Analysis of the Relationship between Credit Rating and Foreign Direct Investment in Indonesia

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Abstract
The purpose of studied is to determine whether there is a short-term and long-term influence and cointegration between Foreign Direct Investment, to the credit ratings of Indonesia provided by credit institutions such as Moody's (MO), S & P (SP) and Fitch (FIT). The studied uses secondary time series data from 1998-2016,which consists of data on the amount of direct investment that goes to Indonesia and the credit rating of the State of Indonesia. This research uses the Vector Autoregression (VAR) method which includes Johansen Cointegration test, followed by Vector Error Correction Model (VECM) estimation and also forecasting by Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) analysis. The result of the VECM test there is two significant negative variables, the Johansen Co-Integration test shows that the four variables are cointegrated. The IRF and FEVD analysis show that the FIT variable has a significant or direct positive effect on the direct investment (FDI), in which the rise of the credit rating of the State of Indonesia may increase the amount of direct investment in Indonesia. While, other variables have no effect on direct investment in Indonesia.
Keywords: direct investment, state credit rating indonesia, credit rating agency

Introduction
State credit ratings (Sovereign Credit Rating) is one of the factors investors to make investments, whether direct investment or investment indirectly. The State's credit rating Indonesia has already entered the country worthy of investment (Investment Grade) has been granted by credit rating agencies, including Moody's world that gives the State's credit rating Baa2 to Indonesia. According to the results of research (Bayar &Kilic, 2014) there is a positive relationship between the State's credit rating and the inclusion of Direct Investment, then in the research of Emir et al. (2013) there is a positive relationship between the credit ratings of the country against the direct investment (FDI).

Based on research (Cai, Kim, & Gan, 2016) there is a positive relationship when a country has a nice Country credit rating, it will increase the flow of direct investment funds (FDI). In research (Ozturk, 2012), there is a negative outcome between the credit ratings of the country against a direct investment. According to the results of research (Walch and Wörz 2012), the credit rating of the country has a positive relationship towards the inclusion of direct investment (FDI) in the countries of Central Europe, Eastern Europe, and southeastern Europe with regression panel with a period of 1995-2011.

Next in research (Gande and Parsley 2004) examined the entry and discharge flow of capital from the reaction of mutual funds against the State's credit rating (Sovereign Credit Ratings) in 85 countries with a period of 1996-2002, from the research results found that there is a strong link between the decline in the country's credit ratings and the outflow of capital and the increase in the country's credit ratings are not a significant cause of changes in the flow of the entry of the capital (FDI). Based on a review of the literature, the researchers want to do research on the country's credit rating Indonesia against the flow of direct investment in Indonesia, starting from 1998-2016.

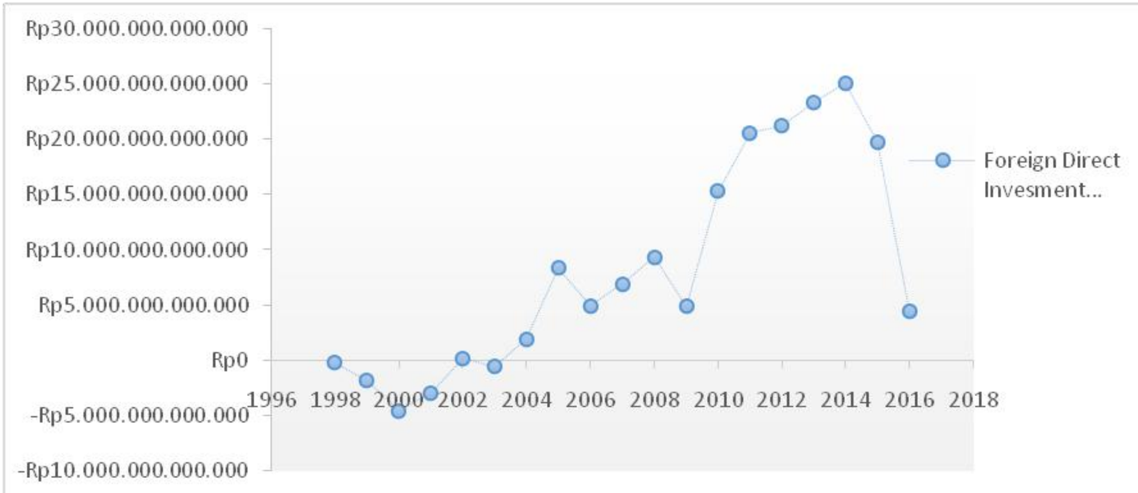


Figure 1 Foreign Direct Investment Indonesia 1998-2016
Sources: World Bank, Processed

