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The Role of Foreign Direct Investment in Supporting Economic Diversification in Algeria and Southeast Asian Countries (Malaysia, Singapore and Indonesia): Empirical study using Panel Data Models for the Period (2000- 2019)

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Abstract

This research paper examines the role of foreign direct investment (FDI) in supporting economic diversification in Algeria and Southeast Asian countries (Malaysia, Indonesia, Singapore) from 2000 to 2019. using panel models and the Cointegration tests PEDRONI and Kao. The results show that there is a long-run equilibrium between the study variables. Based on the results of estimating the relationship in the long term, we found that there was a positive relationship between

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FDI inflows and trade openness with economic diversification on the one hand and an inverse relationship between inflation and economic diversification on the other hand.

Keyword: Foreign Direct Investment, Economic diversification, Panel data, PEDRONI test, Kao test.

Jel classification: C23, C43, F21

1. INTRODUCTION

Many developing countries depend on natural resources for their revenues, making them vulnerable to several risks. Therefore, these countries seek economic and social development and eliminate structural imbalances in their economies through economic diversification. Many studies have shown that economic diversification contributes to finding new sources of income, reducing dependency on traditional sectors in GDP formation and mitigating external shocks, such as oil-rich countries aiming to reduce dependence on oil and developing non-oil productive sectors (Alkhathlan & al, 2020, p. 384). Moreover, economic diversification enhances trade volume, reduces the risk of exporting limited goods, and creates jobs because more than one sector is active and contributing to the country's economic activities (Albassam, 2015, p. 113).

1.1. Research Problem:

Foreign direct investment is one of the available and reliable alternatives to drive economic development and achieve economic diversification because it helps to augment productive capacity and increases employment and trade. It also argued that FDI generates positive knowledge externalities through labour training and skill acquisition, helping transfer technology and organisational know-how (Iamsiraroj & Ulubaşoğlu, 2015). Based on the previous advantages, many developing countries have sought to attract FDI by creating the appropriate investment climate. So, in this study, we ask the following question: **Does foreign direct investment support economic diversification in Algeria and Southeast Asian Countries (Malaysia, Singapore and Indonesia)?**

1.2. Research hypotheses:

To answer the research question, we test the following hypothesis:

- **Increasing FDI inflows enhances economic diversification.**

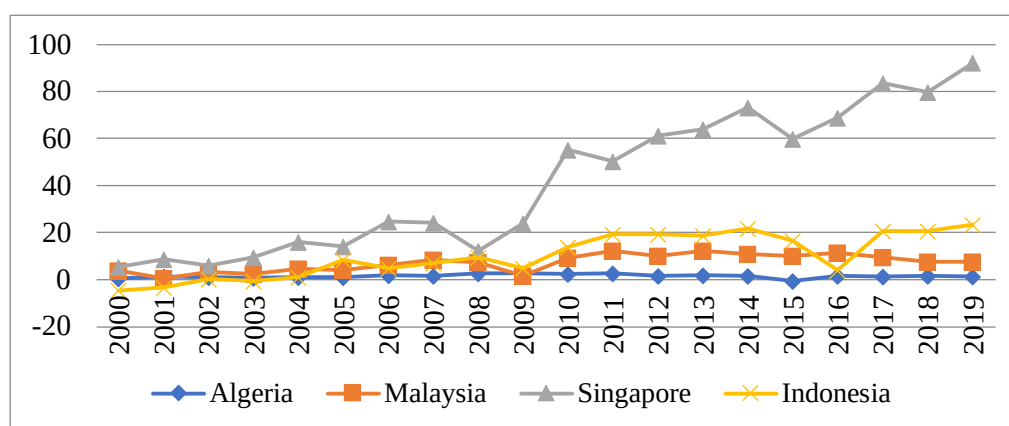
To answer this problem, we divided this study into four axes:

First, we analyze the FDI inflow trends and the economic diversification index, the ease of doing business index, and the index of economic freedom, and measure and analyze the values of the economic diversification index. Second, the literature review will present some studies about FDI and its relation to economic diversification. The third is methodology, and the fourth is results and discussion.

