Analysis of Determinants of Foreign Exchange Reserves in ASEAN-5 Countries

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ABSTRACT

Foreign exchange reserves represent a nation's holdings of foreign currencies or currency equivalents, managed by its central monetary authority, and utilized in global transactions and engagements. This research aims to analyze the influence of inflation, Foreign direct investment, Exchange rate, economic growth and exports to the level of foreign exchange reserves in ASEAN-5 countries 2000-2022. This study relies on secondary data sourced from the World Bank's official website. The analytical methodology involves employing a panel data regression technique known as the Fixed Effect Model (FEM) alongside the analysis tools provided by StataMP17. The results of data processing show that partially each independent variable is inflation, Foreign direct investment, Exchange rate, Economic growth demonstrates a notable negative impact on Foreign Exchange Reserves within ASEAN-5 nations, with statistical significance. Conversely, the independent variable Exports exhibits a positive and significant correlation with Foreign Exchange Reserves across ASEAN-5 countries.

INTRODUCTION

A country can be said to be successful if the country is able to create a just, prosperous and peaceful state. One indicator to support the country's success in realizing this is by improving development in the economic sector. National economic development can be achieved if there are indicators to support development so that it can be realized optimally. There are sources of development financing that come from within the country, namely in the form of domestic investment, tax revenues, and foreign funding sources in the form of foreign exchange reserves. The strength of a nation's economy can be gauged by examining the extent of its economic expansion, as evidenced by fluctuations in Gross Domestic Product (GDP) each year. GDP is a series of collections of economic activities

in producing goods and services which are influenced by various factors within the country (Kusuma, Sheila, and Malik 2018).

International trade is an activity carried out between countries based on mutual agreement and the needs within the country (Sitohang and Sudiana 2017). In the economy, international trade is important because it is an indicator that influences economic growth and of course has a mutually beneficial relationship between countries. International trade is one of the determinants in maintaining the quality of economic growth within a country and has an important role in creating economic cooperation between countries, especially in ASEAN, which is a good opportunity to increase foreign trade and capital inflow (Dian and Dwiatmoko 2022). And one of the biggest contributors to foreign exchange is exports, this activity sends domestic production results between countries to obtain foreign currency or foreign exchange (Togatrop and Seriawan 2013). Foreign exchange reserves refer to the currency liquidity (IRFCL) or official reserves, encompassing all foreign assets overseen by the monetary authority or domestic central bank. Typically, it is employed to address imbalances in the balance of payments or for the purpose of financial stabilization, often exerting influence on the foreign exchange market (Suripto et al. 2021).

According to foreign exchange reserve management, there is a balance of payments theory using an elasticity approach. The elasticity approach shows the process of adjusting the balance of payments through changes that occur between export and import activities, this indicator is closely related to the exchange rate. In times of a balance of payments deficit, adjustments can be made to export prices relative to import prices by raising foreign exchange rates (Devaluation) (Effendy 2014).

According to elasticity theory, various macroeconomic factors play a role in determining the rise in foreign exchange reserves, one of which is the exchange rateof foreign exchange reserves initially emerged as international activities, both exports and imports, progressed. When these activities occur, that is when the exchange rate is also used and played out in activities between countries. And this exchange rate can be specified into two, namely, controlled floating exchange rate and free floating exchange rate (Masri and Hadi 2016).

Devaluation can increase exports and attract foreign investment to the country. However, devaluation can also increase inflation because the cost of importing raw materials and finished goods becomes more expensive. This can reduce people's purchasing power. There are two types of currency devaluation. One of them is gradual, which occurs gradually and credibly, and the other is the big bang, which is a massive and extraordinary devaluation. Gradual devaluation seems to have better results. Once a gradual devaluation occurs, the trade balance of the affected economy tends to improve, because the economy has to deal with only slowly developing changes in relative prices. In the long term, further exchange rate adjustments can be expected. However, the outcome of any gradual devaluation also depends on a country's initial conditions (Mawardi 2023).

A surge in foreign exchange reserves can signal economic challenges within a country, such as inflation. This situation typically manifests as heightened demand surpassing supply or production capacity, leading to price escalations (referred to as demand-pull inflation). Inflation can also arise from the supply side, marked by escalating production costs and subsequent price hikes (Susanto and Pangesti 2021). Inflation can be classified as arising from several reasons such as Demand pull and cost push inflation,

natural nflation and humman error, spiralling inflation and imported inflation (Nurul, 2022).