To facilitate research about the existence of causality between the credit ratings of countries (Sovereign Credit Rating) against direct investment (FDI), then the researcher use table 1 to calculate the credit rating Indonesia received a 1998-2016 period of the three worlds namely S&P credit rating, Moody's and Fitch respectively with long-term credit ratings. To make it easier to read the variables in the research results, then the researchers create table 2 with a simple variable symbol may be so easily understood by readers

Table 1 Indonesia's long-term credit rating by S&P, Moody's, and Fitch. 1998-2016.

Credit Rating Agencies	Total Changes	Credit Rating		Credit Outlook	
		Decrease	Increase	Decrease	Increase
Long-term credit ratings by S&P	33	7	7	6	5
Long-term credit ratings by MO	19	1	7	6	6
Long-term credit ratings by FITCH	18	1	7	6	6
Total	70	9	21	18	17

Sources: trading economics.com, (processed).

Table 2 Variables used in the analysis of econometric and symbol

Symbols of Variable	Variables
FDI	Foreign Direct Investment
FIT	Fitch-Long term foreign currency rating
MO	Moody's- Long-term foreign currency rating
SP	S&P - Long-term foreign currency rating

Methods

The data used in this paper are foreign direct investment (FDI) entering Indonesia and the State credit rating given by (CRA) to Indonesia consisting of Moody's, Fitch and S & P. The data used in this paper are time series data from 1998 to 2016. Data on foreign direct investment (FDI) comes from (World Bank) from 1998 to 2016 and data on Indonesian credit ratings comes from Moody's, Fitch, S & P and from the site tradingeconomics.com from 1998 to 2016.

Based on research (Bayar, 2014) To examine the relationship between state credit ratings and direct investment (FDI) using time series analysis. First, do stationary tests for Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Then determine the optimal lag length for the estimated series, the long-term relationship between variables is analyzed by the Johansen co-integration test. However, the short-term and long-term relationships between variables are shown in the Vector Error Correction Model (VECM), Vector Auto regression (VAR) and impulse response analysis.

Results

To determine the condition of stationeries time series is very important to do the estimate. If the variable in a regression model does not have the nature of stationeries, assuming the standards required for analysis will be invalid and will be misleading estimates (Vosvrda 2013; Akram 2012). The case is referred to as false regression analyzed by Granger and Newbold in 1974, Yule (1926) says that estimate the regression model including the non-stationary time series that have divergent trends of the average value of the long-term will cause the bias standard errors and correlation are not reliable (Korap, 2007). There is a different unit root test in literature, unit root tests are most popular are the ADF tests developed by the Dickey-Fuller in 1979 and 1981 and the PP test developed by Phillips and Perron in 1988.

Table 3 Unit root test of ADF

Null Hypothesis: Unit root (individual unit root process)
Series: FDI, FIT, MO, SP
Date: 05/26/18 Time: 22:18
Sample: 1998 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Total number of observations: 64
Cross-sections included: 4

Method	Statistic	Prob.**
ADF - Fisher Chi-square	48,0067	0,0000
ADF - Choi Z-stat	-5,14266	0,0000

World Bank, Processed

Between the two tests has a difference between the two, the ADF Test makes the parametric correction for consecutive dependency problems, while the PP test makes a non-parametric correction. We used the ADF (1981)and PP (1988) tests to test the stationarity of the series in the study. Thus the authors use the ADF Test and PP tests, with the results of data processing in table 3 of the ADF test and 4 PP test tables. Based on table 3 in the ADF test, it can be seen that Prob value <0.05 then Stationary data on First Difference in ADF test and on PP test in table 4, it is known that Prob value <0.05, then Stationary data on First Difference on test PP.

Next to test the VECM and cointegration test first to determine the Optimum length of the Lag (Lag Length Criteria). Thus, data that has transformed the feasible use in the analysis of VAR or VECM. All variables that are found in the first level of stationary (1) given the test results stationeries ADF and PP of the variables. Therefore researchers use test cointegration developed by Johansen (1988) to determine whether there is a long-term relationship between the variables. But the optimal lag length for the model that will be test determined before cointegration was estimated.

