.570192	**-17.20479**	**0.0000**
LNSBN3Y	-3.444890	-2.867845	-2.570192	**-22.46305**	**0.0000**
LNIHSG	-3.444923	-2.867859	-2.570200	**-15.91827**	**0.0000**
LNT-Bond10Y	-3.444991	- 2.867889	-2.570216	**-13.95864**	**0.0000**
LNSP500	-3.444991	- 2.867889	-2.570216	**-11.44101**	**0.0000**
LNIDR/USD	-3.444890	-2.867845	-2.570192	**-17.88680**	**0.0000**

Tables 1, 2, 3 and 4 above gave us the information that data are not stationer at level but stationer by process of differencing (first different) the period prepandemic-covid19 and pandemic-covid19 (ADF t-statistic is bigger than t-statistic and significant at its all critical value), thus we rejected Ho.

3.3 Cointegration Test

Table 5: Cointegration test result in the pre-pandemic-covid19 period

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**

None *	0.115906	207.7184	197.3709	**0.0138**
At most 1	0.068009	141.6875	159.5297	0.3056
At most 2	0.057898	103.9358	125.6154	0.4768
At most 3	0.043123	71.96787	95.75366	0.6546
At most 4	0.034115	48.34066	69.81889	0.7080
At most 5	0.026314	29.73591	47.85613	0.7323
At most 6	0.019979	15.44266	29.79707	0.7507
At most 7	0.006913	4.625473	15.49471	0.8472
At most 8	0.001691	0.907053	3.841466	0.3409

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.115906	66.03094	58.43354	**0.0076**
At most 1	0.068009	37.75166	52.36261	0.6359
At most 2	0.057898	31.96795	46.23142	0.6595
At most 3	0.043123	23.62721	40.07757	0.8459
At most 4	0.034115	18.60475	33.87687	0.8453
At most 5	0.026314	14.29326	27.58434	0.8019
At most 6	0.019979	10.81718	21.13162	0.6655
At most 7	0.006913	3.718420	14.26460	0.8878
At most 8	0.001691	0.907053	3.841466	0.3409

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 6: Cointegration test result in the pandemic-covid19 period

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.188902	244.4461	197.3709	**0.0000**
At most 1	0.091304	152.1155	159.5297	0.1179
At most 2	0.070560	109.8919	125.6154	0.3019
At most 3	0.050346	77.62242	95.75366	0.4473
At most 4	0.042655	54.84126	69.81889	0.4257
At most 5	0.038827	35.61750	47.85613	0.4158
At most 6	0.031042	18.15336	29.79707	0.5547
At most 7	0.008164	4.247006	15.49471	0.8826
At most 8	0.001432	0.631819	3.841466	0.4267

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.188902	92.33064	58.43354	**0.0000**
At most 1	0.091304	42.22360	52.36261	0.3655
At most 2	0.070560	32.26944	46.23142	0.6398
At most 3	0.050346	22.78116	40.07757	0.8860
At most 4	0.042655	19.22376	33.87687	0.8081
At most 5	0.038827	17.46414	27.58434	0.5403
At most 6	0.031042	13.90636	21.13162	0.3728
At most 7	0.008164	3.615187	14.26460	0.8976
At most 8	0.001432	0.631819	3.841466	0.4267

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The information on the cointegration test results above concludes that based on the cointegration rank test (Trace) and maximum eigenvalue values in the period of pre-pandemic-covid19 and during pandemic-covid19, there was one significant cointegration, respectively, at p-values of 0.01% and 0.00% (α =0.05%) in the pre -pandemic-covid19, and p-values (0.00%) and (0.00%) (α=0.05%) during the pandemic-covid19 period, thus we concluded that existence of cointegration in the variables. Therefore, the optimum model used to estimate the changes of dynamic linkages of all variables in the model in the period pre-pandemic-covid19 and during pandemic-covid19 is the Vector Error Correction Model (VECM).

4.0 EMPIRICAL RESULTS AND ANALYSIS

Tables 7 and 8 below will explain the summary statistics result during the period pre pandemic-covid19 and during pandemic-covid-19.

Table 7: Summary statistics result in the pre-pandemic-covid19 period

	SBN20Y	SBN15Y	SBN10Y	SBN5Y	SBN3Y	IHSG	T-Bond10Y	SP500	IDR/USD
Mean	2,072	2,050	2,000	1,941	1,908	8,728	0,870	7,958	9,557
Median	2,066	2,050	1.996	1,931	1,907	8,734	0,976	7,951	9,556
Maximum	2,221	2,200	2,181	2,150	2,094	8,808	1,175	8,128	9,631
Minimum	1,921	1,883	1,802	1,710	1,686	8,604	0,151	7,759	9,495
Std.Dev.	0,066	0,074	0,085	0,115	0,110	0,040	0,239	0,067	0,029
Skewness	-0,060	-0,358	-0,296	-0,127	-0,235	-0,273	-0,665	0,424	0,442

Kurtosis	2,409	2,331	2,439	1,956	1,896	2,254	2,066	3,105	3,373
J-B	8,175	21,591	14,887	25,853	32,341	19,171	59,399	16,393	20,669
Probability	0,017	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Observations	539	539	539	539	539	539	539	539	539

Table 8: Summary statistics result in during pandemic-covid19 period

	SBN20Y	**SBN15Y**	**SBN10Y**	**SBN5Y**	**SBN3Y**	**IHSG**	**T-Bond10Y**	**SP500**	**IDR/USD**
Mean	1,985	1,920	1,895	1,737	1,649	8,644	0,057	8,227	9,579
Median	1,978	1,863	1,872	1,709	1,619	8,699	0,147	8,252	9,573
Maximum	2,165	2,162	2,132	2,033	1,595	8,813	0,556	8,473	9,716
Minimum	1,870	1,814	1,777	1,613	1,465	8,278	-0,670	7,705	9,537
Std.Dev.	0,054	0,093	0,077	0.114	0,127	0.121	0,362	0,171	0,031
Skewness	0,805	0,7682	1,150	1,163	0,896	-0,607	-0,261	-0,584	2,183
Kurtosis	3,644	2,171	3,675	3,334	2,867	2,258	1,523	2,516	8,932
J-B	55,714	56,546	106,623	102,393	59,864	37,520	45,504	29,623	1005,999
Probability	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Observations	445	445	445	445	445	445	445	445	445

Table 9: Correlation matrix in the pre pandemic-covid19 period

	LNSBN20Y	*LNSBN15Y*	*LNSBN10Y*	*LNSBN5Y*	*LNSBN3Y*	*LNIHSG*	*LNTBond10Y*	*LNSP*
LNSBN20Y	1							
LNSBN15Y	0,986641	1						
LNSBN10Y	0,991797	0,987272	1					
LNSBN5Y	0,967839	0,96323	0,980419	1				
LNSBN3Y	0,955202	0,952666	0,966803	0,987356	1			
LNIHSG	-0,37626	-0,367	-0,37735	-0,38259	-0,34934	1		
LNTBond10Y	**0,362378**	**0,303874**	**0,368309**	**0,471051**	**0,466455**	-0,12352	1	
LNSP500	**-0,24813**	**-0,20852**	**-0,27232**	**-0,36218**	**-0,38166**	**-0,04067**	**-0,73618**	
LNIDRUSD	**0,908857**	**0,876821**	**0,904027**	**0,88383**	**0,86792**	**-0,58332**	**0,33042**	-0,20