Apart from that, Foreign Direct Investment (FDI) is also related to foreign exchange reserves. FDI can be traded on the money market, capital market and derivatives market. The expected benefits of FDI include: availability of employment opportunities, technology transfer, management training, and access to international markets through exports. Foreign direct investment is essential to bridge the imbalance between investment and savings in developing countries (Bisantoko and Andriyani 2022). Countries that have good economic growth will usually invest between countries, and to see that a country has good economic development, it can be seen through income calculations using gross domestic product (GDP), and for developed countries using Gross National Product (GNP) (Halim 2020).

There are indicators that can influence a country's foreign exchange reserves, namely Exports, Inflation, Foreign Direct Investment (FDI), Economic Growth and Exchange Rates. This research shows a number of significant differences when compared with previous studies. Where previous research reviewed research over a short period of time between 2010-2018 and also differences in time span and selection of variables that would further explain how the influence of the level of foreign exchange reserves is influenced by macro variables, namely research from (Soeharjoto and Danova 2020) With a small period of time studied, the results obtained are not consistent with existing theory. Hence, scholars are keen on undertaking investigations under the banner of the given title **"Analysis of Determinants of Foreign Exchange Reserves in ASEAN-5 Countries".**

METHOD

This study employs descriptive quantitative research methodology, emphasizing tangible data characterized by numerical values and analyzed through statistical tools to derive conclusions pertaining to the research problem at hand. In the research, statistical data analysis tools were used, namely Stata. The utilized data comprises panel data, encompassing both cross-sectional and time-series data, representing the activities of five ASEAN countries between 2000 and 2022. The data for this study is sourced from secondary data, specifically obtained from the official World Bank website. The use of the model to explore the results of the analysis is in accordance with theory and also previous research using the Fixed Effect Model (FEM). The model used in this research to obtain the truth of the influence caused by each macroeconomic variable, is the panel data model regression equation, namely:

$$CDV_{it} = \beta_0 + \beta_1 logEXP_{it} + \beta_2 INF_{it} + \beta_3 FDI_{it} + \beta_4 PDB_{it} + \beta_5 logEXC_{it} + \varepsilon_{it}$$

Information :
CDV = Foreign Exchange Reserves
Bo = Constant Value
$\beta_1 \beta_2 \beta_3 \beta_4 \beta_5$ = Coefficient Value and Independent Variables
EXP = Export
INF = Inflation
FDI = Foreign Direct Investment

PDB = Economic Growth

EXC   = Exchange Value
εit = Standar Error Model Data Panel

Common Effect Model
   The CEM model is the simplest data analysis compared to other techniques in estimating panel data model regression, which in the analysis uses a combination of two data, after that estimating (Pooling) the data that combines without looking at differences between time and individuals. Usually in this model the OLS method is used to estimate the model. Therefore, this model is called the commond effect or pooled least square. The results of observations in this regression model are usually single-dimensional.

Fixed Effect Model
   The FEM analysis approach is a modeling method known as fixed effects, which means that the fixed effects are the assumed intercept and slope values in the FEM panel regression equation. In data that has been processed and analyzed, each variable is considered constant both between cross section units and between time series units. There are variations in the FEM approach, these variations have been explained previously, namely the assumption of each intercept and slope coefficient in the unit cross section and time series data. There is an index in each intercept equation which indicates that each index variable is different, usually the difference is due to special features in the cross section unit.

Random Effect Model
   The REM model estimates panel data using the FEM approach, there are dummy variables that show uncertain conditions in the model used. So, in solving problems in this model, residuals are used in this approach, which is called the REM model, assuming errors are random.
   There is a selection of the best model to continue the analysis in this research. The selection of the best model approach used in data testing is the Chow Test and Hausman Test approaches. Next, hypothesis analysis is carried out with the aim of interpreting the regression results that have been processed. Various statistical approaches are used in this process, including Simultaneous Test (F Test), Coefficient of Determination (R2), and Partial Test (T Test). In addition, Heteroscedasticity Test and Multicollinearity Test are carried out to see whether there are problems in the model to be studied.