Table 4 Unit root test of PP

Null Hypothesis: Unit root (individual unit root process) Series: FDI, FIT, MO, SP Date: 05/26/18 Time: 22:31 Sample: 1998 2016 Exogenous variables: Individual effects Automatic selection of maximum lags Automatic lag length selection based on SIC: 0 to 3 Total number of observations: 64 Cross-sections included: 4

Method	Statistic	Prob.**
PP - Fisher Chi-square	361.585	0.0000
PP - Choi Z-stat	-14.7540	0.0000

World Bank, Processed

The Optimum Lag (Lag Length Criteria)

Based on research (Coal & Saskara, 2013) determination of amount of lag in the VAR model is specified in the criteria of information recommended by the smallest value of the FPE (Final Prediction Error), AIC (Akaike information criterion), SC (Schwarz Information Criterion) and HQ (Hannan-Quinn Information Criterion).According to (Nugroho, 2009) determination of the amount of lag to be used in the VAR model can be determined based on the criteria of Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC) or Hannan Quinnon (HQ). of the optimal lag, length testing is very useful for relieving the problem of auto correlation in the system of VAR, using the optimal lag is expected not to bring up the problem of auto correlation. Thus, the results from table 5, has obtaining lag will be used that is assigned as the optimum lag, the results of the analysis using lag 2 for the next test.

Table 5 The Optimum Lag Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-588.4496	NA	2.19e+25	69.69995	69.89600*	69.71943
1	-567.7618	29.20617*	1.36e+25	69.14845	70.12870	69.24589
2	**-547.5739**	**19.00046**	**1.24e+25***	**68.65575***	**70.42020**	**68.83114***

Sources: World Bank, Processed, 2018

Johansen Cointegration Test

According to (Wassell& Saunders, n.d.) in his research, cointegration tests are performed to determine the absence or existence of cointegration relationships between all test variables. Cointegration is a common movement between economic variables in the long run. Engle-Granger (1987) states that the linear component of the series can be stationary even though the series is not stationary at level (1). If the series is not stationary, but the linear component does not move, then the Granger Causality test will become invalid. Thus, in the study Pesaran et al (2001) it is said that if the variables are found cointegrated, ie there is a linear, stable and long-term relationship between variables so that the disequilibrium error tends to be close to zero before conducting the Granger Causality test before performing the test of Cointegration Johansen. Cointegration test can be done by

Johansen method. The conclusion is based on the comparison between the Trace Statistic value with the critical value at alpha 0.05, and by looking at the probability value to indicate whether there is an equality in a cointegrated system.

The results are summarized in Table 6, shows the value of Trace Statistic of Trace test of 73.92260 greater than the critical value at alpha 0.05 of 47.85613 which means that in the system there is one cointegrated equation. The Trace Statistic value of 39.88597 which is greater than the critical value at alpha 0.05 of 29.79707 shows at least one cointegrated equation. then from Maximum Eigen value test, Trace Statistic value equal to 34,03663 bigger than critical value0,05 equal to 27,58434 indicate that in a system there is one cointegrated equation. Then from the Trace Statistic value of 25.23212 greater than the critical value of 0.05 of 21.13162 indicates that in the system there is on eco-integrated equation.

Table 6 Cointegration Johanson Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.864956	73.92260	47.85613	0.0000
At most 1 *	0.773326	39.88597	29.79707	0.0025
At most 2	0.427709	14.65385	15.49471	0.0667
At most 3 *	0.262053	5.166021	3.841466	0.0230
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.864956	34.03663	27.58434	0.0064
At most 1 *	0.773326	25.23212	21.13162	0.0125
At most 2	0.427709	9.487832	14.26460	0.2478
At most 3 *	0.262053	5.166021	3.841466	0.0230

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Sources: World Bank, Processed, 2018

Table 7 The results of the equation Cointegration

FDI	FIT	MO	SP
	-8.61E+13	4.93E+13	4.84E+13
1.000000	(1.2E+13)	(7.1E+12)	(5.7E+12)

Table 7 shows that there is a positive long-term relationship between the credit ratings provided by Fitch (FIT)to Direct Investment in Indonesia. And there is a negative relationship between credit ratings of Direct Investment in Indonesia provided by Moody's and S & P from 1998-2016. Cointegration testing through Johansen Cointegration Test showed that in the four variables, FDI, MO, FIT and SP Indonesia period 1998-2016 there isa long-term or cointegrated relationship. Thus in this study, we use VECM analysis.

