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ASSIGNMENT DETAILS

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"GLOBAL FINANCIAL CRISES AND ECONOMIC GROWTH:

EVIDENCE FROM ASEAN ECONOMIES"

TABLE OF CONTENT

I. INTRODUCTION

1. Background

Not being a newly born problem, financial crises have existed since the late beginning of human history, starting as debts and inflation crises in ancient Greece and later, through years and wars, they have evolved to currency crises which still affect countries' economies and societies in the modern period (Wright, 2015). With the help of globalization, financial crisis occurrence has become more and more frequent, with us experiencing. The evidence from the report World Economic Situation Prospects (United Nations, 2021) shows that from 1997 to 2021, we have already experienced three different financial crises, with the next ones being more severe than the previous.

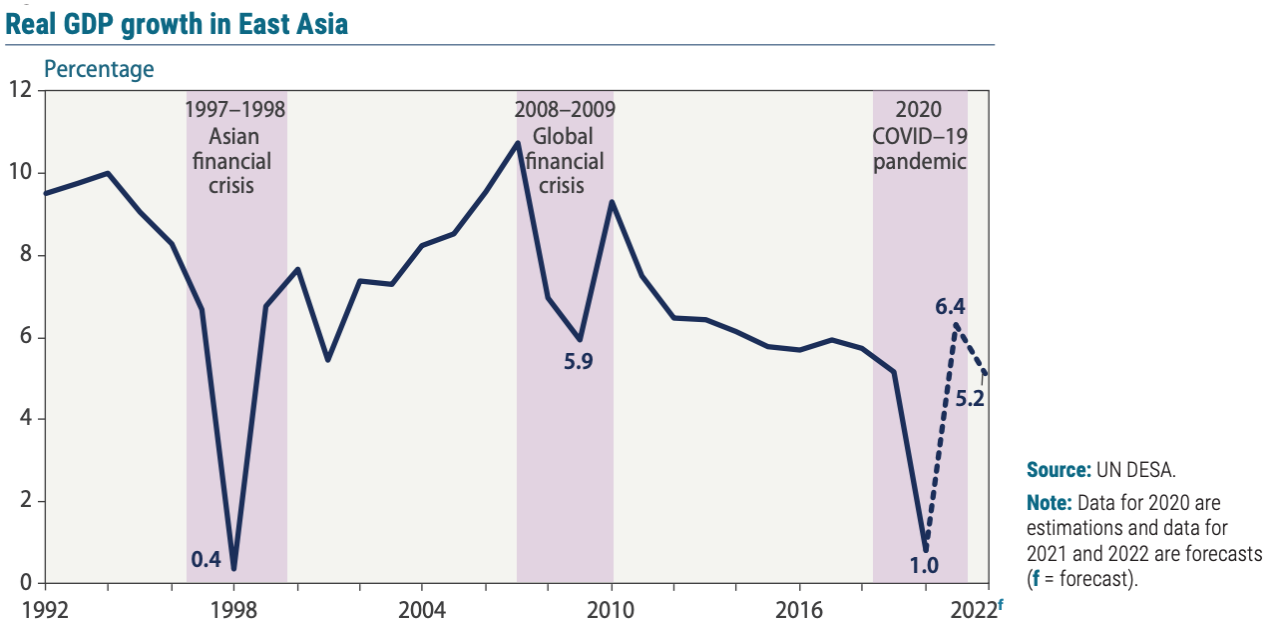

Figure 1. Real GDP growth in SouthEast Asia (United Nations, 2021)

Even though these crises have different sources and reasons, they all have one in common: the way they affect the economic growth of nations. The period that we choose for our economic growth research in ASEAN countries, is quite relevant to this consequence, as it covers the global financial crisis from 2008 to 2009. From the graph above, we can see not only how much East Asian (or South East Asian in specific) countries' GDP plummeted and rose back during the 2008-2009 period but also struggled to recover after this period.

2. Problem statement

During the 2008-2009 crisis, South East Asian economies struggled with both trade and financial issues (Keat, 2009). In detail, South East Asian countries faced a reduction (in together with other Asian countries) more than 60% in stock prices; over 30% in export rates and their exchange rates were under the pressure of about 6.2% from the highest to lowest in the 2009 era.

Although with all these consequences of the crisis, the asian economies face a variety of impacts on their GDP during the crisis. This result is due to the differences in the economy size, the degrees of these countries trading openness and the capacity of governments on their policies. Although they gained a robust recovery, with one element was due to the massive fiscal and monetary stimulus, some of them still faced severe impacts due to the other elements, the macroeconomic policies from the government.

3. Research aims & Questions

The purpose of doing the research about "Global financial crises and economic growth: Evidence from Asean Economies" is to achieve the following aims:

1. *To investigate the factors that may influence the sign of economic growth.*
2. *To examine the impact of the financial crisis on economic growth.*

Towards to research aims stated above, the project thus seeks to fulfill the questions, respectively:

1. *What factors contribute to the change of a ASEAN nation's economic growth?*
2. *How did the economy fluctuate during and after the financial crisis?*

II. LITERATURE REVIEW

1. Growth Theories

Relationship between GDP growth rate and income

GDP (Gross domestic product) is a measure used for the size and the economic health of a nation over a period of time (usually measured in one quarter or one year). We can use GDP to compare the difference in sizes between countries at different time points and also indicate standard livings in different countries. There are 3 ways to approach GDP, which include the value-added, the income, and the expenditures approach, which eventually produce the same result (Bank of England, 2019).

GDP Growth Rate (usually multiplied by 100) on the other hand, is defined as the changes in the rate of GDP each year at market prices, which are based on the continual regional currency. It is used to express the differences between the values of GDP from one period of time to the following as a part of the earlier GDP period. We can usually find GDP Growth rates from the data in the United Nations' Systems of National Accounts and World Bank Data (World Health Organization, 2021).

