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Analysis of Cointegration and VECM of FDI, Labor Force, Government Expenditure and GDP in Indonesia (2005-2019)

Danang Indrajaya [1]

Abstract:

This paper studied the effect of labor force, government expenditure and FDI on GDP of Indonesia (2005-2019) by cointegration analysis and VECM. In the short-term, GDP, labor force and government expenditure significantly affect GDP of Indonesia, while FDI does not significantly affect Indonesia's GDP. However, in the long term, GDP, labor force, government expenditure and FDI have a significant affect GDP of Indonesia. The government must ensure that there are no shocks in GDP, labor force, government expenditure and FDI of Indonesia. Because any shocks that occur in these variables will also have an impact on the GDP of Indonesia.

Keywords: *GDP, Labor Force, FDI, Government Expenditure*

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1. Introduction

Development strategies in developing countries are oriented towards achieving high economic growth. Economic growth is a quantitative description of the development of an economy in a given year compared to the previous year. By knowing economic growth, it can be used to analyze the economic performance of a country and people's welfare measurement. Economic growth is related to an increase in a country's production or an increase in a country's per capita income. Therefore, economic growth is closely related to the Gross Domestic Product (GDP).

Gross Domestic Product (GDP) is considered the best single measure of people's welfare, because it measures two things at the same time: the total income of everyone in the economy and the total state spending on goods and services produced by the economy. GDP can measure the total income and the expenditure because of requirements for an economy as a whole, income must equal expenditure.

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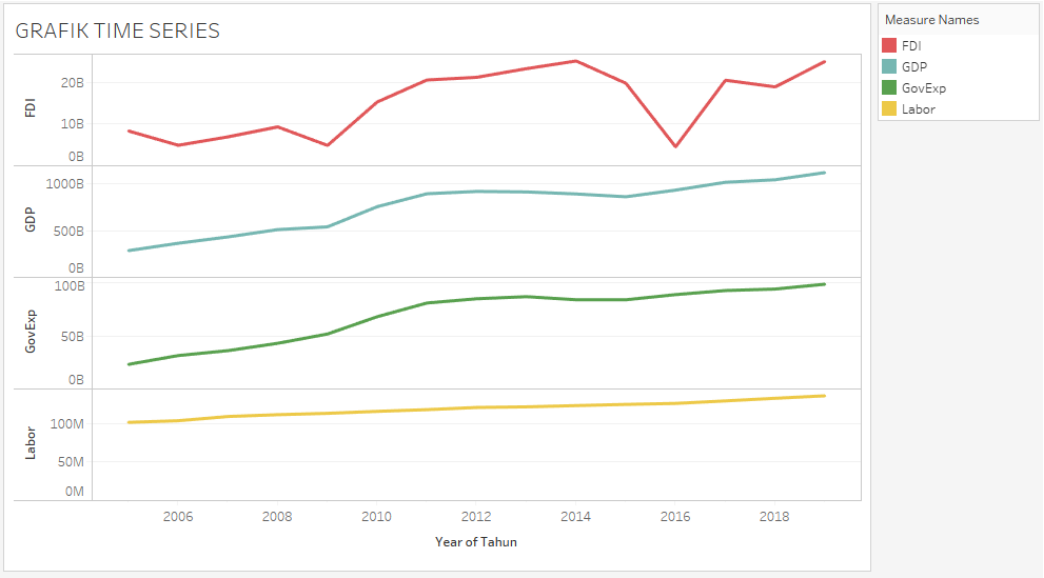


Source: World Bank (2021)

Figure 1. Time Series Graph of FDI, Labor Force, Government Expenditure and GDP in Indonesia

Based on the figure above, FDI in Indonesia experienced a shock (decline) in 2009 and 2016. Total FDI in 2016 to 2019 was 4,541,713,739; 20,510,310,832; 18,909,826,043 and 24,993,551,748 (in US dollars). The graph of government spending allocated mostly to defense and security tends to increase. The government spending in 2016 to 2019 was 88,787,505,533; 92,630,230,500; 94,025,730,842 and 98,588,329,591 (in US dollars). The labor force graph in Indonesia also tends to increase. The labor force in Indonesia from 2016 to 2019 was 125,958,781; 129,204,841; 132,587,588; and 135,802,879 people, respectively. Meanwhile, the graph of Indonesia's GDP (GDP) in 2016 to 2019 also tends to increase, namely 931,877,364,178; 1,015,618,742,566; 1,042,271,531,012; and 1,119,091,259,074 (in US dollars).