Vector Error Correction Model

The previous cointegration test has concluded that the four variables are cointegrated or have long-term relationships, so the analysis is VECM analysis. Furthermore, whether or not the influence of lag or lag of a variable in the system, both the lag effect of a variable on the variable itself and other variables that exist in the system can be known through the significance test of the VECM estimation results. Based on the optimum lag test results, the lag used in the VECM analysis is lag 2. The variable significance test is done by comparing the statistical value and t value with the VECM estimate with the t df table value (0.05; 17-1) at the level significance of 5% and t table df (0.1,17-1) at level obtained t table value at alpha 5% equal to 2.119, and t table at alpha 10%equal to 1.745.

Based on the results of the VECM estimation table 8, showed that FDI in the second lag with alpha 5% no effect on variable FIT with the values of t-female-1,584 < 2,119 and with 10% alpha value of t-female-1,584 <-1.745. Then the variable has no effect positive FDI and significantly to the variable SP and MO with the level of alpha 5% and 10% on the second lag variable FIT, shows that FIT on the second lag with 5% alpha and alpha10% no effect positive and significantly to FDI with variable alpha 5% with a value of t-female-0.164 <2.119and with 10% alpha value of t-female-0,164 <-1.745. Then FIT the variables do not affect positively and significantly to FIT variable and MO, but the variables are negative and significant influential FIT against the variable SP with 10% alpha value of t-female-1,557 <-in case of 1.745, meaning the increased ranking of FIT two years earlier, then the rating agency SP will lower the credit rating of the country in the current year, namely of1.557.

The results of estimation on MO with variable lag 2 with 5% alpha and alpha 10%, it was found that MO is not negative and significant influential variable against FDI on alpha 5% with a value of t-female-0,138 < 2,119and with 10% alpha-0,138 <-1.745. And also not significant variables variable FIT against MO and MO but MO influential negative and significantly to the SP with 10% alpha with value t calculate -1,790 <-1.745. The next variable MO on lag 2 negative and significant effect on alpha 10% against SP registration-1.790. That is, if there is a decrease in the rating by the rating agencies MO in the previous two years, then the rating agency SP will lower the credit rating of the country in this year of 1.790.

Table 8 VECM of FDI among test results, FIT, MO and SP

Error Correction:	D(FDI)	D(FIT)	D(SP)	D(MO)
D(FDI(-2))	-0.193343	-7.15E-14	-1.01E-16	5.01E-15
	(0.53869)	(4.5E-14)	(8.3E-14)	(1.0E-13)
	[-0.35891]	[-1.58432]	[-0.00122]	[0.04798]
D(FIT(-2))	-3.38E+11	-0.293697	-0.490037	0.309539
	(2.1E+12)	(0.17190)	(0.31460)	(0.39708)
	[-0.16465]	[-1.70849]	[-1.55763]	[0.77954]
D(SP(-2))	3.58E+11	0.078798	0.315347	-0.218547
	(1.8E+12)	(0.14939)	(0.27340)	(0.34508)
	[0.20070]	[0.52746]	[1.15341]	[-0.63332]
D(MO(-2))	-1.79E+11	-0.156451	-0.356265	-0.169246
	(1.3E+12)	(0.10871)	(0.19896)	(0.25112)
	[-0.13801]	[-1.43911]	[-1.79066]	[-0.67397]

Sources: processed data, 2018.

Description: ( ): Standard Error of each variable lag.