Income (also known as GDP per capita) is considered to be the most widely used indicator to compare the performance of regional economies (OECD, 2014). It is also used to measure the ability to achieve a decent living standard. Our research involves 10 ASEAN countries, in which according to the ASEAN Key Figures report, the state of income has improved in the last few decades.

In the past, there have been researches on the relationship between growth rate and income. But they usually exist in the form of income distribution and/ or income inequality, instead of income in general. Since the economic literature for this topic is still considered to be limited (Jianu et al., 2021), researchers' views on this topic are still divergent in which case they should consider: specifically the relationship between income inequality and growth or the relationship between income in general and economic growth. But which path they choose to focus on, they usually have one thing in common: income has a positive impact on economic growth.

The first reason for this can be explained in the research by Raz et al. (2012), they bring up the idea income is an important factor of growth because from their research results, income accumulation can act as the main engine which boosts the growth in the momentary. This may explain why Singapore, which used to be a developing country, grew and developed to become the most developed country in ASEAN.

The second reason comes from the idea that income and economic growth has an interdependent relationship (Ventura, 1997). This can be explained as: income inequality caused a decline in economic growth, which has been proved and pointed out by many researchers including Wahiba (2014) and Lahouij (2017); which forces the policymakers to take actions reducing the inequality so as to robust the economy to grow again.

Relationship between GDP growth and human capital and knowledge

Human capital indicates the permanent productive capacity of humans. The capabilities of human capital can be improved by improving other factors such as education, skills development, and health. According to Peterson et al. (2010), human capital is an asset which "generates a flow of services, most often measured as earnings", even though other measuring methods of output can also be used.

The topic of the relationship between GDP growth and human capital and knowledge has long been a debate with a variety of empirical evidence until the appearance of the New Growth Theory. In the overview article about the new growth theory from Corporate Finance Institute (2021), it has shown an optimistic view on this relationship by pointing out that knowledge and human capital are the key factors contributing to the current growing economies. This is because the theory believes that personal, individual forces are the core of economic progress. This is also emphasizing how the growth theory is a fresh twist from its predecessor theories, putting its focus on the human element, rather than other external factors (Tahir et al., 2020).

Research from Barro (1991) gives us the view that incentives for higher human capital assets can result in a higher level of capital growth. Another paper gives a suggestion that the level of a nation's human capital can explain the growth of output in that country (Frankel & Romer, 1999). Another study by Nelson & Phelps (1966) approaches this topic by addressing the assumption that economic growth is associated with human capital in direct and indirect methods. The direct method gives an assumption that the human capital relationship with economic growth is through the ability to innovate the internal environment of a country. While for the indirect method, this relationship is considered to be through the ability of a country to facilitate themselves with technology diffusion or adoption (catch-up effect). Secondly, through the neoclassical growth models, human capital is considered to be an essential element for the growth of GDP, with the rate of change in human capital resulting in the same rate of change in economic growth (Lucas, 1988).

Though, the relationship between growth and knowledge is not a black and white topic. A view of researching the relationship between GDP growth and knowledge is by considering the relationship between the knowledge of growth and the growth of knowledge. A paper by Gans (2002) suggested that we should examine the importance of knowledge in theory and the information of the economic growth process in the researched nation. After these 2 steps, we should think about how the implications from these 2 steps impact the economic policy of the country we are studying.

Although the relationship between growth and knowledge is not a simple matter, the New Growth Theory has given evidence to support the idea that human capital and knowledge has a positive impact on economic growth.

Relationship between GDP and FDI

The relationship between FDI and GDP has long been a source of heated controversy. After 1991, there is sufficient evidence that FDI and GDP significantly impacted each other due to LPG policies (Liberalization, Privatization, and Globalization). According to Moudatsou & Kyrkilis (2011), economic growth motivates inward FDI in both developing and developed economies. On the other hand, FDI promotes economic growth and there is a bidirectional relationship between the two.

All countries throughout the world are seeking quick economic growth, and as a result, they are attracting an increasing number of investments by permitting international investors to invest in their country. FDI can help host countries grow faster by creating jobs, covering savings gaps, and meeting massive investment demand, as well as sharing information and managerial skills through backward and forward linkages (Frenkel et al., 2004). For the host economy, FDI provides productivity spillovers.

Feridun & Sissoko (2011) used a VAR and a Granger causality test to investigate the link between GDP and FDI in Singapore. They came to the conclusion that there was no evidence that GDP and FDI had a one-way causal relationship from FDI to GDP. Apart from showing the importance of FDI on growth, the literature also realizes that economic growth could be an important factor in attracting FDI flows. The important role of economic growth in attracting FDI is closely linked to the fact that FDI tends to be an important component of investing firms' strategic decisions.

In contrast, according to the empirical findings of Mah (2010) in China, FDI inflows have no effect on GDP, but GDP does cause FDI. There was no significant long-term unidirectional effect of FDI on GDP. The empirical findings of Karimi & Yusop's study revealed that there was a lack of meaningful evidence for a bidirectional correlation between GDP and FDI (2009).

There are still many articles having the similarity of pointing out that economic growth and FDI may have an interactive relationship in the beneficiary countries (both developed and developing). Furthermore, growth theory research implies that FDI and economic growth correlations are unfavorable. Though FDI is seen as a critical factor in boosting the economy, it will only do so if its inflows are well-handled (Bezuidenhout, 2009). The extent to which FDI may be used for economic development is determined by the economic climate. FDI may be unproductive in the absence of such a climate, stifling rather than promoting growth.

Relationship between GDP and Openness of trade

Commercial aperture, or trade openness, reflects the role and influence of trade towards GDP. Knowing that GDP is an indicator to measure a nation's growth, therefore, the openness of trade has a significant impact on a nation's economic development. Specifically, some economists have revealed a positive and strong complementary relationship between two variables which trade openness is said to be an engine used to promote the economic efficiency of a country (Keho, 2017). In the long run, the empirical evidence shows that the more outward-oriented countries may lead to a higher potential of economic growth (Huchet-Bourdon et al., 2017). The positive relationship between the openness of trade and economic growth also implies that opening up the borders for international trade and integration can help countries gain more (Dao, 2014). That is why a closed economy is better to liberalize trade so that the country can potentially stimulate its growth rate (Dao, 2014). Furthermore, trade also leads to higher living standards in flexible economies than the rigid ones (Fetahi-Vehapi et al., 2015).