2. Literature Review

Previous studies have generally found mixed empirical evidence on the relationship between FDI, and economic growth. Previous research conducted by Ali and Mingque (2018) used the Johansen cointegration test and analysis of vector error correction models as evaluation techniques. The facts show that there is a positive, significant and long-term relationship between FDI and economic growth. The results also reveal that there is a long-term Granger causality ranging from FDI, gross capital formation, government consumption, trade openness and labor to gross domestic product. Although current studies show a positive and significant effect of FDI on economic growth, some researchers point to the possible negative impact of

FDI on GDP growth (Aitken and Harrison, 1999; Lipsey, 2002). Skare, M. et al (2020) and Dritsaki & Stiakakis (2014) analyze the responses to unit shocks, they conclude there is weak feedback of the FDI and a weak effect of the FDI. The FDI variable does not affect GDP. They point to the key role of exports in economic growth and that FDI has only a supporting role.

The results obtained from research by (Molefe and Choga, 2017; Barro, 1989; Folster and Henrekson, 1999) show a negative relationship in the long run between government spending and economic growth. Meanwhile, (Eid, 2020) found the asymmetric effect of the increase and decrease in government spending on GDP in terms of its magnitude and significance in the long term. In particular, the impact of the current increase in government spending and government capital spending has a positive and significant impact on GDP, while the decline in both types of government spending does not have a significant impact. While the results of the VECM study by (Oladele et al, 2017) show a positive and significant relationship between economic growth and government spending in the long term.

The findings in the research of Ul Haque et al (2019) found a causal relationship between labor force participation and economic growth, as well as between gross fixed capital formation and economic growth. This study also shows a unidirectional causal relationship of female labor force participation to economic progress. The study also found that total labor force participation and women's labor force participation had a significant short-term positive effect on economic development but had an adverse effect in the long run.

3. Theoretical Background

3.1 GDP

GDP has several benefits including measuring how far the national economic growth rate has gone and what still needs to be improved, comparing economic progress between countries to find out which country has the strongest economy, knowing the economic structure of a country, to find out which sectors need improvement, as the basis for the formulation of government policies (In this case, GDP is often interpreted as an indicator of the welfare of a country). A high GDP figure is defined as a high production rate. The high production rate is linked to the people's high purchasing power.

The calculation of GDP with the expenditure approach is referred to as the identity of the national income post with the following formula.

$$Y = C + I + G + NX \quad (1)$$

Note:
Y = Total demand for domestic output (GDP)
C = Household consumption

I = Investment spending in the business and household sectors
G = Government spending
NX = Net exports or net foreign demand.

On the production side, the output of goods and services in an economy (GDP) depends on the factors of production available in the economy and the ability of the available production function to convert inputs into outputs. In general, the factors of production consist of capital (K) and labor force (L), and the production function is written in the following formula (Mankiw, 2006).

$$Y = F(K, L) \quad (2)$$

Note:
Y = Income (production)
K = Capital
L = Labor Force

The production function shows how much production is achieved in the economy depending on the amount of use of capital inputs and the labor force. In the long run the amount of capital and labor available in the economy is certain so that the amount of output becomes constant.

3.2 FDI

Foreign Direct Investment (FDI) is foreign investment where an investor in the economic sphere of the countries take an interest in a business in the sphere of the economy of other countries. This cross-border investment usually takes the form of long-term investment from foreign investors to domestic companies. So that generally foreign direct investment involves two countries at once.

FDI can be done by buying companies that already exist in a country, or it can also provide capital to build new companies in that country. Foreign direct investment is also usually marked by the purchase of shares of a company in a country of at least 10 percent by individuals or companies from other countries. If the purchase of shares is less than 10 percent, the International Monetary Fund (IMF) defines the share ownership as a portfolio of shares of a person or a company only. Another way to make foreign direct investment is usually in the form of purchasing or building construction of factories, as well as buying land by foreign investors. This form of ownership of buildings or land from foreign direct investment is generally full or almost full.

