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Determinants of Indonesian Real Effective Exchange Rate

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Abstract

As the study of Indonesian Real Effective Exchange Rate is still rare, this research tries to define the determinants of the Indonesian Real Effective Exchange Rate (REER). Variables used in this research are General Fixed Capital Formation (GFCF), Government Final Consumption Expenditure (GFCE), Gross Domestic Product (GDP), Inflation, and the Ratio of Export to Import in the period of 2005 Q1 to 2019 Q4. All of data are obtained from The United States's Central Bank of The Federal Reserve. Analytical method used in this research is Autoregressive Distributed Lag (ARDL) that is modified with Newey-West HAC Estimator. The results show that in the short run, GFCF and GFCE have no positive effects toward Indonesian REER, yet GDP and the Ratio of Export to Import have positive effects toward Indonesian REER, while Inflation has no a negative effect toward Indonesian REER. In the long run, GFCF, GFCE, and the Ratio of Export to Import have positive effects toward Indonesian REER. GDP has no a positive effect toward Indonesian REER, and Inflation has a negative effect toward Indonesian REER. This research is expected to fill the study gap of Indonesian Real Exchange Rate.

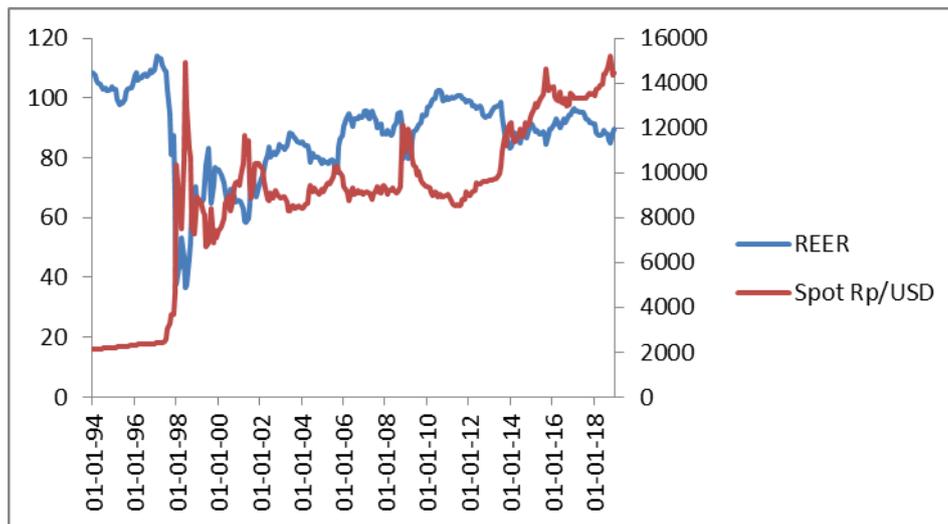
Keywords: *Real Effective Exchange Rate, GFCF, GFCE, GDP, Inflation, Ratio of Export to Import.*

1. Introduction

One of the essential macroeconomy variables for a country is the exchange rate. For developing countries, the exchange rate policy is an exciting discussion regarding the country's suitable exchange rate to improve its economic growth (Ghosh et al., 2015). The fact shows differences in authority makers' and economists' viewpoints regarding the effects of an exchange rate policy on the economy. Some economists also suggested that the exchange rate does not directly relate to economic growth in the short or long run. In contrast, politicians and authority makers believe that a low exchange rate is key to drive economic growth (Habib et al., 2017).

Indonesian exchange rate system has experienced several changes related to the political and economic growth at the time. The collapse of the Bretton Woods system in 1973 made Indonesia used a fixed-value system to maintain price stability and drive economic growth. The problem in this exchange rate system is the inflexibility of short run values that may encourage speculations and even disrupt the money market balance (Mohammad, 2006). In 1987, Indonesia changed its exchange rate policy from the fixed-value to the managed floating rate, marked by exchange rate devaluation. This change was based on the assumption that the exchange rate devaluation will decrease foreign debts' value. Its implication, however, that it did not affect the economic growth in the long run and could not drive high yields on the foreign money market investment (Efron, 1999).