However, there is still no consensus on whether greater trade liberalization gives the better picture of GDP (Keho, 2017). As saying that there is empirical literature supporting the positive nexus of trade liberalization and growth, there are arguments about the ambiguous sign of that relationship since no robust evidence is provided (Fetahi-Vehapi et al., 2015). The adverse effect of trade openness may occur as the result of market imperfections, differences in technology and so on (Silajdzic & Mehic, 2018). For instance, there will be a negative impact of openness to trade on economic growth when the country exports low-quality goods, especially in the short-term (Huchet-Bourdon et al., 2017). There is a research saying that openness may have positive effects on growth in countries having high income but no growth effect due to that for a low level of per capita income countries (Fetahi-Vehapi et al., 2015).

Calculated by the ratio of imports/exports to GDP, the index of trade liberalization not only indicates the reasonable level of openness of an economy but also becomes the basis for investment decisions of FDI (Raz et al., 2012). It is more complex to discuss the relationship between trade openness and income growth since it depends on the two cases of international trade, namely trade creation and trade diversion (Raz et al., 2012). And trade liberalization is also beneficial to nations that have higher gross fixed capital formation (Fetahi-Vehapi et al., 2015). Due to the global financial crisis, the most obvious impact on the economy that can be seen is trade regarding the commodity market (Raz et al., 2012). It faced a severe decline relative to GDP unobserved since the depression was even suspected as a trade collapse (Broll & Jauer, 2014). Income, capital, FDI and trade are the components that contribute to the economic growth of a nation, and more than that, they have mutual impact that can either stimulate the growth or depress the vulnerable economies. The financial and economic crisis can spread from industrialized countries to the developing one through trade and financial flows. In other words, a developing nation that deeply integrates with the global economy will bear a stronger and more rapid impact on the crisis (Gurtner, 2010).

2. Typology of Financial Crisis

Financial stability is defined in a variety of ways, but they have one thing in common: the way the system-wide episodes, in which the region's financial system fails to function, are absent or to be easier to understand, it is "a condition in which the financial system is not unstable" (Bank of Korea, n.d.). This consists of 3 main elements: stability in the financial institutions, in the financial markets, and in the financial infrastructure. Instability in one of these three can cause an economy to suffer from financial instability. When all three elements become unstable and the country suffers from the loss of stability in these 3 elements, we can declare the country is in a financial crisis (Zwolankowski, 2011).

A common view of a financial crisis can be seen from the working paper by Greenwood et al. (2020). It questions a subject that we have wondered about for a long time: are financial crises predictable? When researching the global financial crisis from 2008 to 2009, several papers have taken different approaches to this matter. An example of this is a study by Gorton (2012) in which the author argues that "crises are sudden, unpredictable events". This example is supported by researches and theories, 2 examples are by Cole & Kehoe (2000) and Chari & Kehoe (2003) which consider crises to come from "sunspot equilibrium". The term "sunspot" is described as the "extrinsic random variable" (Ding, 2007), and the early evidence of Kaminsky & Reinhart (1999) shows that while crises usually start from having weak economic fundamentals, the rates that we can predict are still low.

Our research object, South East Asian countries suffered heavily from the two financial crises, the Asian financial crisis in 1997 and the global one in 2008-2009, but the effects and consequences from 2008-2009 were different than in 1997. The research (S.j. & Roy, 2014) shows that the reasons were due to the outbreak of gross financial irregularities, which cause the trade patterns and production structures of Asian countries in general, including ASEAN countries, to be affected and lead to the weakening of the economy. During the global crisis in the 2008-2009 period, several problems of the ASEAN governments' policies at that time brought to light some problems related to transport costs and the decline of export degrees.

The 2008-2009 global crisis has forced Asian economies (including South East Asia) to put a temporary focus on domestic issues rather than regional cooperation (Plummer, 2009). But after the crisis till now, Asian and specifically South East Asian countries, were considered to fare better during the global financial crisis. The reasons pointed out by Park et al. (2013) were due to the economic fundamentals and the government macroeconomics policies. These 2 elements can serve as the key solutions for countries to staving off a crisis, defending them from the crisis's blow and preparing and laying down under the foundation for recovery. But if not careful and insightful enough, South East Asian countries' regional framework can suffer from the protectionism impulses (statement during the November 2009 G-20 meeting in Washington DC).

3. Hypothesis development

Null hypothesis 1 - H_{o1}: Income has a positive impact on economic growth.

Null hypothesis 2 - H_{o2}: Human capital and knowledge has a positive impact on economic growth.

Null hypothesis 3 - H_{o3}: FDI has a positive impact on economic growth.

Null hypothesis 4 - H_{o4}: Trade openness has a positive impact on economic growth.