According to its function, the presence of FDI in Indonesia contributes to economic growth. This function occurs through technology transfer, capital accumulation, access to international markets, job creation and managerial and marketing practices. For capital accumulation, foreign direct investment can form investment as well as increase investment efficiency (Te Velde, 2001). Trade and FDI can certainly

facilitate growth once minimum levels of human capital, infrastructure and technology have been met (Karbasi, et al., 2005).

3.3 Labor Force

The labor force is the population of productive age/working age 15 years and over who work, has a job but temporarily does not work, and is unemployed (unemployment). Examples of people who have jobs but temporarily do not work are workers on leave, illness, strike, permission/absence, and so on.

The labor force are the responsibility of the government, where they are entitled to a decent job and livelihood. The government's obligation is to provide employment opportunities to regulate the protection of their rights through labor regulations. The government regulates the matter of Indonesian workers, from placement, training, to protection, which are described in the articles of the Manpower Law. The law also uses the term worker/labor, in the context of an employment relationship, to refer to any person who works for wages or other forms of remuneration. This concept of workers covers all types of employees, including permanent employees, temporary employees, and daily/casual/piecemeal employees.

3.4 Government expenditure

Government expenditure is part of fiscal policy which is an action by the government to regulate the course of the economy by determining the amount of government revenues and expenditures each year which is reflected in the documents of the National and Regional Budget. The aim of this fiscal policy is to stabilize prices, employment opportunities and spur economic growth.

Methodology

In conducting the analysis using the VAR method, there are several tests need to be carried out.

Stationarity Test Data

Stationarity test is one of the important condition in the econometric model especially for time series data. Stationary condition is reached when the time series data shows the mean, variance, and autovariance (on the lag variation) remain the same at any time the data is formed. The use of stationary data will make the time series model more stable. According to Engle and Granger (1987), stationarity has important consequences in translating economic data and models. A linear regression model using non-stationary data will cause spurious regression. One method that is often used to determine the stationarity of data is the unit root test. David Dickey and Wayne Fuller have developed the test namely the Augmented Dickey-Fuller (ADF) Test. If a time series data is not stationary at zero order (level), then the stationarity of the data can be searched through the next order so that the stationarity level is obtained on the nth order, namely first difference, second difference, and so on.

Optimum Lag Test

The aim of optimum lag test is to determine the most optimal lag length which will be used to form the VAR model. This stage of testing the optimum lag is very important because if the lag of the variables involved is too short, it has the potential to not fully explain the dynamics of the model. However, the variable lag involved is too long can result in inefficient estimates due to the reduced degrees of freedom (Basuki & Prawoto, 2016). However, there is a tendency to involve a small number of variable lags in order to minimize the specification error (Gujarati, 2003). The optimal number of lags is determined based on the Schwarz Information Criterion (SIC), Akaike Information Criterion (AIC), and Hannan Quinnon Criterion (HQ).

VAR Stability Test

The VAR stability test is a test by determining the roots of characteristic polynomial. If all the roots of characteristic polynomial are in the unit circle is less than one, then the VAR model is stable. It means the IRF (Impulse Response Function) and VD (Variance Decomposition) generated is valid. After getting the optimal lag from the AIC, SIC, and HQ criteria, the model stability test is carried out using the selected lag. If the lag is not stable, then the lag will be determined again with a smaller number of variable lags to get a stable conditions lag with through the VAR stability test.

Cointegration Test

The cointegration test was first written by (Granger, 1969). Cointegration test is used to obtain a description of whether or not there is a long-term relationship between variables in the model. Engle-Granger explains that the existence of non-stationary variables causes a long-term relationship between variables in the VAR system. This concept is called cointegration. Cointegration is a long-term relationship between variables which although individually are not stationary, but the linear combination between these variables can become stationary (Basuki & Prawoto, 2016).