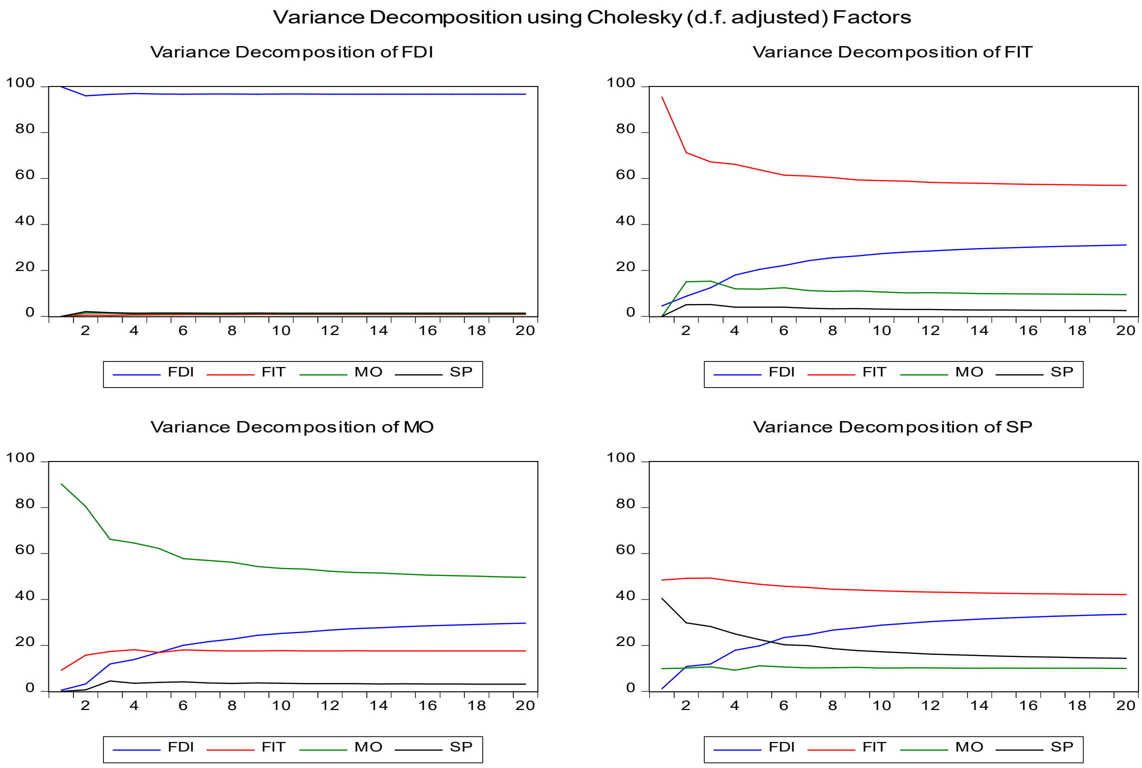
[ ]: t-Value count of each lag variable.

Analysis of Impulse Response Function (IRF).

According to (Nugroho, 2009) analysis of IRF is used to determine the response of an endogenous variable against the shock (shock) of the specified variable. IRF is also used to look at the shocks from one variable to another and how long the influence occurred. IRF analysis needed to know how the influence of shock a variable against itself and other variables in the system, so that it can be known jolts of a variable against other variables and where are the variables gives the biggest response against the existence of the jolts/shock.

Based on Figure 1, with the analysis of IRF with FDI as a response to conclude that in the next 20 years, the highest response is the response of FDI towards FDI itself, which is expected to be stable at standard deviation to eight, and Response the next highest was the response of FDI against mo. Ago response FDI that FIT and SP approached the standard deviation of zero. Next with IRF analysis with a FIT as the response concludes that in the next twenty years the highest response against the FIT itself, which is expected to be stable at standard deviation to sixteen. Then the next highest response is the response FIT against MO, then FTI response against SP approaching standard deviation of zero.

Later analysis of IRF with MO as response concluded that in the next twenty years the highest response towards FDI, which is expected to be stable at standard deviation to seventeen. Then the next highest response is the response against MO FIT, then FTI response against SP are approaching zero and standard deviation of the last IRF analysis with SP as the response concludes that in twenty years time response the highest response against the FIT, which is expected to be stable at standard deviation to sixteen. Then the next highest response is the response of SP towards FDI, then the response against its own SP to SP, and the last response SP against MO.



Sources: processed data, 2018

Figure 2 Impulse Response Function (IRF) with variable FDI, FIT, MO and SP

Analysis of Variance Decomposition (VD)

Variance decomposition (VD) is part of the VECM analysis which serves to support the results of the previous analysis. VD provides an estimate of how large the contribution a variable to change the variable itself and other variables at some future period, whose value is measured in percentage form. Than a variable which is expected to have the greatest contribution to a particular variable will be known.

The analysis of FDI on variable VD table 9 indicates that the variable is expected to have the greatest contribution towards FDI during the next ten years is variable FDI itself with an average contribution per year amounted to 87%, followed by MO's contribution of 7%, 6%, SP and FIT 1%. Analysis of the variable VD FIT on table 10, indicating that the variable is expected to have contributed most to FIT during the next ten years is variable FIT themselves with an average contribution per year of 76.18 % followed by the contribution of FDI amounting to 16.57%, SP amounted to 3.67%, and MO 3.63%.