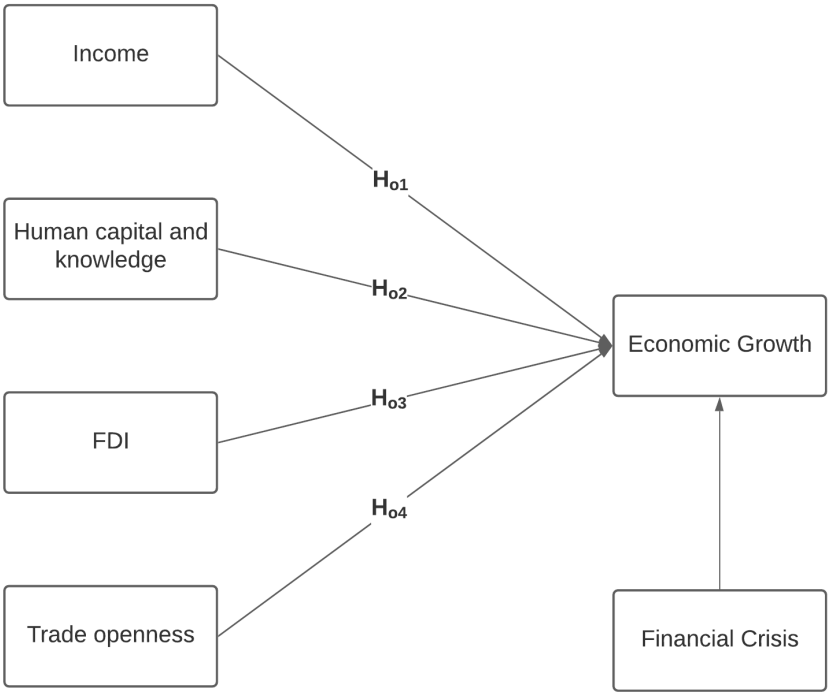

Figure 2. Conceptual framework

III. METHODOLOGY

1. Measurement of variables

Growth

Economic growth is measured by many different tools set by the System of National Accounts (SNA), GDP per capita growth rate is the most common tool for comparing the cross national economic size (OECD, 2014). Besides, this can be used to compare the standard of living of a nation over time as it includes two parts: “GDP" and “per capita”. The component “GDP" measures the goods and services of country products within a year. The component “per capita” means “per person" so the GDP per capita can reflect the goods or services consumed by each person in a nation, so the indicator makes it easier to compare the GDP for the countries with huge differences in population (Amadeo, 2020).

The GDP of capita growth rate of a country is calculated by deivie the GDP by the population within a country in a period of time. GDP per capita can be calculated by the following formula:

$$\frac{GDP}{Population} = GDP\ per\ capita$$

(Rosa, 2017)

GDP per capita growth rate can be calculated by the following formula:

$$\frac{GPC(t+1) - GPC(t)}{GPC(t)} x\ 100$$

(Rosa, 2017)

Where:
- GPC(t + 1) illustrates GDP per capita in year (t + 1)
- GPC(t) illustrates GDP per capita in year t

Income

In this paper, income is calculated by taking logarithm of GDP per capita:

$$Income = log(GDP\ per\ capita)$$

Income is the factor indicating the growth of an economy as a country with lower income will put more effort on growing faster in order to catch up with those who have higher income (Andrade Araujo et al., 2018).

Capital

Capital in this paper stands for Gross fixed capital as percentage of GDP. Land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and other structures, such as schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings, are all included in gross fixed capital formation (formerly gross domestic fixed investment) (data.worldbank, n.d.). Countries that grow rapidly may have higher gross fixed capital rate as those countries need more fixed assets to accelerate growth (Pettinger, 2016).

FDI

$$FDI = Equity + Long\text{-}term\ Capital + Short\text{-}term\ Capital$$

Foreign Direct Invest is equal to the sum of Equity, Long-term investment and short-term investment. Foreign Direct Investment (FDI) is the situation where the investor country has the ownership rights of the assets in another country (home country) along with the right to manage the assets. In most cases, both the investors and the asset that is owned by the investor is the business premises. In those cases, investors are called “parent companies” and the assets are called "subsidiaries" or "branches" (Duce, 2003). Growing economies always have higher FDI since FDI is a source of technology and promotes the association of businesses in the local industry which can kickstart the economy (Kanczuk, 2003).

Trade

Trade openness refers to the orientation of a country’s economy in the context of international trade (Mazumdar et al., 2019). Openness of trade in in narrow sense is calculated by the following formula:

$$Openness\ of\ trade = \frac{Export + Import}{GDP}$$

In a wider sense, The openness of the economy is also reflected in many indicators of the foreign-invested sector (FDI) in a country, including: GDP of the FDI sector/total GDP of the whole country, value of industrial production due to foreign direct investment (FDI) in a country. FDI sector generates/total industrial production value of the whole country calculated at actual prices, exports of FDI sector/total export turnover, etc.

In scope of this paper we mainly examine openness of trade in the narrow sense.

2. Basic model

This section provides the model to examine the impact of the financial crisis and economic growth in ASEAN from 2008 to 2019. Growth is regressed on Income, capital, fdi and trade. The model is presented below:

$$Growth = \beta_0 + \beta_1 Income + \beta_2 Capital + \beta_3 FDI + \beta_4 Trade + \beta_5 Crisis + \varepsilon$$

The dependent variable is Growth is the GDP per capita growth rate of 10 countries from 2008 to 2020. The explanatory variable Income is the logarithmic form of the gross fixed capital as percentage of GDP which is added to the model to illustrate the country specific productivity levels (Acemoglu & Dell, 2010). On the other hand, the higher capital level leads to better productivity, thus passively increasing the income of the nation. Turning to FDI, FDI in the model is net foriegn direct investment. FDI creates favorable conditions for the external environment and access to technological advances to increase production capacity of enterprises, increasing economic growth (Javorcik et al., 2017). Trade represents openness of trade which measures the export and import ratio to GDP. Finally, dummy variable, Crisis - take the binary 1 for year in crisis period and 0 is otherwise.

IV. DATA

1. Data source

To see how the financial crisis affects economic growth in ASEAN, we collected data from 2008 to 2019 on 10 country members. The main data sources come from The World Bank, supplemented by other sources such as ASEAN Development Bank, and UNSD-National Accounts Main Aggregates Database.