Uji Chow
   Chow Test is a testing approach method that aims to determine the optimal model or which one is better in estimating panel data, namely whether to use the Common Effect or Fixed Effect approach. The hypothesis tested is:
H0: Model Common Effect (CEM)
Ha: Model Fixed Effect (FEM)

Uji Hausman

The Hausman test is a testing method for determining between random effects and fixed effects. The hypothesis for the Hausman test is outlined as follows:

H0: Model Random Effect (REM)

Ha: Model Fixed Effect (FEM)

RESEARCH RESULT

Panel Data Regression Analysis

To follow up on this research, panel data regression analysis was carried out, namely by testing initial data or statistical data descriptions, then testing using three data models, after that testing and selecting the best model and analyzing whether the data was free from heteroscedasticity or multicollinearity problems.

Description of Statistical Data

Table 4. 1 Statistical Data

Variable	Obs	Mean	Std. dev	Min	Max
Cadev	115	1.1311	8.5910	3.4209	4.2511
Inflation	115	3.5628	3.7535	-1.7103	23.115
FDI	115	8.2509	1.5410	-9.0110	2.3510
Exchange Value	115	4.8763	3.9930	22288	10.054
PDB	115	4.8288	2.9345	-6.0669	14.519
Export	115	25.935	0.7858	23.565	27.492

Source: Data processed by research, 2024

The findings presented in Table 4.1 demonstrate that there were 115 observations included in this analysis, with a mean value of 1.1311 and a standard deviation of approximately 8.5910. A standard deviation lower than the mean value indicates a high level of data accuracy. When observing the foreign exchange reserve variable, it can be seen that the minimum value reached 3.4209 which occurred in Vietnam in 2000. Then the maximum value reached 4.2511 Singapore in 2021.Commond Effect Model (CEM)

Table 4. 2 Commod Effect Model

CEM			
Variable	Koefisien	T	Prob
Inflation	-1.30	-1.08	0.282
FDI	-1.56	-5.30	0.000
Exchange Value	-3.38	-2.64	0.009
Economic Growth	-5.24	-3.79	0.000
Export	6.17	8.96	0.000
Constanta	-1.45	-7.97	0.000

Source: Data processed by research, 2024

Random Effect Model (REM)

Table 4. 3 Random Effect Model

FEM			
Variabel	Koefisien	T	Prob
Inflation	-3.05	-3.41	0.001
FDI	-1.41	-5.83	0.000
Exchange Value	-1.72	-8.74	0.000
Economic Growth	-4.08	-4.05	0.000
Export	6.81	13.08	0.000
Constanta	-7.93	-5.39	0.000

Source: Data processed by research, 2024

Fixed Effect Model (FEM)

Table 4. 4 Fixed Effect Model

REM			
Variabel	Koefisien	T	Prob
Inflation	-1.30	-1.08	0.280
FDI	-1.56	-5.30	0.000
Exchange Value	-3.38	-2.64	0.008
Economic Growth	-5.24	-3.79	0.000
Export	6.17	8.96	0.000
Constanta	-1.45	-7.97	0.000

Source: Data processed by research, 2024

Selection of the Best Model

Table 4. 5 Fixed Effect Model

Selection of the Best Model	
Diagnostick Tools	
Uji Chow	0.000
Uji Hausman	0.000

Source: Data processed by research, 2024

The best model conclusions in this research are as follows:

Uji Chow

H0: *Model Common Effect* (CEM)

Ha: *Model Fixed Effect* (FEM)

a. If the Probability value receives Ha, or Chow Statistics (F-Statistics) (>) F Calculate then the Fixed Effect model is selected.

b.   If the Probability value rejects Ha, or Chow Statistics (F-Statistics) (<) F Calculation then the Common Effect model is selected.

Uji Hasman

H0: Model Random Effect (REM)

Ha: Model Fixed Effect (FEM)

a.   If $Chi2$stat is higher (>) than critical then accepting the alternative hypothesis (Ha), means*Fixed Effect* selected.

b.   If $Chi2$stat is higher (<) than critical then rejecting the alternative hypothesis (Ha), means*Random Effect* selected.