2. Analysis FDI Inflows trends and the Economic Diversification Index:

2.1. Foreign Direct Investment Inflows trends in the sample study:

Figure.1. Foreign Direct Investment Inflows



Source: prepared by author based on UNCTED reports (2002 to 2020)

Between 2000 and 2005, these countries saw positive foreign direct investment inflows except Indonesia. The highest FDI inflows during this era were recorded by Singapore in 2004, reaching a value of 17 billion dollars. However, Indonesia experienced negative inflows of over 4.5 billion dollars in 2000 and 3.2 billion dollars in 2001. This can be mainly attributed to substantial investments made in Indonesia following the commencement of the financial crisis. Overall, the three Southeast Asian countries remained below the pre-crisis level of 1997 (UNCTED, 2001). The successful privatization of state assets and foreign purchases of private enterprises in Indonesia in 2004 effectively halted the ongoing era of negative foreign

direct investment inflows that had commenced in 1998 (UNCTED, 2005, p. 52). The occurrence of significant cross-border mergers and acquisitions (M&As) has witnessed a notable upsurge, exemplified by the acquisition of Sampoerna (Indonesia) by Philip Morris (United States), which has been the primary factor contributing to this growth (UNCTED, 2006, p. 52). The primary source of inflows in Algeria was the production of oil and natural gas (UNCTED, 2005, p. 41). Malaysia implemented investment promotion laws that allowed foreign investors full ownership in futures brokerage and venture capital firms. Meanwhile, Indonesia offered a 15-year income tax exemption to foreign corporations that invested in special zones (UNCTED, 2006, p. 58). Algeria streamlined certain areas of their rules about foreign direct investment (UNCTED, 2005, p. 43).

From 2006 to 2019, Singapore is the most receiver of foreign direct investment in Southeast Asia, with inflows totalling 24 billion dollars in 2006. Other nations in the region also saw positive inflows during this period. In 2015, the inflows reduced by 5% to 65 billion dollars, and the total amount of announced greenfield investments by multinational enterprises (MNEs) in the country declined from 12 billion dollars in 2014 to 8 billion dollars in 2015 (UNCTED, 2016, p. 49). In 2019, Singapore the largest beneficiary of foreign direct investment (FDI) in the subregion, experienced a 15% increase in FDI, reaching a record high of 92 billion dollars. Inflows were boosted by substantial investments in electronics manufacturing, electricity, the chemical industry and services. In 2019, notable investments were made by Micron Technology (United States) to expand its semiconductor operation and by Linde (United Kingdom) to establish a new gas complex. Significant investment was allocated to the services sector, specifically in finance, wholesale and retail commerce, and the digital economy. In 2006, inflows to Malaysia experienced a significant increase, reaching their greatest level since the Asian financial crisis with a rise of 53% to record 6 billion dollars. The foreign direct investment remained unchanged at 8 billion dollars in 2019. Several large-scale mergers and acquisitions, particularly in the healthcare and mining sectors, such as the purchase of a share in IHH Healthcare by Mitsui & Co (Japan) and the acquisition of Seb Upstream by OMV (Austria), contributed to the overall investment activity in the country (UNCTED, 2020, p. 43).

In 2006, Indonesia experienced a significant decrease of 33% in foreign direct investment inflows, which interrupted the previously observed upward trend from 2005. In 2006, Indonesia significantly decreased 33% in foreign direct investment inflows, which interrupted the previously observed upward trend since 2005

(UNCTED, 2007, pp. 41- 42). In 2014, FDI inflows to Indonesia rose by 20% to about 23 billion dollars. The increase was driven by a significant increase in equity investment, particularly in the third quarter of this year. According to recent data from the Indonesia Investment Coordinating Board, the most essential targeted industries were mining, food, transportation and telecommunications; metal, machinery and electronics; and chemicals and pharmaceuticals. In that order, the most significant investing countries were Singapore, Japan, Malaysia, the Netherlands and the United Kingdom. Indonesia, for instance, has recorded many such projects in transport infrastructure with a total investment of more than 1 billion dollars. (UNCTED, 2015, p. 41). In 2015, temporary economic uncertainty resulted in a decrease of 29% in the amount of foreign direct investment (FDI) flowing into Indonesia, reaching a total of 16 billion dollars. However, these incoming funds experienced a 14% increase, reaching an unprecedented amount of 23 billion dollars, primarily due to substantial investments in the industrial, financial services, and mining sectors. Approximately 65% of the inflows in 2019 were attributed to investments in these specific industries. Asian firms, particularly those from Japan and within the ASEAN region, were the primary investors. Notably, companies in Singapore and Japan played a significant role in investing in the manufacturing sector. Korean corporations have also been engaged. For example, Lotte Chemical is now constructing a petrochemical complex worth 4.3 billion dollars, while Hyundai is investing 1.5 billion dollars in a vehicle manufacturing facility. Japanese and South Korean multinational enterprises (MNEs) played a significant role as investors in financial operations.