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Source: United States's Federal Reserve

Figure 1. Indonesian Nominal and Real Exchange Rate 1994-2018

Due to the depreciation of the Rupiah exchange rate to USD and the failure of many banks in fulfilling their liquidities, the economic crisis that hit Indonesia made Bank Indonesia released the controlled intervention tape system and changed it to free-floating. It made the Indonesian exchange rate susceptible to disturbance from external and internal (Shabbir & Rehman, 2016).

In the more open economic era, the exchange rate's role becomes more critical, especially in the trade sector. The central bank's monetary policy does not necessarily put a nominal exchange rate on its long run balance value. Furthermore, speculators' and expectant' roles in the money market did not reflect the real value of an economic condition or commonly called decoupling.

Gopinath (2015) explained that relative price values in a country do not correlate with the country's nominal value. In international trade, the relative price of goods traded in other countries can be measured equally by comparing the real exchange rate resulted from the formation of customer's indices in the country (Cavallo et al., 2018).

Studies regarding real exchange rates have been conducted many times, such as a study from Koirala (2018) that examined the effects of real exchange rates on Nepal's economic growth. The study showed that real GDP was positively affected by the REER value of Nepal. The study also expressed the REER value transmission through aggregate demand for economic growth.

Kilicarslan, (2018) studied factors determining the REER exchange rate in Turkey, i.e., General Government Expenditure, Trade Openness, Gross Domestic Product, General Fixed Capital Formation, the money supply, and foreign direct investment. The study results explained that the government's expenses, economic growth, and foreign capital investment negatively affected the REER value. Meanwhile, capital formation, money supply, and trade openness positively affected the REER value.

In contrast with studies regarding the nominal exchange rate, studies of the Indonesian real exchange rate were scarce because, perhaps, data of the real exchange rate provided by Bank Indonesia, Statistics Indonesia, and other government bodies were limited. Therefore, this study aimed to examine the effects of factors affecting the Indonesian real exchange rate, such as GDP. The study existence is expected to augment literature regarding the Indonesian real exchange rate and occupy the study gap.

2. Literature Review and Previous Studies

Government Final Consumption Expenditure

Juliansyah dan Nazamuddin (2018) defined the Government Final Consumption Expenditure as all government expenses used to fulfill the public needs, such as civil servant spendings, infrastructure developments, and others. Public goods provision aims to improve public welfare and increase economic growth. GFCE is a reflection of the government's fiscal policy (Harremi & Koti, 2018). Nurlina (2015) explained that the portion size of government expenses reflects the size of activities funded from such expenses. Moreover, this instrument also illustrates the size of government expenses in funding the economic activities of a country.

Gross Domestic Product

Sujianto dan Azmi (2020) defined GDP as the total production size in a country's economy in a particular time unit. GDP is an essential indicator in the economy because components in the GDP measurement reflect the economy sector condition of a country. Meanwhile, Brilliant (2020) explained that GDP is the value of goods and services produced by a country's public.

General Fixed Capital Formation

GFCF is defined as a part or proportion of the country's income saved or invested in receiving yields in the future (Onyinye et al., 2017). Then, Owolabi and Ajayi (2013) stated that GFCF plays a vital role in economic growth because it acts as the capacity determinant of an economy in national production, which in the end will drive economic growth.

Inflation

Taylor (1995) defined inflation as the continuous tendency of increasing price. High inflation will decrease the buying power, and therefore, the public's ability to enjoy goods and services decreases. According to Setiartiti dan Hapsari (2019), the inflation phenomenon is common and inevitable. Even so, inflation should be controlled regarding the impact of high inflation on the public economic and social aspects.

According to Boediono (1998), inflation is classified into two, i.e., inflation from the increasing domestic price and inflation from the increasing foreign goods price. Then, viewed from its causes, inflation is classified into three types. First, the core inflation that commonly occurred due to economic development. Second, volatile food inflation, caused by changes in basic commodity prices. Third, the arranged price inflation, which is an inflation that is deliberately arranged by the government.

Export and Import

Yee et al., (2016) defined export as the selling process of goods and services produced in the original country to other countries to obtain profit, either competitive or comparative. Meanwhile, according to Purnamawati and Fatmawati (2013), the definition of import is the buying process of foreign goods according to the government's needs paid in foreign exchanges. In the globalization era, many countries are depending on their economic activities in international trade. The export and import positions are illustrated in the trade balance. A positive trade balance shows a bigger export

value than import value. Consequently, if the trade balance of a period is negative, it means that the import value is bigger than the country's export value (Astuti et al., 2015).