Variables	Unit	Description	Sources
Growth	Annual %	The annual percentage growth rate of GDP per capita over the world from 1960 to 2020 is based on constant local currency.	World Development Indicators, The World Bank
Income	Constant 2010 US$	GDP per capita of the world from 1960 to 2020.	World Development Indicators, The World Bank
Capital	% of GDP	Gross fixed capital formation in the whole world from 1960 to 2020 (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.	- World Development Indicators, The World Bank - UNSD-National Accounts Main Aggregates Database
FDI	Billion current US$	Foreign direct investments from 1960 to 2020 of the world are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.	World Development Indicators, The World Bank
Trade Openness	% of GDP	Trade is the sum of exports and imports of goods and services measured as a share of the gross domestic product of 266 countries from 1960 to 2020.	- World Development Indicators, The World Bank - ASEAN Development Bank

Crisis		A dummy variable to represent the occurrence of a crisis (2008-2009 Global Financial Crisis). It takes the value of unity during the crisis and nil during the non-crisis period).	

Table 1. Variables: Descriptions and sources

To complete our report, we collected a data set of 120 observations from 10 ASEAN member countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam) over 12 years.

2. Data processing

This paper collects data mostly from the World Bank, the data set is in the period of 2008-2020 and includes 10 countries of ASEAN: VietNam, Cambodia, Thailand, Myanmar, Lao, Philippines, Singapore, Indonesia, Brunei. First of all, all raw data is gathered into Excel for basic calculation and formatting. Turning to Descriptive statistics and Correlation Matrix, data is imported into Python for further analysis since Python provides friendly-user-libraries such as pandas for easier analysis and data distribution. Besides, in order to make sure the model has no problem with perfect collinearity, we use SPSS test VIF to increase reliability. Then, Breusch-Pagan test, OLS linear regression and Robust Standard Error regression are conducted in Rstudio to examine more on economic growth and the effect of the economic crisis, finally, using “stargazer” packages to present the finding.

V. EMPIRICAL RESULTS

To demonstrate the correlation between economic growth and financial crisis, we ran a regression with response variables as growth, and independent variables such as income, capital, FDI, trade openness, especially the occurrence of crisis dummy based on the basic model.

1. Descriptive statistics

Variables	Mean	Std	Min	Max	Median
Growth	3.757725	2.911057	-3.78452	12.514307	4.40588
FDI	11.546639	19.259458	-0.150439	114.1584	4.926412
Income	3.577653	0.572195	2.876678	4.773600	3.407326
Capital	26.344359	5.273811	13.672486	40.890729	25.851006
Trade	124.38368	89.097262	0.167418	437.32671	109.10213

Table 2. Descriptive statistic of variables

To begin with the data analyses, we had a complete picture of all variables in Table 2. The numerical data shows the basic features of the dataset through the mean, standard deviation, min, max, and median of the dataset. As a result, we can see that the spread out of trade (89.1) is the highest and the lowest is income (0.57) based on standard deviation. Still, trade (437.16) has the largest range, and income (1.9) has the smallest range based on the min and max of the data. Just like the previous two results, trade and income are still the two variables that can be the most and the lowest in terms of mean and median.

2. Correlation matrix

There is a common problem called multicollinearity in a multiple regression model which should be soon recognized since this can lead to misleading results and produce less reliable statistical inferences for the further analysis process (Hayes, 2021). Multicollinearity is defined when two or more independent variables are highly intercorrelated that the effects of two independent variables on the dependent variable can not be distinguished (Frost, 2017). This is stated as a problem since it impedes the researchers and analysts from determining how well each explanatory variable can most effectively explain the explained variable, and thus affects the ability to understand and predict it (Hayes, 2021).

Understanding inclusive components is not enough to get started with a model. In order to avoid multicollinearity, we need to determine whether the independent variables are correlated. In fact, the rule of thumb suggests if the correlation coefficient is higher than 0.8, it assumes a “perfect collinearity” exists

which is defined as a strong link between independent variables, which would be extremely difficult to estimate using OLS.

	FDI	Income	Capital	Trade
FDI	1			
Income	0.581455***	1		
Capital	-0.003908	0.198307*	1	
Trade	0.717857***	0.573252***	-0.132953	1

Table 3. Correlation coefficient matrix

Note: *This table provides the correlation coefficient matrix of the main independent variables. The sample includes 120 country-year observations covering the 12-year period from 2008 to 2019 with 2 years in crisis.*

**Significance at the 10% level*

***Significance at the 5% level*

****Significance at the 1% level*

Based on the rule of thumb, if there is any correlation coefficient greater than 0.8 the model is considered having trouble with "perfect collinearity". Fortunately, our model has the highest correlation coefficient is 0.718 (between FDI and trade), which is still significant even at 1%. Other cases which are 0.581 (between FDI and income) and 0.573 (between income and trade) are both significant at 1%, so in conclusion, the model is "perfect collinearity" problem free.

Variance Inflation Factor (VIF) test

As to firm the non-existence of multicollinearity in our multiple regression model, particularly between trade and FDI, we decide to run the VIF test as the following table:

	Income	Capital	FDI	Trade	Crisis
VIF	1.817326	1.188037	2.373504	2.449864	1.091320

Table 4. Variance Inflation Factor (VIF)

Basically, there is no certain value of VIF to determine the presence of multicollinearity. There are several assumptions about the upper limiting value that can cause multicollinearity. Generally, we aggregate the most common assumptions that if the VIF value exceeds 10, then there is absolutely a problem of

multicollinearity; if the value lies within the range from 2.5 to 10, then it can be considered as a cause for concern (research consultation, n.d.); otherwise, the model is acceptable.

Seeing our results in the table, the VIF values are all less than 10. In particular, both the trade's and FDI's VIF values are less than 2.5, which are about 2.450 and 2.374, respectively. Therefore, we can infer that the independent variables, especially trade and FDI, are relatively acceptable and we assume that there is no multicollinearity problem occured in our multiple regression model.