Algeria was not affected by the global financial crisis in 2008 due to the high FDI inflows in 2008-2009 to reach its highest value that exceeded 2.7 billion dollars, contributed by investments of TOTAL and PARTEX companies in oil and natural gas exploitation, amounted to 1.436 billion euros (Bouabid & Benelbar, 2020, p. 150). Between 2010 and 2019, FDI inflows in Algeria fluctuated but did not exceed 1.7 billion dollars and recorded its lowest value in 2015 of more than 580 million dollars as a result of the decline in oil prices, which affected the Algerian economy, which led to fear of foreign investors from investing. Despite the investment by Huawei and Samsung, they opened their first factory installing mobile phones. However, investment in Algeria was at most 1.33 billion dollars in 2017, with more FDI in the petroleum and telecommunication industries. In general, investments in Algeria still need to be more robust compared to the other study countries because the investment climate has not improved, especially with implementing the 51/49 rule.

2.2.The ease of doing business index:

The World Bank published the Index of Ease Doing Business. The composite measure encompasses various indicators that delineate the level of business facilitation within a nation (The Economic Times, 2022). The economies are evaluated based on the ease with which business activities can be conducted, ranging from 1 to 191. A higher ranking indicates that the regulatory framework of an economy is more favourable for initiating and running a local business. The rating is established by arranging the collective performance outcomes into 10th topics, each comprising multiple indicators, with equal importance assigned to each category (World Bank, 2020).

Table 01.The ease of doing business index for countries studied in 2019

Countries Topics	Algeria	Malaysia	Singapore	Indonesia
Starting a business	150	122	3	134
Getting a building permit	129	3	8	112
Obtaining an electricity connection	106	4	16	33
Transferring property	165	29	21	100
Getting access to credit	178	32	32	44
Protecting minority investors	168	2	7	51
Paying taxes	156	72	8	112
Trading across borders	173	48	45	116
Enforcing contracts	112	33	1	146
Resolving insolvency	76	41	27	36
Doing business index	157	15	2	73

Source: Ease of doing business score and ranking, World Bank report, 2019

From the table, we note that Singapore and Malaysia occupy advanced positions on indicators of ease of doing business, as Singapore ranked second in the world after New Zealand, while Malaysia came in 15th and Indonesia in 73rd, while Algeria ranked 157th, and this shows that the investment climate in Algeria is not appropriate compared to other study countries. We also note that Singapore is characterized by the ease of administrative procedures about the first phase of starting a business, as it ranked third, unlike the other study countries with many complex administrative procedures, especially Algeria, which came in 150th place. Malaysia and Indonesia ranked 122nd and 134th, respectively. The investment climate in Singapore is more

attractive, and this is due to the low administrative procedures, as the project needs only two procedures for approximately two days, while the investment climate in Malaysia is generally attractive, as the project needs approximately 10th procedures and 14 days, while the project started of 10 procedures for a period 19 days in Indonesia and 12 procedures for about 18 days in Algeria.

2.3.Index of economic freedom:

The Index of Economic Freedom is a yearly assessment and rating established in 1995 by The Heritage Foundation, a conservative think-tank, and The Wall Street Journal. Its purpose is to evaluate the extent of economic freedom in countries worldwide. The index quantifies 12 dimensions of economic freedom that are categorized into four overarching groups (The Heritage Foundation, 2019, p. 3):

- **rule of law:** (property rights, judicial effectiveness, and government integrity);
- **government size:** (tax burden, government spending, and fiscal health);
- **regulatory efficiency:** (business freedom, labor freedom, and monetary freedom);
- **open markets:** (trade freedom, investment freedom, and financial freedom);

The results of this indicator are divided into five groups as follows:

- The first group includes free countries between 80–100.
- Second group: mostly free countries between 70–79.
- Third group: moderately free countries between 60–69.9.
- Fourth group: mostly unfree countries between 50–59.9
- Fifth group: repressed countries between 0–49.9.

Table 2. Evolution of the Index of Economic Freedom in study countries

Countries	Algeria		Malaysia		Singapore		Indonesia	
Years	Overall score	Rank	Overall score	Rank	Overall score	Rank	Overall score	Rank
2010	56.9	105	64.8	59	86.1	2	55.5	114
2015	48.9	157	70.8	31	89.4	2	58.1	105
2016	50.1	154	71.5	29	87.8	2	59.4	99
2017	46.5	172	73.8	27	88.6	2	61.6	84
2018	44.7	172	74.5	22	88.8	2	64.2	69
2019	46.2	171	74	22	89.4	2	65.8	56

Source: The Heritage foundation reports (2010 to 2019)

Indonesia and Malaysia experienced an improvement in economic freedom. Indonesia was ranked among the group of moderately free countries with a score of

65.8 in 2019, after it was among the non-free countries with a score of 55.5 in 2010. Malaysia was classified within the group of free countries with a score of 74 in 2019 and the group of medium freedom countries with a score of 65.8 in 2010. Algeria witnessed a deterioration in economic freedom. It was ranked among the group of repressed countries, with a score of 46.2 in 2019, after being among the group of non-free countries in 2010 and ranked 171 globally.