Based on the tests that have been done, it can be concluded that based on the VECM test there are two variables significantly negative at alpha 10%, the variable FIT to SP and variable MO to SP. The cointegration test through Johansen Co-Integration test shows that the four variables are cointegrated. Analysis of IRF and FEVD shows that the variables affecting FDI are FDI itself, the variables affecting FIT are the FIT variable itself, then the variables affecting the MO variable are the own MO variable and the last SP variable that the highest influencing variable is FIT

Table 9 Variance Decomposition of variables of FDI.

Variance Decomposition of FDI: Period	S.E.	FDI	FIT	MO	SP
1	7.22E+12	100.0000	0.000000	0.000000	0.000000
2	7.22E+12	100.0000	0.000000	0.000000	0.000000
3	8.52E+12	92.06507	0.001145	5.532563	2.401222
4	8.52E+12	92.06507	0.001145	5.532563	2.401222
5	9.14E+12	83.55929	1.137638	8.366168	6.936905
6	9.14E+12	83.55929	1.137638	8.366168	6.936905
7	9.39E+12	79.88014	1.401341	9.997627	8.720887
8	9.39E+12	79.88014	1.401341	9.997627	8.720887
9	9.50E+12	78.17782	1.636218	10.55700	9.628963
10	9.50E+12	78.17782	1.636218	10.55700	9.628963

Sources: processed data, 2018

Table 10 Variance Decomposition of variables of FIT

Variance Decomposition of FIT: Period	S.E.	FDI	FIT	MO	SP
1	0.472646	0.576835	99.42317	0.000000	0.000000
2	0.472646	0.576835	99.42317	0.000000	0.000000
3	0.597566	21.10208	73.71720	2.452796	2.727919
4	0.597566	21.10208	73.71720	2.452796	2.727919
5	0.612364	20.76965	70.54456	4.523132	4.162653
6	0.612364	20.76965	70.54456	4.523132	4.162653
7	0.624954	20.48315	68.70774	5.251486	5.557620
8	0.624954	20.48315	68.70774	5.251486	5.557620
9	0.627878	20.33036	68.08316	5.660484	5.925996
10	0.627878	20.33036	68.08316	5.660484	5.925996

Sources: processed data, 2018

Table 11 Variance Decomposition of variables of MO

Variance Decomposition of MO: Period	S.E.	FDI	FIT	MO	SP
1	0.861420	0.008270	0.008415	99.98332	0.000000
2	0.861420	0.008270	0.008415	99.98332	0.000000
3	1.188642	22.26894	8.321941	52.54662	16.86251
4	1.188642	22.26894	8.321941	52.54662	16.86251
5	1.203261	22.39596	8.772616	51.42567	17.40575
6	1.203261	22.39596	8.772616	51.42567	17.40575
7	1.212244	23.02011	8.782224	51.03939	17.15827
8	1.212244	23.02011	8.782224	51.03939	17.15827
9	1.216120	22.93746	8.883362	50.78790	17.39128
10	1.216120	22.93746	8.883362	50.78790	17.39128

Sources: processed data, 2018

Table 12 Variance Decomposition of variables of SP

Variance Decomposition of SP: Period	S.E.	FDI	FIT	MO	SP
1	0.741848	0.702325	0.948557	10.53277	87.81635
2	0.741848	0.702325	0.948557	10.53277	87.81635
3	0.947892	15.35103	3.202878	21.92271	59.52338
4	0.947892	15.35103	3.202878	21.92271	59.52338
5	1.013500	13.62285	4.064876	22.62878	59.68350
6	1.013500	13.62285	4.064876	22.62878	59.68350
7	1.034463	13.34473	4.262300	23.51248	58.88049
8	1.034463	13.34473	4.262300	23.51248	58.88049
9	1.042155	13.15087	4.391005	23.63068	58.82744
10	1.042155	13.15087	4.391005	23.63068	58.82744

Sources: processed data, 2018

Conclusions

A country's credit rating given by credit rating agencies is one factor for investors to make investments in a country. Because investors will see the level of risk returns in a country, based on the literature found that, if the country's credit rating is good, then it would increase the influx of foreign direct investment into the country. Improviding credit ratings, credit rating agencies look at the internal and external conditions of a country.

Based on the result of studied that have been done, it can be concluded that based on the VECM test there are two variables significantly negative at alpha 10%, the variable FIT to SP and variable MO to SP. The cointegration test through Johansen Co-Integration test shows that the four variables are cointegrated. Analysis of IRF and FEVD shows that the variables affecting FDI are FDI itself, the variables affecting FIT are the FIT variable itself, then the variables affecting the MO variable are the own MO variable and the last SP variable that the highest influencing variable is FIT.

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