Cointegration test is carried out to determine whether the non-stationary variables at the level meet the integration requirements, namely all stationary variables at the same degree, namely degree 1. Cointegration test is very necessary to do to avoid false regression phenomena. If the two variables have a cointegration relationship, the resulting regression is not false and the t test and F test's results will be valid (Gujarati, 2003). Cointegration test can be done using Johansen cointegration test. The hypothesis in the cointegration test is:

H_0 = There is no cointegration
H_1 = Cointegration occurs

Johansen Cointegration Test uses two forms of analysis, namely the trace statistic test and the maximum eigenvalue test (Johansen, 1988). The trace statistic and maximum eigenvalues obtained from the test results are compared with the critical value at a certain level of significance. If the trace statistic and maximum eigenvalue

are greater than the critical value at 0,05 or 5 percent, then it can be concluded that there is cointegration between these variables or H_0 is rejected. Based on the results of the cointegration test, it will be determined whether to use Vector Error Correction Model (VECM) or Vector Autoregression (VAR) analysis. If it is cointegrated, the model used is VECM and vice versa will use VAR in First Difference.

Estimation of VAR and VECM Models
The estimation of the VAR or VECM models is done after testing the pre-estimation of the VAR or VECM Models. This model estimate will be used as a reference in the resulting analysis. The estimation of the VAR or VECM model is adjusted to equations 1 and 2. In the estimation of the model, it will produce a two-way t-statistic value based on the number of observations with a confidence interval of +/- 2.5 percent. If the t-statistic value > critical value (+) or the t-statistic value < critical value (-) then the coefficients and significant variables or Ho (not significant) are rejected and vice versa.

Analysis of VAR and VECM estimation results consists of two types, namely Impulse Response Function (IRF) and Variance Decomposition (VD), which can be explained as follows.

Impulse Response Function (IRF)
IRF analysis is used to dynamically evaluate the impact of changes in one variable on other variables. The purpose of IRF is to detect shocks to be more specific, which means a variable can be affected by a particular shock. The impact of changes can be seen by giving a shock to one of the endogenous variables, the shock given is one standard deviation of a variable (Juanda & Junaidi, 2012).

Variance Decomposition (VD)
VD is a method can be used to evaluate how changes in a variable are indicated by changes in error variance that are affected by other variables (Firdaus, 2011). VD summarizes the variance of forecasting errors into components can be associated with each endogenous variable. By calculating the percentage of the future k-stage error prediction of a variable due to innovation in other variables, it will be able to see how big the difference between the error variance before and after the shock comes from itself or from other variables (Novrianti, 2012)

To analyze the factors that influence the price of olein, the operational model in this study is:

$$\Delta LnGDP_t = \alpha_1 + \sum_{i=1}^{k} \alpha_i \Delta LnGDP_{t-i} + \sum_{i=1}^{k} \beta_i \Delta LnLabor_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta LnFDI_{t-i} + \sum_{i=1}^{k} \theta_i \Delta LnGovExp_{t-i} + \varepsilon_t$$

Where

a_1 = Constant

$\alpha, \beta, \gamma, \theta$ = Parameters

ε = Error

GDP = GDP Riil

$Labor$ = Labor Force

FDI = Foreign Direct Investment

$GovExp$ = Government Expenditure

4. Empirical Findings/Result

The The unit root test in this study used the Augmented Dickey Fuller (ADF) test. To determine whether the variable is stationary or not, that is, if the p-value is less than the critical value at 5percent level of confidence, it can be said that the variable is stationary. In other words, if the |ADF-value| is more than the |t-ADF| (i.e. 1.946), it can be said that the variable is stationary. Variables that are not stationary at the level stage are carried out differentially to improve non-stationary.

Table 1. Unit Root Test Result

Variables	Level		First Difference		Second Difference	
	ADF	p-value	ADF	p-value	ADF	p-value
LnGDP	0.968	0.906	-1.38	0.1774	-2.59	**0.0123**
LnFDI	0.806	0.867	-1.78	0.074	-2.54	**0.0143**
LnLabor	3.06	0.99	-0.499	0.4897	-2.32	**0.0229**
LnGovExp	0.514	0.783	-1.48	0.1422	-2.32	**0.0225**

Notes: ADF with no drift and no trend (lag 2)
Source: Author (2021)

Based on the ADF test that has been carried out, all variables are not stationary at the level and first difference. They are already stationary at the second difference level. Non-stationary data often show an imbalance relationship in the short term, but there is a tendency for an equilibrium relationship to occur in the long run. To find out whether there is a long-term relationship in the variables, cointegration test is necessary. Therefore, to analyze long-term information, level data will be used so that the VAR model will be combined with the error correction model to become VECM.