2.4. Analyzing the values of the economic diversification index:

There are numerous statistical indicators available to assess diversification. However, the Herfindahl-Hirschman index is often regarded as the most commonly used indicator. This metric relies on assessing the market shares of the companies operating in the industry, with a scale that spans from zero (indicating complete diversification) to one (indicating no diversification). The Herfindahl-Hirschman Index (HHI) was extensively utilized throughout the 1980s by the Department of Justice in the United States to assess the degree of monopoly within industries. The United Nations Conference on Trade and Development also employed the HHI to gauge export diversification. The formula for the Herfindahl-Hirschman index is as follows (Abu Wadi & Bashayreh, 2018, p. 121):

$$\text{H.H.I} = \frac{\sqrt{\sum_{i=1}^n \left(\frac{x_i}{x}\right)^2} - \sqrt{1/N}}{1 - \sqrt{1/N}}$$

Where:

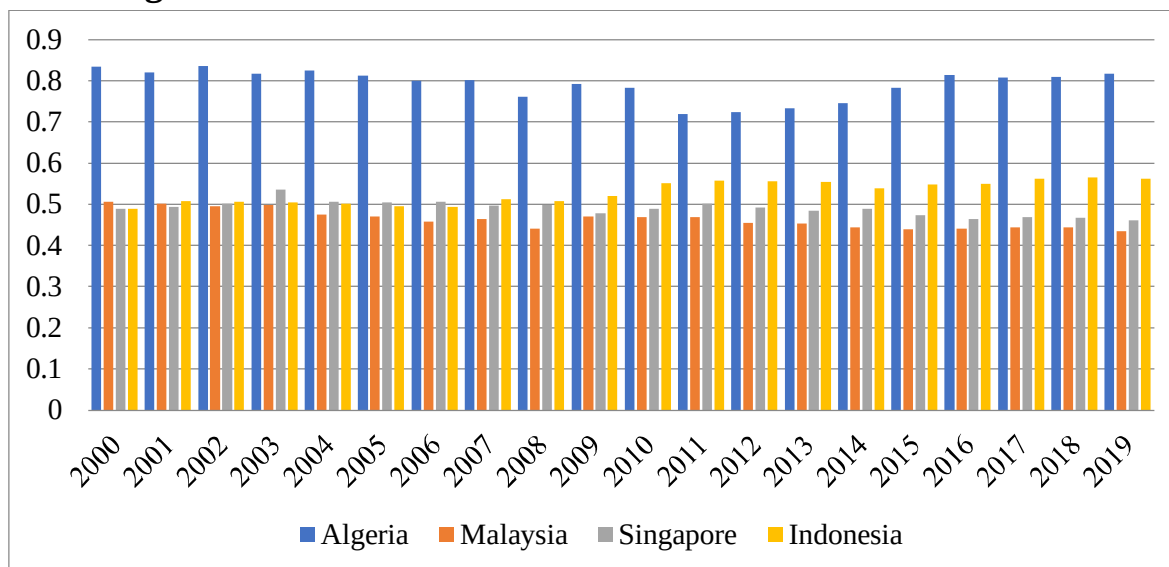
X_i : is the value of exports of commodity i .

X : is the market share of each firm.

N : total number of goods that can be exported.

If the value of this indicator approaches zero, this indicates a large diversity, while it approaches one, this indicates a significant concentration.

Fig.2. Herfindahl-Hirschman index values from 2000 to 2019



Source: prepared by author based on UNCTED data

From the previous figure, we note the significant discrepancy in the values of the economic diversification index between Algeria and the Southeast Asian countries. Algeria suffers from economic specialisation due to the hydrocarbon sector, where the highest value is recorded at 0.82%. In the average period from 2000 to 2019, this percentage amounted to 0.45% in Malaysia, 0.48% in Singapore, and 0.52% in Indonesia. These percentages reflect an acceptable degree of economic diversification in the three Asian countries, with a relative preference for Malaysia.

3. Literature review

Several studies deal with the issue of FDI's impact on economic growth and its importance in achieving economic diversification. We mention, for instance:

Nganga and Koumou (2021). They analysed the impact of investments on the economic diversification of the member countries within the Economic and Monetary Community of Central Africa (CEMAC). They applied panel data econometrics techniques from 1995 to 2019. Their findings demonstrated that private investment favours the expansion of export variety, thereby enhancing economic diversification. Conversely, governmental investment impedes economic diversity.