Table 10: Correlation matrix during pandemic-covid19 period

	LNSBN20Y	*LNSBN15Y*	*LNSBN10Y*	*LNSBN5Y*	*LNSBN3Y*	*LNIHSG*	*LNTBOND10Y*	*LN*
LNSBN20Y	1							
LNSBN15Y	0,885691	1						
LNSBN10Y	0,97122	0,919629	1					
LNSBN5Y	0,926787	0,886818	0,960192	1				
LNSBN3Y	0,838294	0,841801	0,881102	**0,956528**	1			
LNIHSG	-0,82134	-0,96198	-0,86715	-0,84482	-0,79913	1		
LNTBOND10Y	**-0,54206**	**-0,83489**	**-0,62372**	**-0,60393**	**-0,61757**	**0,841511**	1	
LNSP500	**-0,76969**	**-0,92204**	**-0,83446**	**-0,85138**	**-0,85343**	**0,924231**	**0,828646**	
LNIDRUSD	**0,792076**	**0,705853**	**0,788364**	**0,683498**	**0,553902**	**-0,67991**	-0,43163	-(

Tables 9 and 10 above showed the changing correlation between variables in both periods, but the significant correlation has changed in the period pandemic-covid19 especially the correlation SBN-Domestics and IHSG to the SP500 and T-Bond10Y. T-Bond10Y has a

Volume: 06, Issue: 01 January - February 2023

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negative correlation to all SBN-Domestic and a positive correlation to the IHSG during the pandemic covid19 period while has a positive correlation to all SBN-Domestic and a negative correlation to the IHSG in the pre-pandemic-covid19 period. SP 500 has a negative correlation to all SBN-Domestic and IHSG in the pre-pandemic-covid19 and during the pandemic-covid19 period (except USD/IDR) and the correlations were significantly encreased during the pandemic-covid19 period. USD/IDR has dominated in the period pre-pandemic-covid-19, in other words, we find that the variable USD/IDR does not show a significant changing during the pandemic-covid-19 period.

Table 11: Lag-length criteria selection results pre pandemic-covid 19 periods

Lag	LogL	LR	FPE	**AIC**	SC	HQ
0	10765.57	NA	3.00e-29	-40.13646	-40.06453	-40.10832
1	17629.40	13471.54	3.06e-40	-65.44552	-64.72617*	-65.16409
2	17795.44	320.3086*	2.23e-40*	**-65.76283***	-64.39607	-65.22812*
3	17848.56	100.6915	2.47e-40	-65.65881	-63.64462	-64.87081

Table 12: Lag-length criteria selection results during pandemic-covid 19 periods

Lag	LogL	LR	FPE	**AIC**	SC	HQ
0	7564.143	NA	1.15e-26	-34.18617	-34.10286	-34.15331
1	13010.52	10646.32	3.29e-37	-58.46390	-57.63083	-58.13532
2	13291.57	537.9417	1.33e-37	-59.36912	-57.78628*	-58.74480*
3	13415.59	232.3120*	1.10e-37*	**-59.56374***	-57.23114	-58.64370

*** Indicates the lag order selected by the criterion**

The optimum lag chosen based on the Akaike Information Criterion (AIC) is lag-2 during the period pre pandemic-covid19 and lag-3 during the pandemic-covid-19 period.

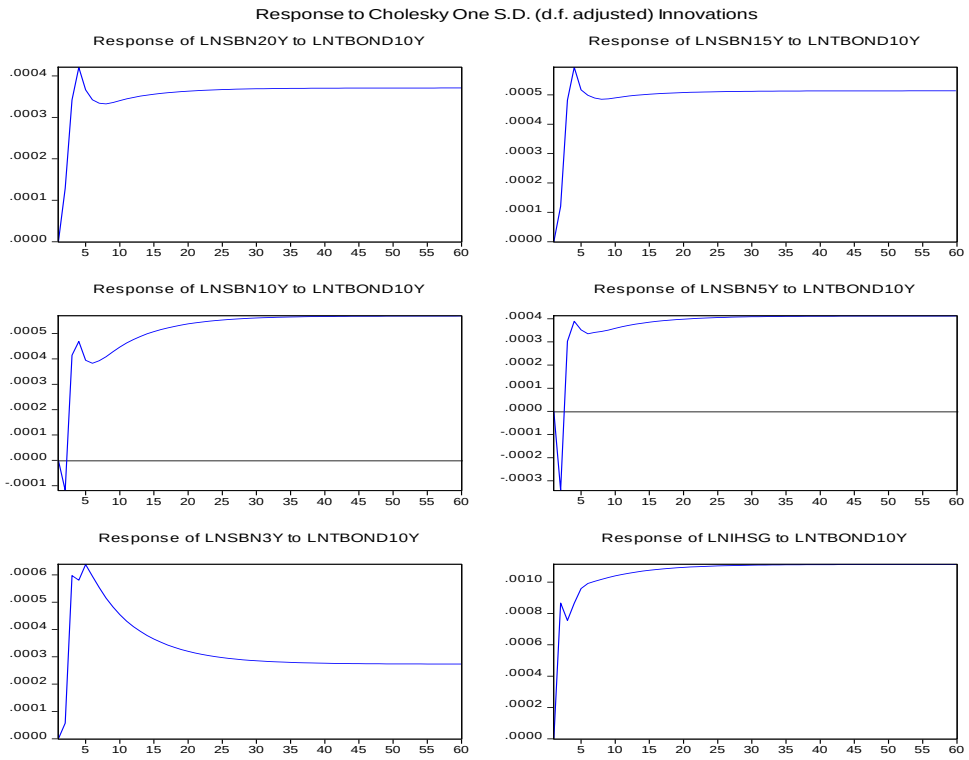
4.1 Impluse Response Fuction (IRF) by VECM in the pre-pandemic-covid19 and duringpandemic-covid19 period

4.1.1 Impulse Response Functions (IRF)SBN-Domestic (SBN20Y,SBN15YSBN10Y, SBN5Y and SBN3Y) and IHSG to the shocks from T-Bond10Y in the pre- pandemic-covid19 and during pandemic-covid19 period

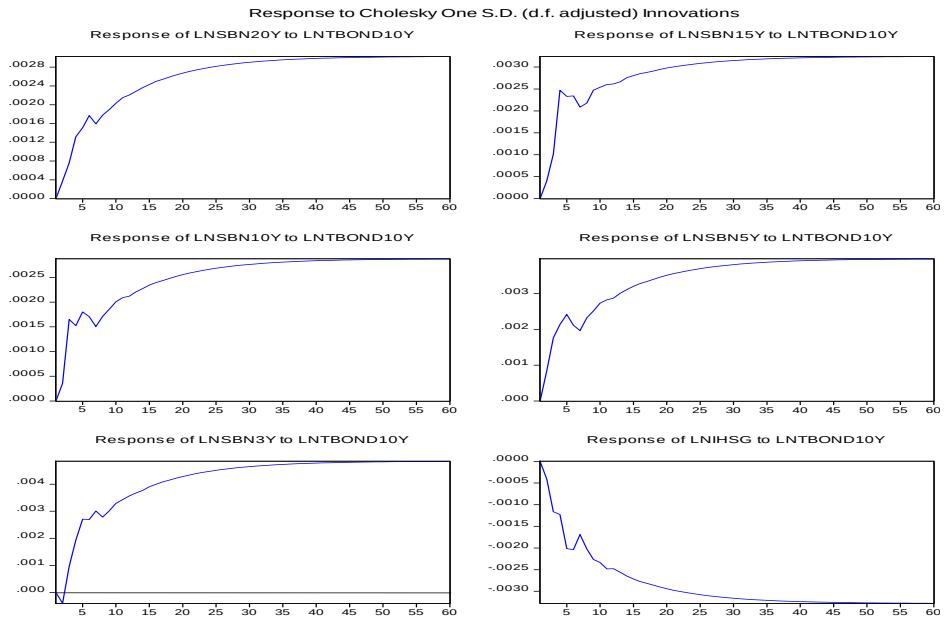
a. In the pre- pandemic-covid19

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176



b. During pandemic-covid19 period



4.1.2 Impulse Response Functions (IRF) SBN-Domestic (SBN20Y,SBN15YSBN10Y, SBN5Y and SBN3Y) and IHSG to the shocks fromSP500 in the pre- pandemic-covid19 and during pandemic-covid19 period