Real Effective Exchange Rate

Ginting (2013) defined the real effective exchange rate as the alternative value of goods prices in two compared countries. In other words, the real exchange rate determined the level of which economy actors can trade goods from a country to others. The real exchange rate calculation of a country is carried out by multiplying the nominal exchange rate to the trade partner countries' price level ratio. The real exchange rate calculation is explained by the formulation below:

$$\text{REER} = \text{Nominal Exchange Rate} \times ((\text{Foreign Price})/(\text{Domestic Price}))$$

Then, Mankiw (2003) explained that the real exchange rate movement affects a country's macroeconomy condition, especially regarding the export net position. If the nominal exchange rate is strengthened, it will boost trade balance growth because a strong exchange rate indicates low domestic prices in the country. In other words, each dollar will generate a higher Rupiah currency value.

Previous Studies

Studies regarding volatility determinants of countries' real exchange rates joined in the Economic Monetary Union (EMU) using TARARCH was conducted by Stancik (2007). Generally, the study results suggested that economic openness affected the real exchange rate volatility. The study results also showed that the flexible exchange rate regime possessed higher volatility than other exchange rate regimes.

Calderon and Kubota (2009) studied the exchange rate volatility caused by financial openness and trade capabilities of developing countries from 1975-2005. The study results stated that the high real exchange rate volatility was caused by the high productivity shock volatility and shocks from monetary and fiscal policies. Besides, this study showed that a country with excellent economic openness in trading and finance tended to show the stability of exchange rate fluctuations.

The results of Aipi's (2012) study regarding Papua New Guinean real exchange rate stated that ToT (Terms of Trade) did not affect in long run concerning RER and PNG. Meanwhile, increasing net capital inflows and foreign aid flows caused RER to be appreciated. Then, expansive fiscal policies resulted in increased non-traded goods' domestic prices and led to RER appreciation.

Then, Mustafa (2019) studied determinants of Jordan's real exchange rate using dependent variables, i.e., foreign exchange reserves, workers' remittance, government's expenses, and terms of trade (ToT). The study results stated that the government's expenses negatively affected the real exchange rate either in the short or long run. Meanwhile, foreign exchange reserves, workers' remittance, and ToT positively affected Jordan's real exchange rate.

A study conducted by Oriavwote dan Oyovwi (2012) regarding the Nigerian real exchange rate determinants showed that government spending to GDP, terms of trade, and the technological process did not affect the real exchange rate. Meanwhile, capital flow, inflation, price level, and the nominal exchange rate affected the real exchange rate.

Hassan et al.,(2017) studied the Nigerian real exchange rate source from 1989Q1 to 2015Q4. The study results presented that fiscal balance, economic openness, world oil prices, net foreign asset, and interest rate positively affected the real exchange rate volatility. Then, the nominal GDP negatively affected the real exchange rate volatility.

Hypothesis

Based on the background, theoretical review, and previous researchs explained above, the study proposes five hypotheses as follows:

H1: General Fixed Capital Formation does positively affect the Indonesian Real Exchange Rate

H2: Government Final Capital Expenditure does positively affect the Indonesian Real Exchange Rate

H3: Gross Domestic Product does positively affect the Indonesian Real Exchange Rate

H4: Inflation does negatively affect the Indonesian Real Exchange Rate

H5: Ratio of Export to Import does positively affect the Indonesian Real Exchange Rate

3. Data and Method

Data

Variables used in this study referred to a study by Kilicarslan (2018) by using the real exchange rate as the dependent variable, and export-import ratio, Gross Domestic Product, inflation, General Fixed Capital Formation, and General Government Final Consumption as the independent variables.