Mebrek and Mekid (2021). They examined the degree to which foreign direct investment (FDI) aided the economic growth of a selection of Middle Eastern and North African (MENA) nations from 1990-2018. The researchers utilised panel models. The study demonstrated that the variables under investigation are co-

integrated in the long term. Additionally, it was found that 22% of the short-term errors can be rectified to restore equilibrium in the long term. Furthermore, through the evaluation of the long-term relationship, it was established that a direct correlation exists between Foreign Direct Investment and Gross Domestic Product.

Bouabid and Benlbar (2020). They analysed the influence of foreign direct investment on the process of economic diversification in Algeria. Employing the Autoregressive Distributed Lag (ARDL) approach, the variables considered include FDI inflows and the Hirschmann-Hervindahl index, and the data covers the period from 2000 to 2018. The researchers discovered no enduring equilibrium connection between foreign direct investment (FDI) and economic diversification. They also noted that there is no causal relationship between the two variables. This is primarily because the volume of FDI in Algeria has yet to reach the necessary level, and it is concentrated in a few sectors, particularly the hydrocarbons sector, which attracts most foreign direct investments.

Benhaddou and Abdous (2019). They analysed and assessed the foreign direct investment (FDI) inflows in the Maghreb nations: Algeria, Morocco, and Tunisia. They examined their potential to facilitate economic diversification. The Panel (PMG-ARDL) model validated the enduring and immediate correlation between FDI, Trade Openness, Inflation, and the Hirschmann-Hervindahl index. By analysing data from 1995 to 2015, researchers discovered a significant and enduring cause-and-effect connection between the Hirschmann-Hervindahl index and foreign direct investment inflows, trade openness, and inflation. The short-term PMG estimate showed a positive link between the economic diversity index and FDI and an inverse relationship between FDI and trade openness and inflation.

Jung Li and al (2015). The researchers examined the correlation between foreign direct investment (FDI) and economic growth as a contributing element to the diversification of Kazakhstan's economy. They analyzed the impact of economic development on both the natural resources and manufacturing sectors from 1994 to 2013. The updated model incorporates additional variables such as Gross Domestic Product, Human Development Index, Gross Capital Formation, and Foreign Direct Investment, in addition to the original Multiple Regression model. They discovered a substantial correlation between GDP, FDI, and Gross Capital Formation. However, there is no dependency between the Human Development Index and GDP. Nevertheless, foreign direct investment (FDI) in the manufacturing and commodity sectors yields disparate outcomes that have a relatively minor impact on the gross domestic product (GDP). Furthermore, the findings indicate that Kazakhstan

maintains a substantial level of foreign direct investment in the raw materials and extraction industry.

Chun Li Ji (2015). He investigated the impact of foreign direct investment (FDI) on the expansion of economic activities in a small open economy, using Macau as a case study from 2002 to 2013, utilizing the Grey Relational Analysis technique, and employing a time series dataset for several economic variables such as FDI stock, the entropy index, GDP per capita, employment-population, an index of trade openness, and gross fixed capital creation.

He demonstrated that in tiny open economies, such as Macau, there is a negative correlation between foreign direct investment (FDI) and economic diversity. Simultaneously, foreign direct investment (FDI) exhibits a stronger negative correlation with economic diversity than other economic factors (excluding trade openness).

Tadesse and Shukralla (2013). They analyzed the impact of Foreign Direct Investment (FDI) on the expansion of exports across different industries in 131 countries from 1984 to 2004. The researchers employed parametric (quantile) and semi-parametric econometric techniques, utilizing data on Foreign Direct Investment stocks and the quantity of exported products in each country. The study concluded that the effect of Foreign Direct Investment (FDI) on export diversification is either nonexistent or negative. This is especially true for countries with low ($q=0.10$ and $q=0.20$) or high ($q=0.80$, $q=0.90$) levels of diversification. However, the researchers did find a statistically significant impact of FDI in countries that were slightly below or above the median level of diversification. The researcher demonstrated that, on the whole, an augmentation in the stock of foreign direct investment (FDI) improves the expansion of exports in various industries.

4. Methodology:

4.1.Variables:

It is necessary to present the economic variables before the study. These variables fall into two parts:

-The dependent variable: H.H.I: Hirschmann-Hervindahl index.

-Independent variables: FDI, Trade Openness (TO), Inflation.