3. Factors on economic growth

After regressing the model on economic growth of Asean countries, we obtain the following result:

Parameters	Estimate	S.e	t-value	p-value	Adjusted R-squared
Constant	18.244***	1.524	11.975	< 2e-16***	0.5076
FDI	0.066***	0.015	4.394	2.5e-05***	
Income	- 4.183***	0.441	-9.481	4.5e-16***	
Capital	0.008	0.039	0.216	0.829	
Trade	-0.001	0.003	-0.447	0.656	
Crisis	-1.912***	0.523	-3.657	0.0004***	

Table 5. Regression Result

Note:

- ****, **, and * denote significance at the 1%, 5% and 10% levels, respectively.*
- *Number of observations: 120*

Briefly analyzed, the model shows that both FDI, income, and crisis are significant at 1%, all of those have a big impact on economic growth. Besides, adjusted R-squared is 0.5076 which means the explanatory variables can explain more than 50% of the dependent variable.

Before examining more deeply, heteroskedasticity needs to be tested to make sure that the model is free from the heteroskedasticity problem which is a serious problem that causes bias standard error will lead to a bias inference. Therefore, the results of hypothesis tests are possibly wrong.

This paper conduct Bresuch-Pagan test, the results is in the table below:

Test statistic	df	p-value
43.89	5	2.44e-08

Table 6. Bresuch-Pagan test

Note: ****, **, and * denote significance at the 1%, 5% and 10% levels, respectively.*

Based on the result above, p-value equals 2.44e-08 is much lower than 0.05 which means the model is suffering from heteroskedasticity problems that violate one of the key assumptions of linear regression. Thus, Robust Standard error needed to be applied for this model to overcome the consequence.

The table below shows the results of the fitted regression model to panel data with Robust standard error.

Parameter	Estimate	Robust S.e	t-value	p-value	Adjusted R-squared
Constant	18.244***	1.823	10.009	< 2.2e-16***	0.508
FDI	0.066**	0.03	2.173	0.032**	
Income	-4.183***	0.424	- 9.866	< 2.2e-16***	
Capital	0.008	0.038	0.218	0.828	
Trade	-0.001	0.004	- 3.309	0.758	
Crisis	-1.912***	0.707	- 2.704	0.008*	

Table 7. Robust Standard Error Result

Note:

- ****, **, and * denote significance at the 1%, 5% and 10% levels, respectively.*
- *Number of observation: 120*

	Dependent variable	
	Growth OLS (1)	**Robust standard error regression (2)**
FDI	0.066***	0.066***

	(0.015)	(0.030)
Income	-4.183*** (0.441)	-4.183*** (0.424)
Capital	0.008 (0.039)	0.008 (0.038)
Trade	-0.001 (0.003)	-0.001 (0.005)
Crisis	-1.912*** (0.523)	-1.912*** (0.707)
Constant	18.244*** (1.524)	18.244*** (1.823)

Table 8. OLS regression result with Robust Standard Error result

Note:

- ****, **, and * denote significance at the 1%, 5% and 10% levels, respectively.*
- *Observation : 120*
- *R2: 0.528*
- *Adjusted R2: 0.508*

Compare the result from the OLS regression model with the Robust Standard Error regression model. Both income and crisis are significant at 1% level. In both models, income has negatively correlated with economic growth. FDI has positive sign and significant at 1% in the OLS model, but in reality, based on Robust Standard Error, FDI is significant at 5% which means it would fail to reject the null hypothesis at 1% level of confidence. If we ignore the step of conduct Bresuch-Pagan testing it will lead to bias in growth rate testing. In the model, it indicates that FDI has the strongest impact on the growth rate of an economy, it will lead to a serious problem to analyze.

Besides, take a further look into the Robust Standard Error result to better understand the economic growth and the factor effect on it, examine how the financial crisis impacts the growth rate. Table 7 shows there are 120 observations in total including 10 countries in Asean in the period of 2008-2019. The adjusted R-squared is 0.508 which is quite good, it means that 50.8% of the dependent variable is explained by the independent variables (Team, 2021). The first explanatory variance FDI is significant at 5% level of significance, can be concluded that FDI has the most impact on economic growth. If FDI is increased by 1 billion dollars, then

the economy may grow by 6.6%. The realistic explanation for this is that FDI influences growth by raising the technology of the host country and FDI optimizes the scarce resources of the host country (OECD, 2002). On the other hand, there is strong evidence that countries with higher income have lower growth rate compared to the lower-income-countries (significant at 1% level of significance). Whenever income increases by 1 unit, the economic growth rate decreases by 4.18%. The reason for the above problem is that most low-income countries are developing countries, in contrast, high-income countries are almost always developed countries with fully-developed economies; those growth rates can't be as high as developing countries. Thus, countries have to pay close attention to FDI to get the expected growth rate.

Next, the crisis dummy is significant at 1%. According to the estimation, under the ceteris paribus, the financial crisis leads to the ASEAN economies growth negatively about 2%. Compared with the real data from the World Bank, we can see that there is a decrease in growth during the crisis period (2008 to 2009). It shows that our results can be explained through the literature we have found for financial crises.

Having mentioned in the literature review of financial crisis typology, crises are considered to be "sunspot equilibrium" (or random variable) so we cannot predict when it will happen and even if we can, the predictable rates are still too low. This financial crisis was considered to be the outbreak of financial irregularities (S.j. & Roy, 2014) which strained the production and trade structures (have been clarified and mentioned in the literature review).

As a result, most of the ASEAN governments at the time cannot give out appropriate policies to stand against the global crisis and it caused the problem in their transports costs to other countries and declined their exports in 2009, and similar to the report by Plummer (2009), forcing the ASEAN government to focus temporarily on domestic issues, the root cause, caused by the global crisis first.