Data used were quarter data from quarter 1 of 2005 to quarter 4 of 2019, obtained from the United States of America's central bank data through <https://fred.stlouisfed.org>. In facilitating the study interpretation, all data were transformed into logarithms. Here is the explanation of the data and variables used:

Table 1. Data and Variable's Operationalization

Variable	Variable's Operationalization	Source
Real Exchange Rate	LOG_REER	The Federal Reserve
Ratio of Export to Import	LOG_EXP_IMP	The Federal Reserve
Gross Domestic Product	LOG_GDP	The Federal Reserve
Inflation	LOG_INF	The Federal Reserve
General Fixed Capital Formation	LOG_GFCF	The Federal Reserve
Government Final Consumption Expenditure	LOG_GFCE	The Federal Reserve

Methods

This study used the Autoregressive Distributed Lag (ARDL) analysis with the aid of the Software Eviews 9.0 to interpret the study results. Prior to the ARDL testing, several steps had to be conducted, namely:

a. Stationarity Test

Data in stationary nature is the ultimate requirement in the ARDL study model. The unit root test was conducted to discover to which degree the data will be stationary. In the data time series, non-stationary data mostly on the level degree so that the data would be transformed into difference-shaped data. This stationarity test used the Augmented Dickey Fuller (ADF) method.

b. Cointegration Test

The Bound Test Cointegration method was introduced by Pesharan et al., (2001) to generate a long run balance. The cointegration test was carried out if one follows this equation:

$$Y_t = \beta_0 + \beta_1 x_1 + e_t$$

Then, the operationalization from the equation variant can be written as:

$$E_t = y_t - \beta_0 - \beta_1 x_1$$

The decision-making of the Bound Test Cointegration is by comparing the F-Statistic with lower and upper bound values. If the F-Statistic value is bigger than the upper bound, there is cointegration. In contrast, if the F-Statistic value is smaller than the upper bound, there is no cointegration.

c. Optimum Lag Determination

In the ARDL method, it is necessary to conduct the optimum lag determination to discover which lag the model is effective to utilize. There are several methods to determine the optimum lag length, as explained below:

$$\text{Schwartz Criterion (SC)} = -2 (\text{f} / \text{T}) + k \log (\text{T}) / \text{T}$$

$$\text{Akaike Information Criterion (AIC)} = -2 (\text{f} / \text{T}) + 2 (k + \text{T})$$

$$\text{Hannan-Quinn Information Criterion (HQ)} = -2 (\text{f} / \text{T}) + 2k \log (\log(\text{T})) / \text{T}$$

In this study, the optimum lag length was picked from the lag generated by the Akaike Information Criterion (AIC).

d. Classic Assumption Tests

Fundamentally, the ARDL concept is a regression that may contain classic assumptions. Therefore, to generate a valid study result, the study used three classic assumption tests. The first one is the normality test. This test is the primary requirement of classic assumption tests. Normal data is the main requirement in regression modeling. The study used the Jarque-Bera test method to determine whether the data met the normality assumption or not. The second one is the heteroscedasticity test. It is conducted to discover whether data variants in the study were constant or not. This study used a glejser method to determine whether the data had fulfilled homoscedasticity assumptions or not. The third one is the autocorrelation test. Time series data are susceptible to autocorrelation due to its nature that may be influenced by past data behavior. In ensuring whether to have an autocorrelation problem, the study used the Breusch-Godfrey test method.

e. Autoregressive Distributed Lag (ARDL)

ARDL is used to analyze both the long- and short run relationships between independent and dependent variables. This model is used when the data is not on different stationarity levels. The ARDL estimation results generate a consistent long run coefficient, although the regressor is I(0) or I(1). Besides, the ARDL method can also result in the Error Correction Model (ECM) estimation. Here is the long run equation on the ARDL method:

$$Y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^p \alpha_2 Y_{t-i} + \sum_{i=0}^q \alpha_3 X_{1t-i} + \sum_{i=0}^r \alpha_4 X_{2t-i} + \sum_{i=0}^s \alpha_5 X_{3t-i} + et$$

Then, the short run equation of ECM can be written as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \sum_{i=0}^q \gamma_i \Delta X_{1t-i} + \sum_{i=0}^r \delta_i \Delta X_{2t-i} + \sum_{i=0}^s \theta_i \Delta X_{3t-i} + \ell \text{ECM}_{t-1} + et$$

The primary requirement to validate ECM is that cointEq should be negative and significant to alpha so that the ARDL ECM result can be utilized.