The results of the tests carried out using the Chow Test and Hausman Test approaches can be concluded that, in the Chow Test, the Prob value was obtained: 0.000 < 0.05 = This means that the Fixed Effect Model was selected, then in the Hausman Test the Prob value was obtained: 0.000 <0.05 = This means Fixed Selected Effects. Because the selection model was selected twice with the same conclusion that the Fixed Effect Model was selected as the best model, the Legrange Multiplier Test did not need to be carried out.

Simultaneous Test (F-Test) Statistics

Tabel 4. 6 Simultaneous Test

F-Statistics	2.30
F- Table	110
Prob (F-Statistics)	0.0000

Source: Data processed by research, 2024

The F statistical test assesses the collective impact of the independent variable (X) on the dependent variable (Y). The decision is made based on whether the F count is greater than the F table value or if the significance is less than 0.05. If F count > F table or sig < 0.05, the null hypothesis (H0) is rejected, and the alternative hypothesis (Ha) is accepted, indicating that the variables X collectively affect variable Y, and vice versa. Based on the data analysis outcomes presented in Table 4.6. The conclusion is that all variables have a probability below 0.05 so that the variables Inflation, FDI, Exchange Rate, Economic Growth and Exports exert an impact on the variable of foreign exchange reserves.

Partial Test (T-Test) Statistics

<p align="center">Table 4. 7 Partial Test</p>

FEM					
Variabel	Koefisien	T-Hitung	T-Tabel	Prob	Keterangan
Inflation	-3.05	-3.41	1.658	0.001	Signifikan
FDI	-1.41	-5.83	1.658	0.000	Signifikan
Exchange Value	-1.72	-8.74	1.658	0.000	Signifikan
Economic Growth	-4.08	-4.05	1.658	0.000	Signifikan
Export	6.81	13.08	1.658	0.000	Signifikan
Constanta	-7.93	-5.39	1.658	0.000	Signifikan

Source: Data processed by research, 2024

The purpose of the t-test is to assess the individual impact of the independent variable Y on explaining the dependent variable X. The independent variable will exert a partial influence on the dependent variable if the calculated t-value exceeds the critical t-value from the table. This research adopts an alpha level of 0.05 or $\alpha = 5\%$. Based on the analyzed data, it is evident that:

a. The findings regarding the Inflation Variable indicate a t-value of 3.41, surpassing the critical threshold of 1.658 as per the T-table. Consequently, it suggests that the inflation variable significantly influences foreign exchange reserves.

b. The analysis of the FDI variable reveals a t-value of 5.83, which exceeds the critical threshold of 1.658 as indicated by the T-table. This suggests that the FDI variable significantly impacts foreign exchange reserves.

c. The outcomes related to the exchange rate variable demonstrate a t-value of 8.74, surpassing the critical threshold of 1.658 according to the T-table. Hence, indicating that the exchange rate variable significantly influences foreign exchange reserves.

d. The findings pertaining to the economic growth variable reveal a t-value of 4.05, exceeding the critical threshold of 1.658 as per the T-table. This suggests that the economic growth variable significantly impacts foreign exchange reserves.

e. The analysis of the Export Variable indicates a t-value of 13.08, surpassing the critical threshold of 1.658 as per the T-table. This indicates that the export variable significantly influences foreign exchange reserves.

Coefficient of Determination (R^2)

Table 4. 8 Coefficient of Determination (R^2)

R-Square	0.7803
Adjusted R-Square	0.6301

Source: Data processed by research, 2024

The coefficient of determination, R-squared, measures the degree to which the model can explain variations in the dependent variable. A value nearing 1 signifies that the independent variable furnishes nearly all the requisite information for forecasting variations in the dependent variable. Based on Table 4.6 above, the Fixed Effect Model can explain the dependent variable with an accuracy level of 0.7803. The R-Squared value for the model determination coefficient is 0.998238, This suggests that 78.03% of the variability in the dependent variable can be attributed to the independent variables considered in the model, while the residual portion is influenced by external factors not encompassed within the present model.

Heteroscedasticity Test

Table 4. 9 Heteroscedasticity Test

Chi2(1)	2.84
Prob > chi2	0.0918

Source: Data processed by research, 2024

According to Table 4.9, the results of the heteroscedasticity test indicate whether there are deviations from the classical assumption of homoscedasticity, which means there is an unequal variance in the residuals from all regression panel observations. If the significant level is > 0.05, it means that there is no problem of hetero deviation (passing the heteroscedasticity test) and vice versa. The conclusion from this test is that the Prob value is 0.0918 > 0.05, which means that in this study there were no hetero problems found (passing the heteroscedasticity test).