a. In the pre- pandemic-covid19

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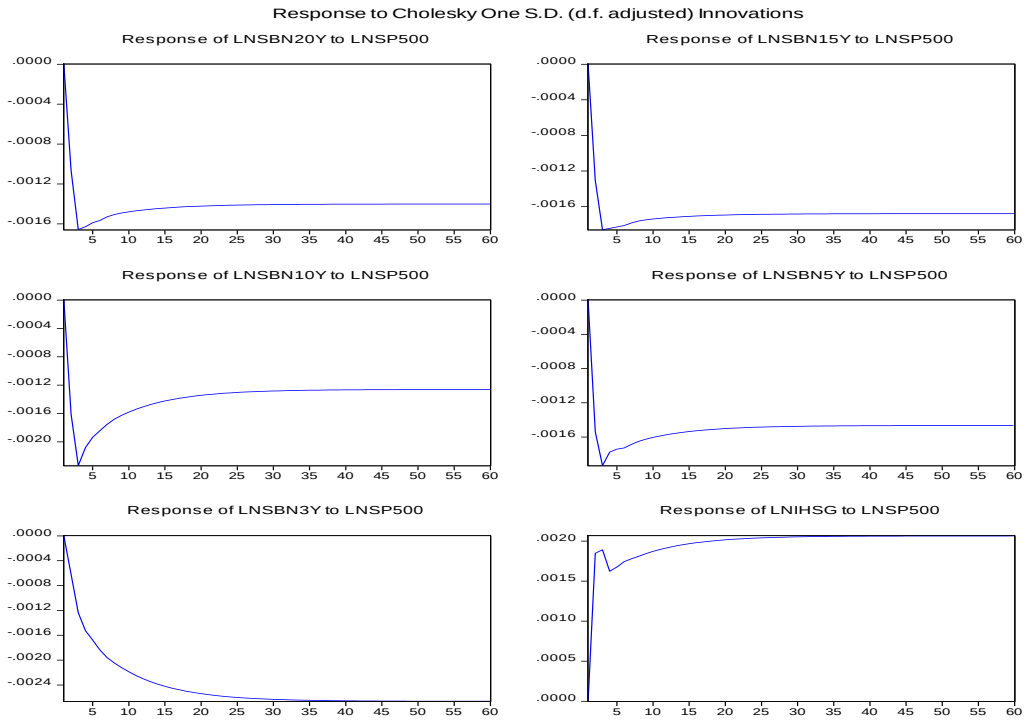
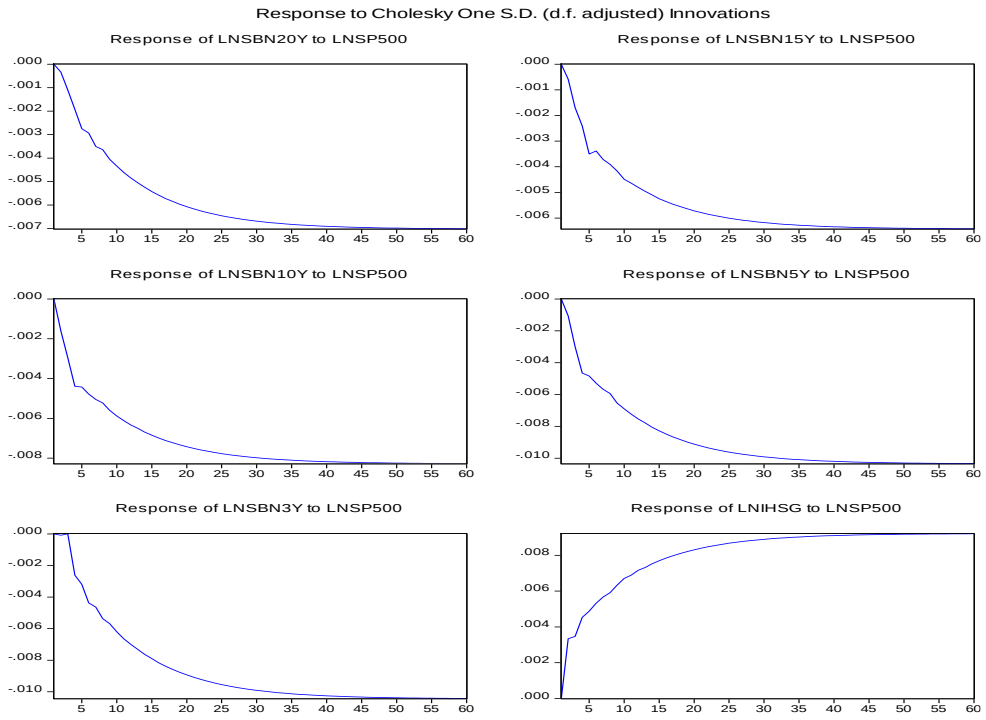


b. During pandemic-covid19 period



4.1.3 Impulse Response Functions (IRF) SBN-Domestic (SBN20Y, SBN15YSBN10Y, SBN5Y, and SBN3Y) and IHSG to the shocks from/IDR in the pre- pandemic-covid19 and during the pandemic-covid19 period