From the movement or pattern of former data, autocorrelated data will result in an acute and misleading regression for decision-making.

4. Result and Discussion

The first testing was the stationarity test. This test was required, so that study data were stationary on the same level. If they were not stationary, the data would be derived from the first to the second differentiation levels until they became stationary. Here are the results of the stationarity test.

Table 2. Stationarity Test

LEVEL		FIRST DIFFERENCE	
Variable	Prob.	Variable	Probability
LOG_REER	0,0782	LOG_REER	0,0000
LOG_EXP_IMP	0,1522	LOG_EXP_IMP	0,0000
LOG_GDP	0,9842	LOG_GDP	0,0000
LOG_INF	0,3054	LOG_INF	0,0000
LOG_GFCF	0,6544	LOG_GFCF	0,0001
LOG_GFCE	0,7650	LOG_GFCE	0,0000

Table 2 above shows that all variables do not show the stationarity from the probability value over alpha 5% on level degrees. Then, the data were transformed into the first difference to ensure their stationarity. From Table 2, it is discovered than on the first difference degree, all variables were stationary on the same level. Hence, the testing continued to the cointegration test.

Table 3. Cointegration Test

Test Statistic	Value
F-statistic	4,822520*
Significance	
10%	3,35
5%	3,79
2.5%	4,18
1%	4,68*

From Table 3, it is concluded that the study data were cointegrated in the long run, demonstrated from the F-Statistic value of 4.822520, bigger than the smallest 1% significance value of 4.68. Hence, this study was integrated into long run and valid to be utilized.

Table 4. Lag Determination Test

Akaike Information Criteria (top 20 models)

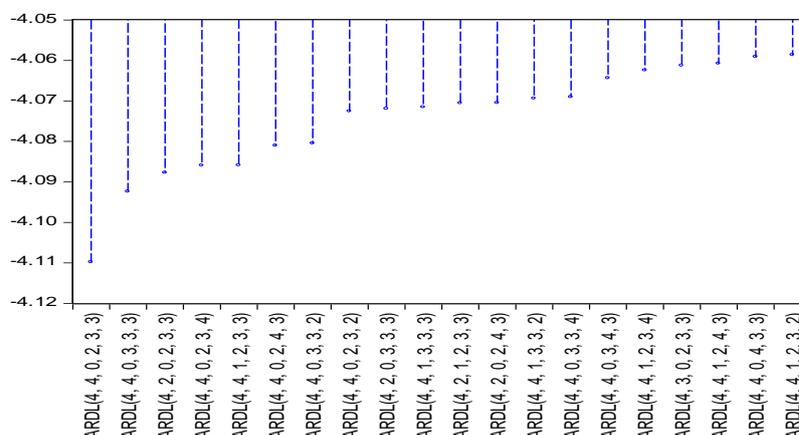


Table 4 shows that from the Akaike Information Criteria (AIC) method, suitable lag lengths in this study were 4, 0, 2, 3, 3. The next study was the classic assumption test to ensure that the ARDL regression result has met the normality, heteroscedasticity, and autocorrelation assumptions.

Table 5. Classic Assumption Test

Testing	Probability	Good if,	Decision
Jarque-Bera	0,67	> 0,05	Data are normal
Glejser	0,46	> 0,05	No Heterokedacity
Breusch-Godfrey	0,01	> 0,05	Autocorrelation Exists

From the classic assumption test results, It is discovered that the study data had fulfilled the normality assumption because the probability value of 0.67 was higher than alpha 0.05. Then, Table 5 also shows that the regression results did not have heteroscedasticity because the probability value of 0.46 was higher than alpha 0.05. However, the autocorrelation test shows that there was autocorrelation in the regression results because the probability value of 0.01 was lower than alpha 0.05. Therefore, a correction was made using the Newey-West estimator method to correct the standard error value to be constant.

Newey and West (1986) explained the simple calculation of heteroscedasticity and autocorrelation solutions, where they mentioned that the Newey-West estimator will result in a consistent result. The study's solution autocorrelation problem used aid from E-views so that the data could be directly used and released from the autocorrelation problem and continues to the hypotheses testing.