The following table gives the measures used for our variables:

Table 04. Study variables

Variables	The measure chosen
Economic diversification	Hirschmann-Hervindahl index.
FDI	Foreign Direct Investment (billion US\$).
TO	Trade Openness, It is expressed as the ratio of total foreign trade (exports and imports) to GDP, (%).
INF	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products

Source: prepared by author's

4.2.Data:

In our study, we use panel data or longitudinal data. We can define it as a combination of cross-sectional and time-series data or panel data if the observations are collected from cross-sectional units and over time (Chung-Ki, 2019, p. 152). In our study, the space dimensions are four countries (Algeria, Malaysia, Singapore, Indonesia), while the time dimension is that each country contains 20 years of time series of annual data ranging from 2000 to 2019. The panel data in this study is characterized as a balanced panel where each cross-section unit has the same number of time-series observations; 80 observations are collected for the whole sample. We use Eviews program 12, and the main variables of interest are FDI, trade openness and economic diversification (Hirschmann-Hervindahl index). Data is collected from World Development Indicators published by the World Bank and UNCTED.

4.3.Empirical Model:

Our study aims to investigate the link between the independent variables, which are FDI inflows and trade openness (TO), and the dependent variable is economic diversification measured by the Hirschmann- Hervindahl index in our study. We used panel data analysis to investigate the link between the independent variables FDI inflows and trade openness (TO). The dependent variable is economic diversification measured by the Hirschmann-Hervindahl index. as follows:

$$\mathbf{H.H.I = f (FDI, TO, INF)}$$

The formula of the model that we want to estimate in this study is given by the following statistical equation:

$$HHI_{i,t} = \alpha_i + \beta_{i,t}X + \varepsilon_{i,t} \quad ; t = 1, \dots, T ; i = 1, \dots, n$$

Where :

- $HHI_{i,t}$ is the diversity index.
- α_i It represents the special effect of each economy (country) during the study period and measures the unobserved effects of countries on the levels of foreign investment inflows in addition to the explanatory variables under study. This parameter can be fixed (statistically) or random. The basis for choosing between them is based on the Hausman test.
- β is a vector of coefficients of the explanatory variables.
- X is a matrix that contains the observations of the explanatory variables.
- $\varepsilon_{i,t}$ is the error term (corresponds to all other variables which are not integrated into the model).

5. Empirical results and discussion:

5.1. Unit root test:

In the first step, it is essential to determine the stationary properties of the time series before we proceed with the multivariate analysis. To examine when a time series has a unit root, we use the Fisher-ADF (1979) test, Levin-Lin-Chu (2002) and Im-Pesaran-Shin (2003) to test the null hypothesis against an alternative hypothesis. The results of the analysis and testing are summarized in the following table.

H₀: contains a unit root or the series are not stationary.

H₁: non-unit root or the series are stationary.

Table 4. Results of the panel unit root test

Variables		At Level			First-Difference		
	Model	LLC	IPS	ADF	LLC	IPS	ADF
HHI	M1 (prob)	9.53300 0.2993	0.44626- 0.3277	0.82424- 0.2049	37.2638 0.0000	5.33991- 0.0000	6.67684- 0.0000
	M2 (prob)	5.03257 0.7541	0.19545 0.5775	0.71242- 0.2381	48.0727 0.0000	6.41345- 0.0000	7.69979- 0.0000
	M3 (prob)	8.92547 0.3486	////////	0.51596- 0.3029	74.2465 0.0000	////////	9.10933- 0.0000
FDI	M1 (prob)	14.1435 0.0781	1.73862- 0.0411	3.80391- 0.0001	49.6748 0.0000	7.19843- 0.0000	9.10605- 0.0000
	M2 (prob)	9.38900 0.3105	0.29800- 0.3829	1.50900- 0.0656	63.2131 0.0000	8.39412- 0.0000	10.2973- 0.0000
	M3 (prob)	4.15187 0.8432	////////	0.45686 0.6761	80.5133 0.0000	////////	10.3200- 0.0000

Variables		At Level			First-Difference		
	Model	LLC	IPS	ADF	LLC	IPS	ADF
OPEN	M1 (prob)	10.8564 0.2100	0.84044- 0.2003	1.31111- 0.0949	50.2451 0.0000	7.30364- 0.0000	7.59231- 0.0000
	M2 (prob)	2.30936 0.9700	1.31130 0.9051	0.35775 0.6397	63.5735 0.0000	8.46501- 0.0000	8.80112- 0.0000
	M3 (prob)	15.0179 0.0588	////////	2.46983- 0.0068	82.5620 0.0000	////////	10.2613- 0.0000
Inflation	M1 (prob)	27.9037 0.0005	3.80811- 0.0001	5.99438- 0.0000	50.3324 0.0000	7.21233- 0.0000	7.46840- 0.0000
	M2 (prob)	31.9903 0.0001	4.27660- 0.0000	5.32030- 0.0000	63.7133 0.0000	8.41224- 0.0000	8.74727- 0.0000
	M3 (prob)	13.9978 0.0818	////////	2.24322- 0.0124	89.0857 0.0000	////////	10.3783- 0.0000

Source: Author's Compilation

Based on the results of the unit root tests of the study variables, where the probabilities of the variables FDI inflows, trade openness, and economic diversification are more than (0.05), we accept the alternative hypothesis of level stationary and reject the null hypothesis, so it allows us to conclude that the variables are not stationary in level. Therefore, it is necessary to test the first difference.