a. In the pre- pandemic-covid19

Volume: 06, Issue: 01 January - February 2023

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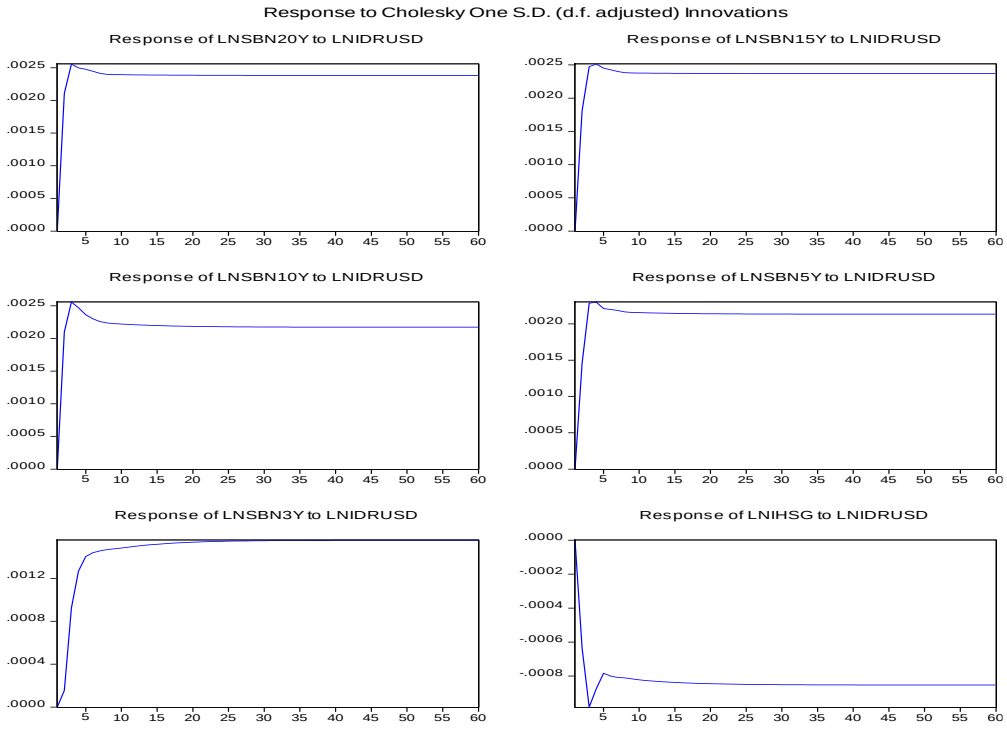
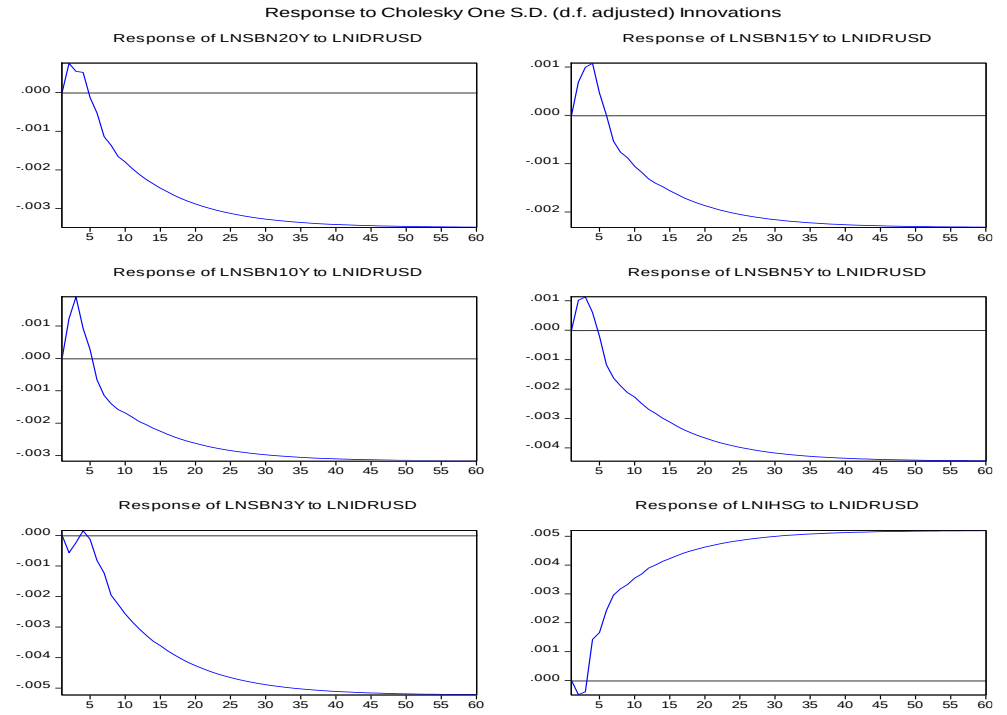


b. During pandemic-covid19 period



Impulse response function analysis showed that: In the long run when the shock came from the T-Bond10Y yield at the pre-pandemic-covid19 period, the biggest response is given by the SBN10Y yield (0.057%), while the yields of SBN20Y (0.037%), SBN15Y (0.05%), SBN5Y (0.04%), SBN3Y (0.03%) and IHSG (0.01%). Whereas in the long run during the

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176

pandemic-covid19 period, the response tended to increase significantly, the largest response values were given by yields of SBN3Y (0.50%) and SBN5Y (0.40%), meanwhile, SBN20Y, SBN15Y, and SBN10Y gave the same response in around 0.3%, and the IHSG response was -0.33%.In the long run, when a shock comes from SP500, the biggest response is given by the yield on SBN3Y (-0.27%) while the yield on SBN20Y (-0.14%), SBN15Y (-0.17%), SBN10Y (-0.13%), SBN5Y (-0.15%) and IHSG (0.21%). Meanwhile, in the long run during the pandemic-covid19 period, the response tended to increase significantly, the largest response value was given by the yields of SBN3Y (-1.04%) and SBN5Y (-1.03%), meanwhile, SBN20Y (-0.70 %), SBN15Y (-0.60%) and SBN10Y (-0.80%) while JCI (0.92%).In the long run, when the shock came from IDR/USD, the biggest response is given by the yields of SBN20Y (0.24%) and SBN15Y (0.24%), while yields of SBN10Y (0.22%), SBN5Y (0.21%), SBN3Y (0.16%), and IHSG (-0.09%). Meanwhile, in the long run during the pandemic-covid19 period, the response tended to increase significantly, the largest response value was given by the yields of SBN3Y (-0.52%) and SBN5Y (-0.44%), meanwhile, SBN20Y (-0.35 %), SBN15Y (-0.32%) and SBN10Y (-0.32%) while IHSG (0.05%).

4.2 Variance Decomposition (VD) yield SBN Domestik (SBN20Y, SBN15, SBN10Y, SBN5Y DAN SBN3Y), IHSG, yield T-Bond10Y, SP500, dan USD/IDRin the pre-pandemic-covid19andduring pandemic-covid19period

Table 13: variance decomposition SBN20Y results in the pre- pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	LNSBN5Y	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.005802	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	**0.010119**	**88.56279**	**1.478755**	**2.877197**	**0.296538**	**0.119503**	**1.201556**	**0.016243**	**1.101258**	**4.346164**
3	0.013331	81.82378	3.143682	4.104631	0.244639	0.101280	2.147004	**0.075220**	**2.180341**	**6.179424**
4	0.015862	78.93739	3.749239	4.549484	0.191578	0.075705	2.935883	**0.123489**	**2.594061**	**6.843172**
5	0.017973	77.47181	3.933687	4.761386	0.159392	0.062286	3.444658	**0.137786**	**2.801294**	**7.227704**
10	0.025676	75.42839	4.141765	4.843015	0.106144	0.060246	4.212678	**0.153735**	**3.112311**	**7.941715**
20	0.036249	75.12003	4.082722	4.487053	0.104536	0.114357	4.453098	**0.173501**	**3.141911**	**8.322788**
30	0.044299	75.18289	4.019329	4.258318	0.112595	0.155148	4.501172	**0.184854**	**3.118977**	**8.466718**
40	0.051081	75.24559	3.978979	4.122496	0.118455	0.180648	4.519051	**0.191505**	**3.101080**	**8.542196**
50	0.057058	75.28974	3.952913	4.036378	0.122367	0.197077	4.528522	**0.195708**	**3.088980**	**8.588312**
60	0.062466	75.32063	3.935107	3.977876	0.125065	0.208292	4.534573	**0.198560**	**3.080607**	**8.619285**