The next pre-estimation stage is testing the optimal lag. This test is very important because the lag of the endogenous variables in the system of equations will be used as an exogenous variable. In addition, this test is useful for eliminating autocorrelation problems in VAR systems. The size of the lag chosen in this study is the smallest lag, because if a large lag is chosen, it will reduce the diversity in

degrees of freedom. Based on the AIC, HQ, SC and FPE value used, lag 2 is the optimal lag.

Table 2. Cointegration Test Result

	test	10percent	5percent	1percent
r <= 3	2.56	7.52	9.24	12.97
r <= 2	11.43	13.75	15.67	20.20
r <= 1	**27.19**	19.77	22.00	26.81
r = 0	47.10	25.56	28.14	33.24

Source: Author (2021)

If the test value is more than the critical value at various levels of confidence (i.e. 10 percent, 5 percent and 1 percent), it can be said that there is cointegration. Based on the table above, the cointegration test shows that there is at least 1 cointegration (r <= 1), so the VECM estimation can be done.

Table 3. VECM Estimation

Variables	Coefficient	T-Statistics
Ect1	-2.57559	0.000485 ***
D(LnGDP(-1))	-2.60416	0.000271 ***
D(LnFDI(-1))	0.01496	0.430088
D(LnLabor(-1))	6.77182	0.000236 ***
D(LnGovExp(-1))	3.15699	7.71e-05 ***

Notes: Dependent Variable: D(LnGDP)
Source: Author (2021)

Based on the table 3, ECT has a significant effect to GDP. It means, in the long term, GDP, labor force, government expenditure and FDI have a significant affect to GDP of Indonesia. The values of ECT can be found in the following table.

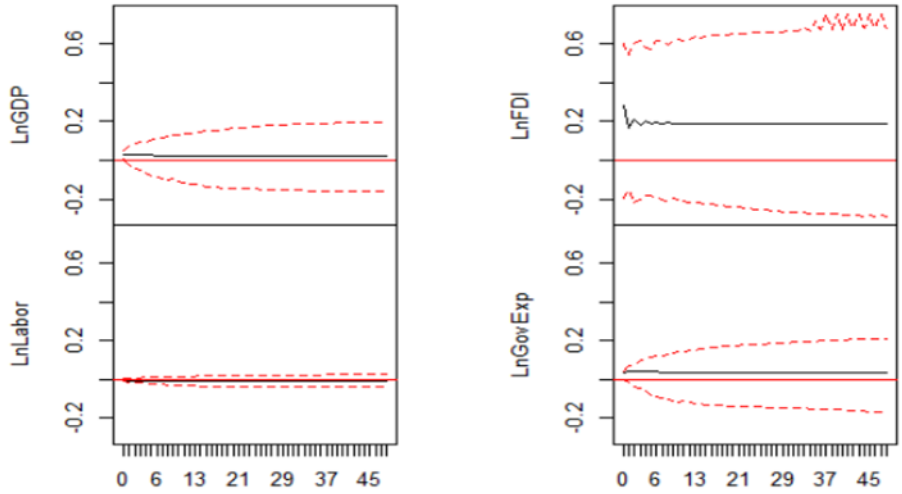
Table 4. ECT Values

Variables	Ect1
LnGDP(-2)	1.00000000
LnFDI(-2)	-0.01456022
LnLabor(-2)	-0.90512005
LnGovExp(-2)	-0.79201516
Constant	9.63313481

Source: Author (2021)

The next test is a simulation test of factor shocks with IRF analysis. The results of this analysis describe the current and future impact of shocks of one variable on the other endogenous variables. The response in the short term is usually quite significant and tends to change, while the long term response tends to be consistent. In this study, we will look at the impact of shocks over 48 months (4 years). The

shock response of labor force, FDI, government expenditure and GDP itself that affect GDP of Indonesia can be seen in Figure 2.