Multicollenarity Test

Variabel	VIF	1/VIF
Export	2.00	0.4997
Exchange Value	1.78	0.5607

FDI	1.41	0.7105
Inflation	1.39	0.7178
Economic Growth	1.12	0.8895
Mean VIF	1.54	

Table 4. 9 Multicollenarity Test

Source: Data processed by research, 2024

a. If the tolerance value (1/VIF) exceeds 0.10 and the VIF value is below 10, it indicates the absence of multicollinearity symptoms, thereby passing the multicollinearity test.
b. When the tolerance value (1/VIF) falls below 0.10 and the VIF value exceeds 10, it indicates the presence of multicollinearity symptoms, thus failing the multicollinearity test.

Based on the information in the table, it can be inferred that the Variance Inflation Factor (VIF) for the variables Export, exchange rate, FDI, inflation, and economic growth is less than 10, and the reciprocal of VIF is greater than 0.10. Consequently, it can be deduced that there are no indications of multicollinearity, thus passing the multicollinearity test.

Interstate Intercept

Tabel 4. 10 Interstate Intercept

Kode	Negara	Intercept
1	Indonesia	-3.50
2	Malaysia	4.89
3	Thailand	13.14
4	Vietnam	4.51
5	Singapura	5.02

Source: Data processed by research, 2024

The table above shows that the intercept for each ASEAN country from 2000-2022 is different. The country with the highest intercept is Thailand (3) with an intercept of 13.14. This value shows that Thailand (3) has more foreign exchange reserves than other countries assuming all independent variables are zero. Inflation will cause a

decrease in foreign exchange reserves by 3.05%. Likewise with the independent variables that have negative values, namely FDI, exchange rate and economic growth. As for exports, this variable has a positive value, namely 6.81, where when there is a 1% increase in exports in Thailand, this will also cause foreign exchange reserves to increase. Likewise with other variables.

DISCUSSION

The results of analyzing data through the Fixed Effect Model indicate that the inflation rate significantly affects the foreign exchange reserves in ASEAN-5 countries within the period of 2000 to 2022. Specifically, it was found that for every 1% increase in the inflation rate, there is a corresponding 3.05% decrease in foreign exchange reserves, with a statistically significant coefficient of -3.05 (p-value = 0.001, α = 0.05). Thus, confirming a noteworthy negative impact of inflation on foreign exchange reserves in the ASEAN-5 nations during the specified timeframe. The findings of this research are consistent with previous research reviewed by (Juliansyah and Apridar 2020) A higher exchange rate has the potential to mitigate inflation rates. When prices in the goods and service sectors rise, leading to inflation, economic activities within the country may be impeded. Consequently, the country would require more foreign exchange for international transactions, leading to depletion of foreign exchange reserves. This scenario is often observed when inflation occurs domestically, This will cause an increase in domestic imports compared to exported goods, which when this happens, when a country experiences high inflation, it tends to expend a significant amount of foreign exchange, leading to a reduction in its foreign exchange reserves. Elevated inflation rates result in increased prices of goods and services within the country. Consequently, this leads to fluctuations in currency values and impacts current accounts as well as foreign exchange reserves held by commercial banks (Adhitya 2021).

Based on the results of the data analysis, it was found that the foreign direct investment coefficient value was -1.41, so it can be concluded that when the foreign direct investment variable increases by 1%, this value will also reduce the level of foreign exchange reserves in ASEAN-5 countries from 2000-2022. The p-value of the frequency direct investment variable is 0.000, which means the value is <0.05 or α = 5%, which means the variable is significant. In line with previous research studied by Lumbanraja (2006) that when a country has a strong currency value it usually tends to invest abroad, so this will make the country spend a lot of foreign exchange (foreign exchange) for investment purposes in other countries. Therefore, foreign direct investment has a negative effect on the accumulation of foreign exchange reserves in a country (Syaula 2021). These results are also in line with research conducted by (Ussa'diyah and Nofrian 2023) that the results of foreign direct investment are negative, because countries with stronger currency values will tend to invest more in countries with weak exchange rates.