Cholesky Ordering: LNSBN20Y LNSBN15Y LNSBN10Y LNSBN5Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 14: variance decomposition SBN20Y results during pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	LNSBN5Y	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	**0.004531**	**100.0000**	**0.000000**	**0.000000**	**0.000000**	**0.000000**	**0.000000**	**0.000000**	**0.000000**	**0.000000**
2	0.007199	88.38794	2.051104	7.266403	0.109596	0.000917	0.588422	**0.267570**	**0.220755**	**1.107296**
3	0.009443	79.89909	3.600223	11.29089	0.765786	0.340203	0.834129	**0.805154**	**1.485645**	**0.978879**
4	0.011573	72.45420	3.179359	15.16505	0.669025	0.416940	1.678148	**1.830044**	**3.753280**	**0.853955**
5	0.013559	66.74659	2.704749	16.58817	0.526644	1.022827	2.374662	**2.570866**	**6.834388**	**0.631111**
10	0.022732	47.00054	2.627803	21.34123	0.200501	4.596168	2.218167	**4.115044**	**15.85742**	**2.043124**
20	0.039455	29.23940	2.746019	24.05628	0.069393	8.243925	1.366964	**5.199294**	**24.38733**	**4.691390**
30	0.053709	22.68044	2.771924	24.58981	0.043147	9.753685	1.033607	**5.562312**	**27.63546**	**5.929617**
40	0.065796	19.60575	2.779448	24.75210	0.034115	10.49257	0.876120	**5.724904**	**29.17404**	**6.560956**
50	0.076267	17.90738	2.782389	24.82106	0.029853	10.90807	0.788954	**5.812873**	**30.02764**	**6.921780**
60	0.085556	16.85689	2.783872	24.85818	0.027407	11.16704	0.735002	**5.866785**	**30.55662**	**7.148203**

Cholesky Ordering: LNSBN20Y LNSBN15Y LNSBN10Y LNSBN5Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 15: variance decomposition SBN15Y results in the pre- pandemic-covid 19 period

Period	S.E.	LNSBN20Y	**LNSBN15Y**	LNSBN10Y	LNSBN5Y	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	**0.005802**	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.010119	0.692055	91.93000	2.219119	0.120222	0.487322	0.852775	0.010777	1.263760	2.423975
3	0.013331	0.569824	88.30170	2.869641	0.100755	0.403081	1.589265	0.102865	2.150927	3.911940
4	0.015862	0.449271	86.49482	3.217476	0.079951	0.320133	2.234051	0.173698	2.481200	4.549400
5	**0.017973**	**0.393382**	**85.49973**	**3.406049**	**0.064092**	**0.279443**	**2.647569**	**0.193872**	**2.662035**	**4.853825**
10	**0.025676**	**0.298802**	**84.05056**	**3.541674**	**0.036012**	**0.237024**	**3.278962**	**0.221273**	**2.948836**	**5.386856**
20	**0.036249**	**0.274923**	**83.65054**	**3.377301**	**0.030048**	**0.274902**	**3.494584**	**0.243010**	**3.006806**	**5.647884**
30	**0.044299**	**0.273237**	**83.57936**	**3.260565**	**0.030779**	**0.307003**	**3.547204**	**0.253904**	**3.005917**	**5.742028**
40	**0.051081**	**0.273615**	**83.55498**	**3.190377**	**0.031720**	**0.327075**	**3.569936**	**0.260073**	**3.001620**	**5.790604**
50	**0.057058**	**0.274095**	**83.54262**	**3.145818**	**0.032406**	**0.339967**	**3.582845**	**0.263926**	**2.998246**	**5.820074**
60	**0.062466**	**0.274469**	**83.53487**	**3.115582**	**0.032890**	**0.348747**	**3.591295**	**0.266528**	**2.995826**	**5.839795**

Cholesky Ordering: LNSBN15Y LNSBN20Y LNSBN10Y LNSBN5Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 16: variance decomposition SBN15Y results during pandemic-covid19 period

Period	S.E.	LNSBN20Y	**LNSBN15Y**	LNSBN10Y	LNSBN5Y	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	**0.004531**	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.007199	0.049925	93.49490	4.238639	0.075262	0.001330	0.826086	0.215692	0.463653	0.634515
3	0.009443	0.373678	84.66987	7.298223	0.194950	0.005529	2.856497	0.931227	2.524632	1.145388
4	0.011573	0.361152	74.36086	9.076462	0.657823	0.007541	5.001567	4.055383	5.022026	1.457188
5	**0.013559**	**0.281248**	**67.00743**	**9.554787**	**0.529587**	**0.157086**	**6.892486**	**5.374041**	**9.006797**	**1.196539**
10	**0.022732**	**0.181711**	**54.17746**	**11.91610**	**0.222306**	**2.123242**	**7.190475**	**6.659698**	**16.59718**	**0.931830**
20	**0.039455**	**0.264072**	**42.33113**	**14.46904**	**0.084099**	**4.375600**	**5.675735**	**7.400051**	**23.47811**	**1.922157**
30	**0.053709**	**0.333523**	**37.28139**	**15.45063**	**0.048146**	**5.488332**	**4.874391**	**7.625110**	**26.29628**	**2.602202**
40	**0.065796**	**0.374725**	**34.70988**	**15.92306**	**0.033327**	**6.085665**	**4.448123**	**7.721740**	**27.70572**	**2.997769**
50	**0.076267**	**0.399930**	**33.22133**	**16.18974**	**0.025535**	**6.438646**	**4.197807**	**7.773367**	**28.51522**	**3.238418**
60	**0.085556**	**0.416331**	**32.27409**	**16.35760**	**0.020784**	**6.665198**	**4.037626**	**7.805056**	**29.02862**	**3.394694**

Cholesky Ordering: LNSBN15Y LNSBN20Y LNSBN10Y LNSBN5Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 17: variance decomposition SBN10Y results in the pre- pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	**LNSBN10Y**	LNSBN5Y	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.005802	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.010119	0.003027	0.010266	94.21458	0.302981	0.370258	0.806741	0.008500	1.582867	2.700780
3	0.013331	0.126748	0.119838	90.62011	0.257389	0.298078	1.663119	0.066950	2.897275	3.950489
4	0.015862	0.156472	0.185374	89.04464	0.224058	0.289860	2.265798	0.106497	3.246640	4.480664
5	**0.017973**	**0.150147**	**0.189725**	**88.24340**	**0.207243**	**0.326975**	**2.620670**	**0.117914**	**3.384681**	**4.759244**
10	**0.025676**	**0.096309**	**0.229626**	**86.63674**	**0.280832**	**0.852859**	**2.955803**	**0.158090**	**3.420207**	**5.369536**
20	**0.036249**	**0.254147**	**0.304865**	**84.74547**	**0.561461**	**2.112718**	**2.826016**	**0.242642**	**3.094511**	**5.858166**
40	**0.051081**	**0.584909**	**0.380319**	**82.73146**	**0.894011**	**3.541212**	**2.594841**	**0.332792**	**2.730281**	**6.210178**
50	**0.057058**	**0.677991**	**0.399046**	**82.21783**	**0.979556**	**3.906432**	**2.533788**	**0.355475**	**2.638989**	**6.290894**
60	**0.062466**	**0.743306**	**0.412028**	**81.86069**	**1.039075**	**4.160396**	**2.491230**	**0.371222**	**2.575651**	**6.346405**

Cholesky Ordering: LNSBN10Y LNSBN20Y LNSBN15Y LNSBN5Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 18: variance decomposition SBN10Y results during pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	**LNSBN10Y**	LNSBN5Y	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.004531	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