In the first difference, the test results showed that the variables are integrated of order one I(1) at a 1% significance level. The stationary tests allow us to retain the hypothesis of the absence of the unit root. When the variables are stable in the first difference, this implies the possibility of co-integration between these variables, and this is what the co-integration test shows later.

5.2. Panel Cointegration analysis:

After testing the stationarity of the time series, we investigate the cointegration test for a long-run relationship between the examined variables in the second step. We used the Pedroni Panel cointegration test and the Kao residuals cointegration test to check the cointegration relationships among the study variables. Results have been reported hereafter.

Table 5. Pedroni Panel Cointegration and Kao test

Pedroni Panel Cointegration					Kao test	
Alternative hypothesis: common AR coefs. (within-dimension)						
	Statistic	Prob.	Weighted			
			Statistic	Prob.		
Panel v-Statistic	-1.571248	0.9419	-1.602175	0.9454		
Panel rho-Statistic	-0.384812	0.3502	-0.539790	0.2947		
Panel PP-Statistic	-1.357024	0.0874	-1.768809	0.0385		
Panel ADF-Statistic	-1.640447	0.0505	-2.260804	0.0119		
Alternative hypothesis: individual AR coefs. (between-dimension)						
	Statistic	Prob.				
Group rho-Statistic	0.338473	0.6325				
Group PP-Statistic	-1.495755	0.0674				
Group ADF-Statistic	-2.597892	0.0047				

Source : Author's Compilation

The results shown in Table 5 indicate the presence of simultaneous integration relationships between the different studied variables of the same degree, represented in inflation rates, diversification index, foreign direct, and the openness index, which is what we notice through the ADF, PP, RHO, and v-statistic, which shows the rejection of the null hypothesis and the acceptance of the alternative hypothesis. The Kao test has revealed the same result and, thus, the existence of simultaneous integration relationships within the individual basket. Consequently, the suitable method to estimate the panel data model is the Panel Fully Modified OLS (FMOLS).

After confirming a long-run relationship among the study variables, we used the FMOLS method to estimate the model. Results are reported in the following table:

Table 5. Estimation of the Panel Models

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI	0.000302	0.000331	0.913133	0.3644
INFLATION	-0.008686	0.001739	- 4.993963	0.0000
OPEN	0.000608	0.000190	3.196069	0.0021
R-squared	0.974036	Mean dependent var		0.567885
Adjusted R-squared	0.971778	S.D. dependent var		0.133819
S.E. of regression	0.022481	Sum squared resid		0.034872
Long-run variance	0.000851			

Source: Author's compilation

According to the findings, there is a weak positive effect of the two variations of the foreign direct investment and the trade openness index on the variation of the diversification index in the four countries over the study period. In contrast, the inflation rate had a negative effect (or association) on the diversification index. Statistically, the coefficients estimated for trade openness and inflation were significant, unlike the foreign direct investment coefficient, which is not statistically significant. Unlike foreign direct investment, the country's trade openness and the inflation rate have a limited (significant) effect on the diversification of the economy. So the model will be:

$$H.H.I = 0.000302(FDI) + 0.000608(OPEN) - 0.008686(INF)$$

According to the R2 value = 0.97, the selected explanatory variables explain 97% of the variation in the dependent variable. Accordingly, if foreign direct investment changes by 1%, it improves economic diversification by 0.000302%. If the level of trade openness changes by 1%, it improves economic diversification by 0.000608. In comparison, if the inflation rate changes by 1%, it leads to a deterioration in economic diversification by 0.008686%.

This result indicates that the effect of foreign direct investment needs to be activated in the countries under study. In Algeria, most foreign direct investment is directed towards the oil sector, while the remaining three countries achieved economic diversification a long time ago, so its effect is almost negligible.