Source: Author (2021)

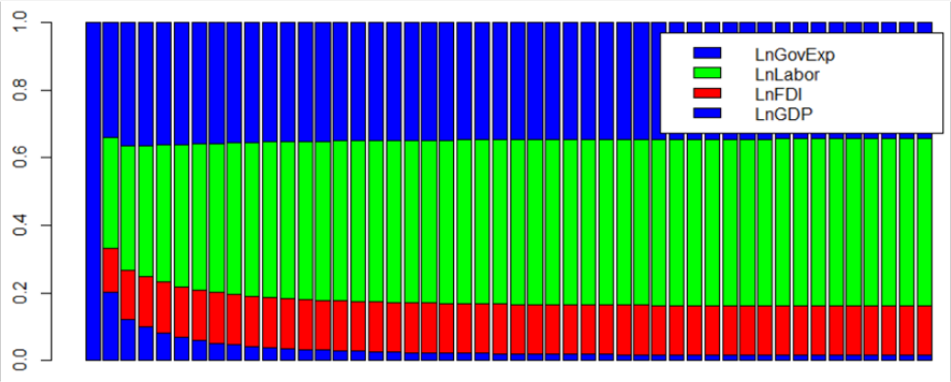
Figure 2. Orthogonal Impulse Response from GDP

If a random shock occurs in the labor force, GDP will respond negatively from the first period onwards. Shocks to the labor force are transmitted by GDP so that an increase in the labor force will decrease GDP. Based on Figure 1, the response of GDP to changes in labor force in the first month is – 0.627 percent. The shock response that occurs in the labor force will have an effect from the first month onwards. If the labor force increases by one percent, then the GDP of Indonesia will decrease by 0.627 percent in the first month. In the 48th month, if the labor force increase of one percent, then it would result in the GDP of Indonesia decreasing by 1.047 percent.

If there is a random shock to FDI, government expenditure and GDP itself, then GDP will respond positively from the first period onwards. Shocks in FDI, government expenditure and GDP itself will be rapidly transmitted by GDP so that from the first period onwards, an increase in FDI, government expenditure and GDP itself will increase GDP. The response of GDP to changes in FDI, government expenditure and GDP itself in the first month are 28.58 percent, 3.54 percent and 2.79 percent respectively. In the 48th month, if FDI, government expenditure and GDP itself increase of one percent, then it would result in the GDP of Indonesia increasing by 18.9 percent, 3.626 percent and 2.2 percent respectively.

To predict how much the influence of random shock among the variables in the VECM model, we use FEVD analysis. FEVD characterizes the dynamic structure between variables in the VAR/VECM model. By FEVD analysis, it can be seen the

strengths and weaknesses of each variable in influencing other variables over a long period of time.



Source: Author (2021)

Figure 3. FEVD results factors that affect GDP

The variability of the GDP (see fig. 3) is dominantly influenced by the GDP itself by 100 percent at the first period. The ability of the GDP to affect itself in the next period continued to decline until the 48th period by 1.53 percent. The effect of the labor force in the previous month (period) was small on the GDP but the percentage of the labor force gradually increased from 0 percent in the first period to 49.56 percent in the 48th period. The effect of government expenditure of the first month was 0 percent and continues increased to 34.38 percent in the 48th month. Likewise, the effect of FDI of the first month was 0 percent and continues increased to 14.53 percent in the 48th month.

Discussion

Discussion must explore the significance of the results of the work. Adequate discussion or comparison of the current results to the previous similar published articles is recommended to shows the positioning of the present research (if available). Scientifically, the results of research obtained in the study may be new findings or improvements, affirmations, or rejection of a scientific phenomenon from previous researchers.

5. Conclusions

Based on the result and discussion of this study, it can be concluded that in the short-term, GDP, labor force and government expenditure significantly affect GDP of Indonesia, while FDI does not significantly affect Indonesia's GDP. However, in the long term, GDP, labor force, government expenditure

and FDI have a significant affect GDP of Indonesia. The government must ensure that there are no shocks in GDP, labor force, government expenditure and FDI of Indonesia. Because as explained in the previous discussion that any shocks that occur in these variables will also have an impact on the GDP of Indonesia.

The existence of different responses produced by the GDP to the shocks of the GDP, labor force, government expenditure and FDI need to take action. One of the actions that can be taken is to observe and predict the movement of macroeconomic and microeconomic variables.`

There are still many factor variables that affect commodity prices that are not studied. Further research can use other variables such as consumption, population, export, import, agricultural land, etc.

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