2	**0.007199**	**0.007697**	**0.005850**	**95.36688**	**0.004259**	**0.006074**	**1.366720**	**0.098090**	**1.972516**	**1.171916**
3	0.009443	0.293863	0.006709	88.80694	0.533512	0.004650	1.999880	1.237825	4.894245	2.222377
4	0.011573	0.240888	0.399418	83.50929	0.413568	0.076533	2.981084	1.535776	9.067474	1.775967
5	**0.013559**	**0.232773**	**0.651707**	**80.37915**	**0.316063**	**0.326952**	**3.499167**	**1.902780**	**11.32325**	**1.368158**
10	**0.022732**	**0.679492**	**0.716911**	**72.64930**	**0.151549**	**1.824557**	**3.023747**	**2.178899**	**17.40616**	**1.369385**
20	**0.039455**	**1.431589**	**0.710496**	**64.18777**	**0.095263**	**3.604970**	**2.037884**	**2.729762**	**22.88716**	**2.315101**
30	**0.053709**	**1.808683**	**0.691531**	**60.09258**	**0.085279**	**4.528980**	**1.649606**	**3.006976**	**25.19269**	**2.943677**
40	**0.065796**	**2.012363**	**0.678817**	**57.90941**	**0.082200**	**5.033632**	**1.456882**	**3.154991**	**26.36403**	**3.307677**
50	**0.076267**	**2.133323**	**0.670753**	**56.61982**	**0.080859**	**5.334557**	**1.346314**	**3.242383**	**27.04272**	**3.529272**
60	**0.085556**	**2.211240**	**0.665427**	**55.79102**	**0.080120**	**5.528713**	**1.276126**	**3.298529**	**27.47539**	**3.673434**

Cholesky Ordering: LNSBN10Y LNSBN20Y LNSBN15Y LNSBN5Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 19: variance decomposition SBN5Y results in the pre-pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	**LNSBN5Y**	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.005802	0.000000	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000
2	**0.010119**	**0.355038**	**0.137544**	**0.774825**	**94.57220**	**0.082646**	**1.428004**	**0.066829**	**1.363853**	**1.219062**
3	0.013331	0.459077	0.513762	0.910141	91.38975	0.135000	2.021767	0.069503	2.044446	2.456554
4	0.015862	0.463932	0.686005	0.978816	89.86311	0.134900	2.572720	0.085607	2.206345	3.008563
5	**0.017973**	**0.476114**	**0.738220**	**1.000138**	**89.09704**	**0.140846**	**2.914502**	**0.089870**	**2.285914**	**3.257356**
10	**0.025676**	**0.491043**	**0.773383**	**0.852285**	**88.07082**	**0.238820**	**3.385881**	**0.098143**	**2.362794**	**3.726828**
20	**0.036249**	**0.519592**	**0.709090**	**0.578650**	**87.94751**	**0.448948**	**3.460127**	**0.116650**	**2.258462**	**3.960975**
30	**0.044299**	**0.536371**	**0.665498**	**0.443829**	**87.97555**	**0.580902**	**3.442097**	**0.128126**	**2.183377**	**4.044245**
40	**0.051081**	**0.546223**	**0.639402**	**0.369171**	**88.00023**	**0.660440**	**3.424701**	**0.134968**	**2.137853**	**4.087016**
50	**0.057058**	**0.552455**	**0.622816**	**0.322837**	**88.01713**	**0.711173**	**3.412491**	**0.139316**	**2.108809**	**4.112976**
60	**0.062466**	**0.556687**	**0.611538**	**0.291563**	**88.02886**	**0.745710**	**3.403952**	**0.142272**	**2.089037**	**4.130378**

Cholesky Ordering: LNSBN5Y LNSBN20Y LNSBN15Y LNSBN10Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 20: variance decomposition SBN5Y results during pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	**LNSBN5Y**	LNSBN3Y	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.004531	0.000000	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000	0.000000
2	**0.007199**	**0.480213**	**0.241453**	**2.939555**	**94.11816**	**0.015741**	**0.313209**	**0.458628**	**0.751043**	**0.681996**
3	0.009443	1.031537	0.191483	6.987314	83.98243	0.074569	1.020633	1.573554	4.180718	0.957768

4	0.011573	1.280608	0.855820	6.774771	77.35003	0.051302	1.501510	2.382765	9.040833	0.762354
5	**0.013559**	**1.490500**	**1.178322**	**6.419908**	**73.68836**	**0.258737**	**1.491342**	**3.050230**	**11.83884**	**0.583760**
10	**0.022732**	**2.321884**	**0.957443**	**6.877997**	**62.94964**	**1.762956**	**0.797893**	**3.356319**	**19.37135**	**1.604514**
20	**0.039455**	**3.023388**	**0.610103**	**7.980438**	**50.69582**	**3.964630**	**0.340008**	**4.033297**	**25.99348**	**3.358839**
30	**0.053709**	**3.256518**	**0.461547**	**8.441365**	**45.38784**	**5.080318**	**0.211701**	**4.324918**	**28.54266**	**4.293135**
40	**0.065796**	**3.362345**	**0.388967**	**8.665721**	**42.72482**	**5.669917**	**0.156644**	**4.468596**	**29.76963**	**4.793358**
50	**0.076267**	**3.420277**	**0.348116**	**8.791965**	**41.20473**	**6.013413**	**0.127228**	**4.549910**	**30.45825**	**5.086119**
60	**0.085556**	**3.456083**	**0.322575**	**8.870902**	**40.24822**	**6.231399**	**0.109240**	**4.600882**	**30.88845**	**5.272249**

Cholesky Ordering: LNSBN5Y LNSBN20Y LNSBN15Y LNSBN10Y LNSBN3Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 21: variance decomposition SBN3Y results in the pre- pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	LNSBN5Y	**LNSBN3Y**	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.005802	0.000000	0.000000	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000	0.000000
2	**0.010119**	**1.659876**	**0.250641**	**0.582961**	**1.120325**	**95.90415**	**0.181881**	**0.002408**	**0.280155**	**0.017604**
3	0.013331	3.846368	1.265903	1.391863	2.572661	89.12697	0.388652	0.160917	0.854501	0.392164
4	0.015862	5.329133	2.232030	2.565014	2.844173	83.92604	0.787948	0.217258	1.322691	0.775716
5	**0.017973**	**6.408918**	**2.983075**	**3.663407**	**2.869382**	**79.93540**	**1.141709**	**0.262380**	**1.675519**	**1.060209**
10	**0.025676**	**8.995585**	**5.521996**	**8.580858**	**2.503683**	**67.22850**	**2.356151**	**0.261978**	**2.939174**	**1.612075**
20	**0.036249**	**10.80204**	**7.997755**	**14.58242**	**1.913687**	**55.09324**	**3.428865**	**0.183919**	**4.154777**	**1.843295**
30	**0.044299**	**11.50414**	**9.132206**	**17.57560**	**1.626627**	**49.50697**	**3.902084**	**0.143893**	**4.705070**	**1.903412**
40	**0.051081**	**11.85885**	**9.735754**	**19.20569**	**1.472776**	**46.52712**	**4.151391**	**0.122496**	**4.996798**	**1.929124**
50	**0.057058**	**12.06807**	**10.09775**	**20.19049**	**1.380346**	**44.73825**	**4.300470**	**0.109665**	**5.171572**	**1.943393**
60	**0.062466**	**12.20485**	**10.33567**	**20.83922**	**1.319568**	**43.56217**	**4.398359**	**0.101233**	**5.286402**	**1.952534**