6. CONCLUSION:

To conclude, this study investigates the role of foreign direct investment on economic diversification in Algeria, Malaysia, Indonesia and Singapore from 2000 to 2019. The study utilized the panel data model, and we have reached a set of results, which can be presented in the following points:

- These differ regarding FDI inflows, and Singapore is considered the biggest recipient of FDI inflows. At the same time, Algeria recorded the minor recipient of FDI inflows, with most of it concentrated in the oil sector.
- The economic diversification index, measured by the Herfindahl-Hirschman coefficient, recorded levels between 0.4 and 0.55 in Southeast Asian countries. Thus, it is considered more diversified than Algeria, which has a concentration level of more than 0.7.
- According to the empirical analysis, the three-unit root tests, ADF, LLC and IPS, showed the stability of all study variables in the first difference $I(1)$. This result allows us to search for long-run relationship cointegration using the Pedroni and Kao tests; we ensured a cointegration relationship between the study variables for all the study samples.
- the results showed us that the role of foreign direct investment is minimal. For the three Southeast Asian countries, the role of FDI did not appear because these countries achieved acceptable levels of economic diversification. At the same time, Algeria did not show the impact of FDI due to the lack of FDI inflows on the one hand, and most of them were concentrated in the oil sector on the other hand.

Through the results of the study, several recommendations were drawn, especially for Algeria, which can be put forward in the following points:

- There is a need to provide an appropriate environment to attract foreign direct investment by easing legal and administrative restrictions and combating corruption.
- Work to increase the contribution of non-oil sectors, especially sectors that have promising prospects such as agriculture, manufacturing industries
- A policy must be adopted to attract foreign direct investment to develop economic sectors rather than the oil sector.

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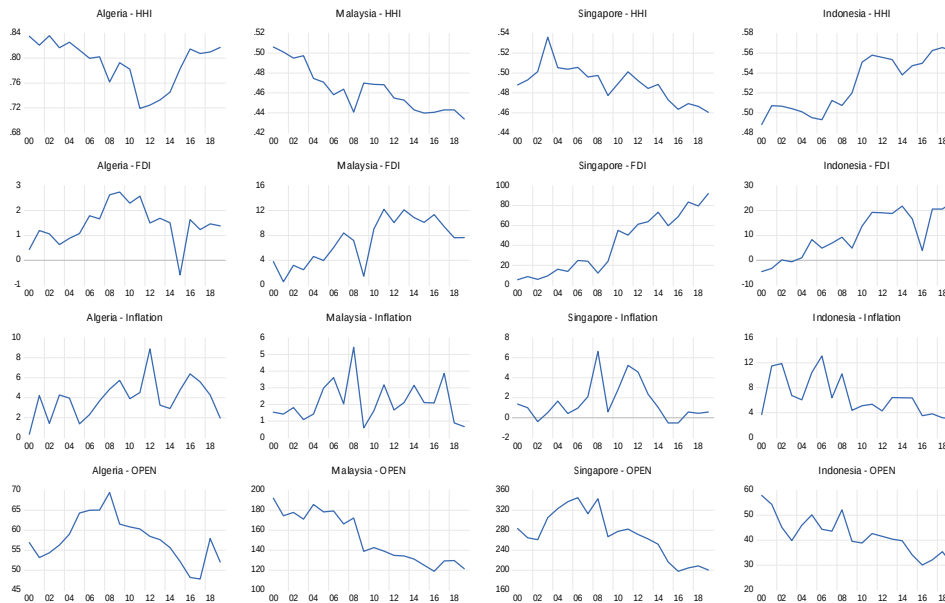
Appendix

Appendix 1. Summary statistics of the study variables

	HHI	FDI	INFLATION	OPEN
Mean	0.568459	15.09533	3.566391	130.6716
Median	0.503993	7.395000	3.158730	94.11075
Maximum	0.835892	92.08100	13.10867	345.3560
Minimum	0.433778	-4.555000	-0.532268	30.06209
Std. Dev.	0.134584	22.01170	2.900679	95.65145
Skewness	1.040282	2.048296	1.203892	0.758766
Kurtosis	2.388083	6.224736	4.481678	2.282553
Jarque-Bera	15.67729	90.60329	26.64263	9.392117
Probability	0.000394	0.000000	0.000002	0.009131
Sum	45.47672	1207.626	285.3112	10453.73
Sum Sq. Dev.	1.430909	38276.67	664.7012	722786.8
Observations	80	80	80	80

Source : Author's compilation

Appendix 2. evolution of the study variables over the period (2000-2019)



Source : Author's compilation

Appendix 3. Matrix of correlation between variables

Correlation	HHI	FDI	INFLATION	OPEN
HHI	1			
FDI	0.482996	1		
INFLATION	0.774272	0.285328	1	
OPEN	0.720333	0.682951	0.442852	1

Source : Author's compilation