Exports are a form of a country's ability to compete in the economic sector within the international arena. The more exports, the more countries will reap profits and get foreign exchange from various countries. The results of this research show that the export

value has a coefficient of 6.81 and a significance of 0.000, meaning that when exports in a country increase, this will also increase foreign exchange reserves by 6.81%. These results are in accordance with previous research reviewed by (Fortuna, Mulyjaningsih, and Asmara 2022) and (Syaula 2021) that international activities or exports or imports will cause high and low foreign exchange reserves. When a country exports a lot of goods abroad, this will affect the foreign exchange reserves in that country. and vice versa, when a country imports a lot of goods from other countries, it will cause the country to spend foreign exchange (foreign exchange).

After carrying out data analysis tests, the coefficient values and p-values were obtained. The coefficient value in the economic growth variable is -4.08 and with a p-value or significance level of 0.000 (Significant). This means that the coefficient value is negative, indicating that when there is an increase in economic growth, foreign exchange reserves will decrease by 4.08%. The level of economic growth alone may not always lead to an increase in foreign exchange reserves among ASEAN countries. These findings align with findings from earlier studies conducted on the subject (Sanida and Widhia 2022) and (Supiyadi and Anggita 2020) it is suggested that an expansion in economic growth resulting from a deficit in trade balance will lead to a rise in foreign exchange reserves. Apart from that, investment can also be said to be negative because in the end FDI initially provides access to capital but the state also has to share the profits and dividends that will be paid to foreign investors. Good economic growth will also cause the country to increasingly need more infrastructure within the country. This is to support the development of the country and also when a country experiences very good economic growth then this will encourage interest in other countries to export goods from that country which is experiencing economic growth, so that purchasing power from other countries through international trade will have an impact on the position foreign exchange reserves, because the country will produce more foreign currency than other countries.

The coefficient value on the exchange rate shows a figure of -1.72 and with a significance level of 0.000. So it can be concluded that when the exchange rate increases it will cause foreign exchange reserves to decrease by 1.72%, and vice versa. When the domestic exchange rate depreciates or when the exchange rate falls, export goods tend to be cheaper in foreign currency. And exports will also increase, seeing that export prices are soaring low, people and companies tend to reduce exports and of course have to reconsider exporting these goods considering that prices in foreign currency are too low, so this directly creates instability in foreign exchange reserves. Therefore, countries will usually make policies such as intervening in the domestic exchange rate, thereby requiring more foreign exchange reserves to make the exchange rate more stable, namely by buying domestic currency on the foreign exchange market. This policy will have the effect of increasing demand for domestic currency and pushing the exchange rate up. If the exchange rate appreciates, export products become more expensive in foreign currency so that the country will experience a decline in exports. Apart from that, when the exchange rate appreciates it will also make the price of imported goods in domestic

currency cheaper. This makes imports more attractive to domestic consumers and companies.

These results are in line with the "J-curve" theory, namely when a country's exchange rate experiences depreciation (decrease), this will cause foreign exchange reserves to fall. The stock of foreign exchange reserves is used for inter-country activities as required by the country concerned, such as imports. Foreign exchange reserves are usually held by each country's central bank and are usually more open to international trade activities, and take priority such as foreign debt and import financing. So when the exchange rate rises, foreign exchange reserves will not necessarily improve (Hapsari and Kurnia 2018).

CONCLUSSION

The variables inflation, foreign direct investment, exchange rates, and economic growth exhibit a significant negative impact on foreign exchange reserves in ASEAN-5 nations. Conversely, the variables show a notable positive effect on foreign exchange reserves in ASEAN-5 countries. This analysis encompasses ASEAN-5 countries, including Indonesia, Malaysia, Thailand, Vietnam, and Singapore. The variables used include Inflation, Exports, Exchange Rates, Economic Growth and FDI, which means it has limited coverage and is not comprehensive. The government and central bank of the country should better maintain the level inflation and the exchange rate so that this does not weaken the country's foreign exchange reserves. Inflation control can be carried out by the Government through monetary policy intervention. The country's government should focus on domestic production so that it can export more goods than imports. Seeing the influence of FDI, the increase in FDI can reduce foreign exchange reserves, therefore the Government should focus on increasing skills and developing technology for FDI invested in the country rather than providing investment outside the country.

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