Table 6. Hypothesis Test

Dependent Variable: LOG_REER			
Short Run			
Variable	Coefficient	Probability	Decision
D(LOG_GFCE)	0,077474	0,7812	H1 is rejected
D(LOG_GFCE)	-0,105017	0,2890	H2 is rejected
D(LOG_GDP)	9,767511	0,0000	H3 is accepted
D(LOG_INF)	-0,131242	0,7834	H4 is rejected
D(LOG_EXP_IMP)	0,263152	0,0247	H5 is accepted
CointEq(-1)	-0,892899	0,0000	Valid
Long Run			
Variable	Coefficient	Probability	Decision
LOG_GFCE	1,386997	0,0000	H1 is accepted
LOG_GFCE	-0,117614	0,2982	H2 is rejected
LOG_GDP	0,310934	0,0722	H3 is rejected
LOG_INF	-2,692135	0,0000	H4 is accepted
LOG_EXP_IMP	0,791443	0,0000	H5 is accepted

The regression results were processed by modifying them using the Newey-West HAC. Table 6 shows the results of short and long run estimation regressions. In determining whether the long run estimation result was valid, the CointEq(-1) was observed where the value presented a negative coefficient value of 0.892899 and was significant below 5%. It means that the long run adjustment speed to the balance value in a quarter was 89.29%.

The short run test result shows that the Gross Fixed Capital Formation did not affect the short run, but in the long run instead, to Indonesian REER value. From this result, it is concluded that capital formation, especially foreign and private investments in Indonesia, take time to be actualized and observed for its economic growth impacts, strengthening the Indonesian real exchange rate. This finding is an input for the government to ease permits and cut regulations to attract more capital inflows to Indonesia to boost national production and eventually strengthen the Indonesian real exchange value position.

From the study results, an exciting fact is that the Government Final Consumption Expenditure negatively affected in both short and long run Indonesian real exchange value. It may be caused by the government's expenses that trigger a budget deficit that is potentially covered by foreign debts. Though not affecting, the regression coefficient shows a negative result that translates into an excessive government's expenses will decrease Indonesian real exchange value. This finding follows a study of Suparjito et al., (2020) that stated the absence of the government's expenses to the Indonesian economy.

Gross Domestic Product affects the short run but does not affect the Indonesian real exchange rate in the long run. Economic growth improvement shows an improvement in a country's production capability. However, as a country with an open economy, the Indonesian economy depends on the global condition. The short run economic growth increases the Indonesian real exchange rate, but it will be responded by economic policy changes in other countries, especially Indonesian trading partners. Therefore, Indonesian economic expansion does not affect much on partner countries' long run, particularly trading partners with a stronger economic condition. It follows a study of Razzaque et al., (2017).

The study results show that inflation was only negatively affecting in the long run. Inflation is a phenomenon where general prices increase in a particular period. This increase indirectly affects the public's buying power. In the short run, the public may anticipate the price increase by allocating more resources to fulfill their consumptions. However, continuous inflation in several periods will decrease the public's buying power. This condition is reflected by a decrease in the real exchange rate. It follows Anwer (2019) study, stating that the exchange rate position is heavily dependent on the country's inflation level.

The export to import ratio shows a positive influence both short and long run towards the real exchange rate. The higher the ratio, the higher the comparative real exchange rate towards trading partner countries. A positive export to import ratio also shows that in real value, goods prices in the originating country is lower than the export destination country. Profit from export trades will occur if the nominal exchange rate experiences overshooting or are over the fair value. This condition gives exporters a gap to expand their exports until the nominal exchange rate goes back to the fair value. It follows the study of Kartikasari (2017).

5. Conclusion and Suggestions

The testing results show that only the Gross Domestic Product and export to import ratio variables positively affect the short run real exchange rate. These results support the third and fifth hypotheses. In the long run, General Fixed Capital Formation and export to import ratio variables were positively affecting, while inflation negatively affected the real exchange rate. This study aimed to fill the study gap regarding the Indonesian real exchange rate, and hence, discussion of the theoretical basis concerning Indonesian real exchange rate development is incomplete. The next study is expected to add theoretical bases of the Indonesian real exchange rate. Besides, the future study may use study methods that can illustrate fluctuations in the real exchange rate, such as VAR/VECM or the GARCH model.

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