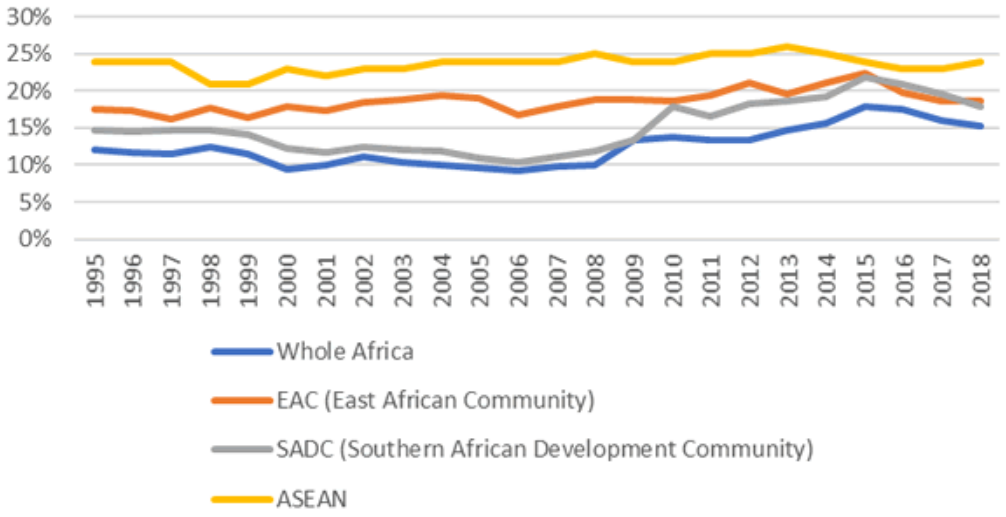

Figure 3. Intra-regional Trade - Export (%) (Bacrot & Valensisi, 2019)

Although the economic growth of ASEAN suffered after the crisis period, from our data of growth in 2010 (Appendix 5) and the graph above (with ASEAN in yellow line), we can see a recovery and increase in export from 2010 to 2018 (with a little decrease in 2015). This comes from 2 elements: the ASEAN governments' efforts in fixing their domestic issues (the root problem) before focusing on the external trading patterns.

This is not contradicting the literature review by Park et al. (2013) above that considers South East Asian countries to fare better in the 2008-2009 global financial crisis than the Asian financial crisis. By focusing on the economic fundamentals (by focusing on internal first) and giving appropriate policies to the macroeconomic issues, most of the ASEAN governments have successfully recovered from the crisis.

Income and economic growth

The interacting coefficient of income from our tests shows the result of (-4.183) and is significantly at 1%. It has been mentioned above from the test that with 1 unit increase in income, it will lead to a decrease of 4.18% in growth. This has shown a contradiction with the hypothesis in the original study.

But when comparing with the literature review of the relationship between income and economic growth, we can see a contradiction and a similarity. The contradiction is when comparing the literature review of old-growth theories and our results, we found that actually during the crisis period, the increase of income was not a factor contributing to the growth of the economy. Although according to the literature of Raz et al. (2012), Singapore's income was a factor that boosted the growth of the country, it may also depend on other factors.

This may be explained by the other literature mentioned in the relationship between income and growth, which is the New Growth Theory. This theory explains that although income level does not have a good effect on economic growth (found from our results), factors such as FDI and Trade can act as variables that create sustainable growth for countries (Corporate Finance Institute, 2021). By creating a good external environment through internal factors (human capital) and putting the foundation on the want-need relationship, it has acted as the engine behind the growth. Singapore's economic case may have resulted from this reason.

In conclusion, from our data results, it has proven that income level does not have a positive impact on the growth of ASEAN economies. There may be other factors other than income that contribute to the boost in the growth of countries.

Human capital and knowledge and economic growth

According to the Robust standard error, we get the result that the coefficient of capital is 0.008 and the no significant level in the relationship between the two components. Based on this number, we can conclude that capital has no effect on economic development. Although New Growth Theory (2011) indicates that human

capital optimistically affects economic growth in our literature review, this does not seem to apply to the economies of ASEAN countries. This leads to a contradiction with H_{o2} - Human capital and knowledge have a positive impact on economic growth. In conclusion, we reject the null hypothesis mentioned before and re-assess that even if we focus on developing human capital, the economy of ASEAN members is still not influenced by human resources.

FDI and economic growth

After processing the data, the coefficient on FDI is 0.066, and the significant level is at 5%. The coefficient of FDI means that if FDI increases by 1 unit, growth will increase by 0.066 units. This proves that the literature review on the relationship of the effect of FDI on growth is a positive fact. According to the Robust standard error, we can come to the conclusion that our hypothesis about a positive relationship between FDI and economic growth is absolutely correct.

In previous reports, the bidirectional relationship of the two factors was controversial. Based on our numbers, we can reject Mah's (2010) hypothesis that FDI has no effect on the economy. Perhaps this applies only to China, but it is not convincing in the fact that ASEAN member countries' economies are growing thanks to FDI.

The crisis has sparked heated debates about how beneficial foreign capital is in boosting economic growth, arguing that it also creates systemic risks that have been at the heart of the financial crisis (Fan & Dickie, 2000). However, based on data from The World Bank during the financial crisis, FDI inflows were considered a stabilizing factor during the Asian financial crisis, even after the crisis increased significantly. These include countries like Indonesia (an increase of 8.89% of GDP) or Malaysia (an increase of 9.05% of GDP), and especially Singapore with a spike of 34.02% of GDP. This asserts its relative stability in comparison to other types of foreign capital, as well as its role in buffering external shocks during the Asian financial crisis.

Overall, we find that FDI has the largest positive contribution of all explanatory variables on economic development. This boosted the economies of ASEAN countries even during the 2008-2009 financial crisis.

Trade and economic growth

As can be seen from our result of the coefficient test, trade has the coefficient rate at (-0.001) and there is no significant level in this relationship, which means that the fluctuation in trade openness has no impact on economic growth, neither positive nor negative effect. This inference shows the contradiction with the H_{o4} stating that "Trade openness has a positive impact on economic growth". Therefore, we reject the aforementioned null hypothesis and conclude that whether a country opens up borders for international trade and integration or not, the movement of that country's economy is irrelative.