Cholesky Ordering: LNSBN3Y LNSBN20Y LNSBN15Y LNSBN10Y LNSBN5Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 22: variance decomposition SBN3Y results during pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	LNSBN5Y	**LNSBN3Y**	LNIHSG	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.004531	0.000000	0.000000	0.000000	0.000000	**100.0000**	**0.000000**	0.000000	0.000000	0.000000
2	**0.007199**	**1.064599**	**1.577117**	**1.902842**	**2.135743**	**93.13265**	**0.003805**	**0.060277**	**0.002802**	**0.120169**
3	0.009443	1.936377	2.985640	7.014587	2.597915	85.10199	0.004762	0.264429	0.001861	0.092444
4	0.011573	2.447041	4.400008	9.596258	2.214517	78.58365	0.556550	0.877159	1.251345	0.073476
5	**0.013559**	**2.841394**	**4.280678**	**12.32299**	**2.084381**	**73.56770**	**0.616989**	**1.756724**	**2.468426**	**0.060723**

10	**0.022732**	**3.137762**	**4.391939**	**21.16004**	**2.713485**	**52.22673**	**0.753366**	**3.789160**	**10.60387**	**1.223648**
20	**0.039455**	**2.013566**	**4.755416**	**28.41786**	**2.869616**	**29.49033**	**0.942443**	**5.727303**	**21.61621**	**4.167256**
30	**0.053709**	**1.439280**	**4.864560**	**30.69084**	**2.783585**	**20.08514**	**0.964862**	**6.514897**	**26.83394**	**5.822902**
40	**0.065796**	**1.147069**	**4.901144**	**31.63010**	**2.712020**	**15.53943**	**0.964350**	**6.889682**	**29.49259**	**6.723625**
50	**0.076267**	**0.979963**	**4.917083**	**32.11655**	**2.664373**	**12.98893**	**0.961269**	**7.098325**	**31.01880**	**7.254711**
60	**0.085556**	**0.874503**	**4.925752**	**32.40988**	**2.632468**	**11.39190**	**0.958573**	**7.228499**	**31.98402**	**7.594412**

Cholesky Ordering: LNSBN3Y LNSBN20Y LNSBN15Y LNSBN10Y LNSBN5Y LNIHSG LNTBOND10Y LNSP500 LNIDRUSD

Table 23: variance decomposition IHSG results in the pre-pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	LNSBN5Y	LNSBN3Y	**LNIHSG**	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.005802	0.000000	0.000000	0.000000	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000
2	**0.010119**	**0.004676**	**0.390432**	**0.140108**	**0.004392**	**0.010339**	**96.48606**	**0.486937**	**2.214945**	**0.262116**
3	0.013331	0.125379	0.798211	0.231523	0.052613	0.023799	94.61049	0.566712	3.003046	0.588232
4	0.015862	0.240386	0.822290	0.266718	0.089113	0.052871	94.10029	0.661689	3.082758	0.683880
5	**0.017973**	**0.312354**	**0.815973**	**0.326684**	**0.125706**	**0.099616**	**93.70311**	**0.758487**	**3.159404**	**0.698669**
10	**0.025676**	**0.432858**	**0.971601**	**0.725949**	**0.270380**	**0.356116**	**91.99394**	**0.994707**	**3.516675**	**0.737777**
20	**0.036249**	**0.465409**	**1.190379**	**1.379393**	**0.449787**	**0.781829**	**89.96728**	**1.133231**	**3.881677**	**0.751017**
30	**0.044299**	**0.468902**	**1.303446**	**1.744880**	**0.542721**	**1.023697**	**88.92746**	**1.183574**	**4.052556**	**0.752765**
40	**0.051081**	**0.469295**	**1.366225**	**1.952596**	**0.594551**	**1.161794**	**88.34846**	**1.208942**	**4.145025**	**0.753109**
50	**0.057058**	**0.469262**	**1.404637**	**2.080613**	**0.626314**	**1.247025**	**87.99378**	**1.224002**	**4.201161**	**0.753207**
60	**0.062466**	**0.469184**	**1.430160**	**2.165865**	**0.647430**	**1.303810**	**87.75802**	**1.233914**	**4.238368**	**0.753249**

Cholesky Ordering: LNIHSG LNSBN20Y LNSBN15Y LNSBN10Y LNSBN5Y LNSBN3Y LNTBOND10Y LNSP500 LNIDRUSD

Table 24: variance decomposition IHSG results during the pandemic-covid19 period

Period	S.E.	LNSBN20Y	LNSBN15Y	LNSBN10Y	LNSBN5Y	LNSBN3Y	**LNIHSG**	LNTBOND10Y	LNSP500	LNIDRUSD
1	0.004531	0.000000	0.000000	0.000000	0.000000	0.000000	**100.0000**	0.000000	0.000000	0.000000
2	**0.007199**	**0.787753**	**1.826958**	**0.057133**	**0.150061**	**0.118022**	**93.40216**	**0.051742**	**3.529024**	**0.077142**
3	0.009443	2.014848	3.356685	0.065302	0.206571	0.581869	88.42217	0.322814	4.944402	0.085342
4	0.011573	1.685839	2.480041	0.116477	0.267148	1.381430	86.87278	0.441996	6.399859	0.354431
5	**0.013559**	**1.764999**	**2.177246**	**0.109479**	**0.347004**	**1.851137**	**84.96864**	**0.778098**	**7.432238**	**0.571156**
10	**0.022732**	**1.726898**	**2.426427**	**0.110458**	**0.360795**	**4.300562**	**75.82357**	**1.326366**	**11.45139**	**2.473537**
20	**0.039455**	**1.770276**	**2.678110**	**0.486618**	**0.289382**	**6.597818**	**65.53942**	**1.972875**	**16.18069**	**4.484808**

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176

30	**0.053709**	**1.790807**	**2.777585**	**0.816756**	**0.244778**	**7.702148**	**60.37444**	**2.295610**	**18.54227**	**5.455616**
40	**0.065796**	**1.800489**	**2.827521**	**1.030209**	**0.219385**	**8.309379**	**57.50049**	**2.474959**	**19.84788**	**5.989686**
50	**0.076267**	**1.805905**	**2.856580**	**1.167632**	**0.203853**	**8.677429**	**55.75026**	**2.584103**	**20.64064**	**6.313593**
60	**0.085556**	**1.809326**	**2.875294**	**1.259943**	**0.193639**	**8.918696**	**54.60066**	**2.655768**	**21.16068**	**6.525992**

Cholesky Ordering: LNIHSG LNSBN20Y LNSBN15Y LNSBN10Y LNSBN5Y LNSBN3Y LNTBOND10Y LNSP500 LNIDRUSD

From the results of the variance decomposition test, it can be concluded that in the long run contribution of the variance of other variables, which has the greatest effect on changes in the variance of SBN-Domestic and IHSG, comes from the SP500 variance, and the other contribution comes from the variance of T-Bond10Y and the IDR/USD. This can be seen in the contribution value of the SP500 variance to variables such as in the pandemic-covid19 period, in the long-run equilibrium the contribution value of the SP500 variance is as follows 5.286% (SBN3Y), 2.995% (SBN15Y), 2.575% (SBN10Y), 2.085% (SBN5Y), and 4.238% (IHSG), meanwhile during pandemic-covid19 period the SP500 variance contribution value increased to 31.984% (SBN3Y), 30.888% (SBN5Y), 30.556% (SBN20Y), 29.028% (SBN15Y), 27.475% (SBN10Y), and 21.160 (IHSG). This proves that there is a change in dynamic linkages and SP500 has the strong ability to predict the changes in SBN-Domestic and IHSG during the pandemic-covid19 period. Another variance contribution comes from the IDR/USD variance. This can be seen in the contribution value of the IDR/USD variance to variables such as in the pre-pandemic-civid19 period, in the long-run equilibrium the contribution value of the IDR/USD variance is as follows 8.619% (SBN20Y), 5.839% (SBN15Y), 6.346% (SBN10Y), 4.130% (SBN5Y), while 1.952% (SBN3Y) and 0.753% (IHSG), meanwhile during the period during the pandemic-covid19 the contribution value of the IDR/USD variance was as follows 7.594% (SBN3Y), 5.272% (SBN5Y), 7.148% (SBN20Y), 3.673% (SBN10Y), 3.394% (SBN15Y), and 6.525 (IHSG) and the last contribution of variance is derived from the T-Bond10Y variance, the contribution of theT-Bond10Y to variables as in the pre-pandemic-covid19 in the long-run equlibrium was as follows 0.371% (SBN10Y), 0.266% (SBN15Y), and 0.198% (SBN20Y), during the pandemic-covid19, in the long-runthe contribution value of the T-Bond10Y variance is as follows 7.228% (SBN3Y), 4.600% (SBN5Y), 7.805% (SBN15Y), 5.886% (SBN20Y), and 3.298% (SBN10Y). The large contribution of the variance of other variables to certain variables indicates that these variables are not independent and significant to the shock transmitted from other variables (T-Bond10Y, SP500, and IDR/USD). In concluded said that yields on SBN-Domestic and IHSG are sensitive to changes (shock) of SP500, IDR/USD, and T-Bond10Y.

4.3 Granger Causality Test Result Pre -Pandemic-covid19and During Pandemic-covid19

Table 25: Granger Causality Test Result Pre - Pandemic-covid19

LNTBOND10Y does not Granger Cause LNSBN20Y	1.84463	0.1591
LNSBN20Y does not Granger Cause LNTBOND10Y	0.15589	0.8557
LNSP500 does not Granger Cause LNSBN20Y	13.9915	**1.E-06**
LNSBN20Y does not Granger Cause LNSP500	0.25988	0.7712
LNIDRUSD does not Granger Cause LNSBN20Y	62.3203	**5.E-25**
LNSBN20Y does not Granger Cause LNIDRUSD	0.56086	0.5711

LNTBOND10Y does not Granger Cause LNSBN15Y	1.13499	0.3222
LNSBN15Y does not Granger Cause LNTBOND10Y	0.30934	0.7341
LNSP500 does not Granger Cause LNSBN15Y	12.1125	**7.E-06**
LNSBN15Y does not Granger Cause LNSP500	0.09917	0.9056
LNIDRUSD does not Granger Cause LNSBN15Y	42.2405	**9.E-18**
LNSBN15Y does not Granger Cause LNIDRUSD	0.10643	0.8991

LNTBOND10Y does not Granger Cause LNSBN10Y	2.35596	**0.0958**
LNSBN10Y does not Granger Cause LNTBOND10Y	0.66244	0.5160
LNSP500 does not Granger Cause LNSBN10Y	13.8673	**1.E-06**
LNSBN10Y does not Granger Cause LNSP500	0.10016	0.9047
LNIDRUSD does not Granger Cause LNSBN10Y	31.8473	**9.E-14**
LNSBN10Y does not Granger Cause LNIDRUSD	0.13781	0.8713

LNTBOND10Y does not Granger Cause LNIHSG	3.82513	**0.022**
LNIHSG does not Granger Cause LNTBOND10Y	1.02284	0.360
LNSP500 does not Granger Cause LNIHSG	22.7952	**3.E-1**
LNIHSG does not Granger Cause LNSP500	0.64580	0.524
LNIDRUSD does not Granger Cause LNIHSG	3.58784	**0.028**
LNIHSG does not Granger Cause LNIDRUSD	2.23976	**0.107**

Table 26: Granger Causality Test ResultDuring Pandemic-covid19

LNTBOND10Y does not Granger Cause LNSBN20Y	2.33549	**0.0732**
LNSBN20Y does not Granger Cause LNTBOND10Y	6.17037	**0.0004**
LNSP500 does not Granger Cause LNSBN20Y	13.4459	**2.E-08**
LNSBN20Y does not Granger Cause LNSP500	2.21620	0.0856
LNIDRUSD does not Granger Cause LNSBN20Y	35.9954	**9.E-21**
LNSBN20Y does not Granger Cause LNIDRUSD	2.01731	0.1108

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176

LNTBOND10Y does not Granger Cause LNSBN10Y	8.94354	**9.E-06**
LNSBN10Y does not Granger Cause LNTBOND10Y	2.57864	**0.0532**
LNSP500 does not Granger Cause LNSBN10Y	16.1423	**6.E-10**
LNSBN10Y does not Granger Cause LNSP500	2.16873	0.0910
LNIDRUSD does not Granger Cause LNSBN10Y	6.34420	**0.0003**
LNSBN10Y does not Granger Cause LNIDRUSD	1.58616	0.1920

LNTBOND10Y does not Granger Cause LNSBN10Y	8.94354	**9.E-06**
LNSBN10Y does not Granger Cause LNTBOND10Y	2.57864	**0.0532**
LNSP500 does not Granger Cause LNSBN10Y	16.1423	**6.E-10**
LNSBN10Y does not Granger Cause LNSP500	2.16873	0.0910
LNIDRUSD does not Granger Cause LNSBN10Y	6.34420	**0.0003**
LNSBN10Y does not Granger Cause LNIDRUSD	1.58616	0.1920

LNTBOND10Y does not Granger Cause LNIHSG	3.52374
LNIHSG does not Granger Cause LNTBOND10Y	7.77602
LNSP500 does not Granger Cause LNIHSG	16.5349
LNIHSG does not Granger Cause LNSP500	3.69734
LNIDRUSD does not Granger Cause LNIHSG	1.25785
LNIHSG does not Granger Cause LNIDRUSD	1.10978

The Granger causality test shows that in the pre- pandemic-covid19 period, the T-Bond10Y yield had causality with SBN10Y, SBN5Y, SBN3Y, and IHSG while during the pandemic-covid19 period the yield T-Bond10 had causality with all SBN-Domestic and IHSG. During pandemic-covid19, SP500 has causality with all variables SBN-Domestic and IHSG, while in the pre-pandemic-covid19 had causality with SBN5Y, SBN3Y, and IHSG. IDR/USD had causality with all variables of SBN and IHSG in the pre-pandemic-covid19 period, while during the pandemic-covid19 period, the causality significantly occurred in the SBN-Domestic variable while IHSG is not significant.

5.0 CONCLUSIONS AND IMPLICATIONS

There was a significant change in the dynamic linkages between the yield of SBN-Domestic and the IHSG to the shock that occurred in the T-Bond10Y, SP500, and IDR/USD in the period pre pandemic-covid19 and during pandemic-covid19. It was proved by increasing values response and variance decomposition contribution from exogenous variables (T-Bond10Y, SP500, and IDR/USD) to endogenous variables in the model (SBN-Domestic and IHSG), and coefficient correlation has supported the findings. The conclusions have implications for investors and the government as policymakers. The results of research on changes in dynamic linkages on the variables tested against shocks in the VECM model provide useful information, especially for the risk assessment of financial assets (stocks and bonds) that will be included in portfolio investment. By knowing the integrated response of

Volume: 06, Issue: 01 January - February 2023

ISSN 2582-0176

domestic SBN-Domestic in various tenors and IHSG to shocks from the US, investors can mitigate risks that occur in investment portfolios, while for the Indonesian government, this information is important to find out the extent of the interdependence of domestic SBN-Domestic yields in various tenors and IHSG to external (US) shocks in the period before and during pandemic-covid19.

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