VI. CONCLUSION

1. Summary of the main findings

This report aims to find out the variables affecting economic development as well as the impact of the financial crisis on the economic growth of 10 ASEAN member countries for 12 years during and after the financial crisis. After running data analysis, we come to conclusions about the elements affecting the economy. The results found that only three variables including FDI, income, and crisis have influences on economic growth. In which, FDI has the most influence as well as the only positive element on economic development, even unaffected by the crisis factor. The other two variables bring negative impacts, especially income. Although based on historical reports showing positive effects on income, it brings great negative ones in the case of Southeast Asian countries. Furthermore, factors that are found to be influential, such as capital and trade, have no effect on the economy of ASEAN in this study.

2. Limitation

L1. Literature related to the subject of Southeast Asian economies is considered to be limited, compared with ones from other more developed Asian economies (China and Japan) or European economies. This is because from the period before 2000 to back, Southeast Asian countries were struggling with themselves in the political world, changing from being a colony of America, Britain, Spain and more. The study of East Asian countries only started sometime during the end 1950s and the beginning of the 1960s, beginning as a program funded by some foundations and the US government (McVey, 1995), comparing with our study that research from the 2008 to 2019 period, this is still considered to be a new and under developing area of study. Although in the last few decades, the economies of Southeast Asian countries have been rapidly grown due to the expanding of global value chains and FDI, there are challenges remain, for example domestic social perceptions, gaps in education and specialization level of researchers, infrastructure, political hidden problems and more (Asian Development Bank & Asian Development Bank Institute, 2013). These challenges proved to be the barriers to economists and researchers, preventing them from countries' research papers and materials.

L2. When doing the literature review about the nexus between the regressors and the response variable, there are some ambiguous inferences that have not been reached the consensus of all the economists. For instance, it is uncommon to directly measure the effectiveness of income in general on economic growth but is particularly measured in terms of income distribution or income inequality, which thus leads to a misleading conclusion about the sign of the relationship. Or, there is a discrepancy of the economists about the impact of trade openness on economic growth since many ideas are proposed according to different cases. Due to the limitation of capability, it is difficult to investigate and examine the accuracy of the information in such a short period of time. The shortcomings of information searching may occur as the ideas are taken from very few sources out of the total number of researches proposed by the specialists. Therefore, when doing the research, the very prominent ideas which are most agreed by the economists are selected and reported.

Overall, it could be a problem if the research does not totally reflect the general viewpoint of the economists and in consequence, it may cause the bias in the null hypothesis formation.

L3. In the above analysis, we mainly analyze the time periods during and after the financial crisis, so we can't exploit all the information related to the financial crisis. Besides, the addition of variable income has helped to better understand economic growth, but the variable income has not been fully exploited. Having only one income variable instead of many to represent countries with different income levels, for example, low, medium, high income. Putting economies with different developments into the same group will lead to unexpected errors and lack of in-depth analysis.

3. Suggestion and Extension

According to L1 and L2 mentioned above, time and effort are two factors that can improve the reliability and validity of the report. Knowing that the literature review provides the important foundation for further research, it should be built firmly and accurately before implementing the data analysis. More time should be invested when doing research since the more papers support the information, the more accuracy and reliability it contains. It is not simple to approach the effective and supportive information on the internet. Hence, to avoid reading heterodox and ambiguous papers, the sources of research should be common and qualified. Moreover, time and effort are even highly required when the information finding is not broadly discussed and mentioned.

Recommendation for L3, to improve the problems, this research can extend the range of time to find out more. Instead of 2008-2019, it will be 2000-2019 to be able to understand all three stages of the financial crisis (before, during and after). Besides, in order to better understand how the financial crisis has impacted different developing economies, it is suggested that the research should add a qualitative variable of income to differentiate the economies. The income variable should be divided into three parts: low, medium, high income that makes the results obtained reflect reality better and the predictions from the results will be much more accurate.

VII. APPENDIX

Appendix 1: Descriptive Statistic code in Python

```
data.describe()
```

	year	growth	fdi	income	capital	trade	crisis
count	120.000000	120.000000	120.000000	120.000000	120.000000	120.000000	120.000000
mean	2013.500000	3.757725	11.546639	3.577653	26.344359	124.383688	0.166667
std	3.466527	2.911057	19.259458	0.572195	5.273811	89.097262	0.374241
min	2008.000000	-3.784520	-0.150439	2.876678	13.672486	0.167418	0.000000
25%	2010.750000	2.696781	1.258247	3.155199	22.875841	61.587420	0.000000
50%	2013.500000	4.405882	4.926412	3.407326	25.851006	109.102138	0.000000
75%	2016.250000	5.524284	12.027443	3.745572	31.018424	139.865808	0.000000
max	2019.000000	12.514307	114.158400	4.773600	40.890729	437.326715	1.000000

Appendix 2: VIF test in Rstudio

```
> model= lm(growth ~ fdi + income + capital + trade + crisis, data=data1)
> vif(model)
     fdi   income  capital    trade   crisis
2.373504 1.817326 1.188037 2.449864 1.091320
>
```

Appendix 3: Correlation Matrix code in Python

```
data1=data
del data1['growth']
data1.corr()
```

	fdi	income	capital	trade
fdi	1.000000	0.581455	-0.003908	0.717857
income	0.581455	1.000000	0.198307	0.573252
capital	-0.003908	0.198307	1.000000	-0.132953
trade	0.717857	0.573252	-0.132953	1.000000

Appendix 4: Regression in Rstudio

```
#Breusch-Pagan test:
bptest(growth ~ fdi + income + capital + trade +crisis, data=data1, studentize=F)

#OLS Regression
model= lm(growth ~ fdi + income + capital + trade + crisis, data=data1)
summary(model)

#Robust standard error:
coeftest(model, vcovHC)
stargazer(model,(coeftest(model, vcovHC)), type='text')
```

Appendix 5: Dataset of 10 ASEAN member countries from 2008 to 2019

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