The Use of Auto-Regressive Distributed Lag Method in Investigating The Impact of Interest Rate on Foreign Direct Investment in Yemen for the Period 1990-2018

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Abstract:

Foreign direct investment has seen increasing interest worldwide, especially in developing economies. However, statistics have shown that Yemen received fluctuating FDI inflows during the period under study. Against this background, this research seeks to determine the relationship and impact of interest rates on FDI flows. The study also found other determinants that greatly affected FDI inflows in Yemen for the period 1990-2018. Study data collected from the World Bank and International Monetary Fund databases. It also ensured that the time series were made balanced and interconnected, and then the Auto Regressive Distributed Lag method used in the analysis. The results showed that the interest rates and inflation rate harmed FDI flows and, therefore, could not be used for policymaking purposes. The research also discovered that GDP growth and trade openness are the main determinants of foreign direct investment in Yemen. Trade openness policies should be encouraged, and GDP growth facilitated if the economy is to achieve long-term FDI flows.

Purpose –The purpose of the paper is to discover the impact of interest rate on foreign direct investment with a combination of the exchange rate, inflation, gross domestic product, and trade openness.

Design/methodology/approach – The paper implements the Auto Regressive Distributed Lag (ARDL)-Bounds testing approach to analyze maintaining the time series properties in terms of stationarity.

Findings – The results indicate that there is a long-run equilibrium between the Foreign Direct Investment and the explanatory variables. Furthermore, the significant factors influencing, positively, FDI in Yemen are Growth domestic

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product, Exchange rate, and Trade openness. In contrast, both the Interest rate and Inflation rate have a substantial negative impact on Foreign Direct Investment.

Practical implications – Policymakers in Yemen advised reconsidering many of the general state policies, including investment policies, financial and administrative governance, and monetary policy that focuses on maintaining an adequate interest rate and reduce the rate of inflation.

Originality/value – As for the case of Yemen, this the first study empirically explores the impact of interest rate and the foreign direct investment using the Auto Regressive Distributed Lag method aiming for more reliable results.

Keywords: Foreign direct investment, GDP growth, Interest rate, Trade openness, ARDL, Yemen.

1-Introduction:

　　Foreign Direct Investment (FDI) has been prominent over the years as a critical engine that ignites economic growth in developing countries through promoting the economic growth of the host country indicators like market development, labor development, financial introduction, and technology spell-over. The host country can benefit from the inflow of foreign direct investment through-out several channels, such as the additional resources available for investment and capital formation, innovative capacity, and organizational and managerial practices.

　　Yemen that is thriving for rapid growth, has made an incredible exertion for the last three decades after the country reunion in 1990 to entice foreign investment by implementing favorable foreign investment policies.

　　Yemen issued laws on investment protection through which Investor rights shielded in many areas of investments including, easy access to many economic sectors of the economy to foreign investment, rights to own and manage companies, and the freedom to use foreign managerial, technical, and unskilled workers.

　　In Yemen, there have been efforts addressing the concerns of the investor, privatizing public enterprises, and actively promoting investment, all of which aimed at creating an excellent environment to boost investor confidence. Again, the government of Yemen has expanded the scope for FDI by reducing the number of industries closed to foreign investors. Given the growing importance of FDI in Yemen, therefore it is vital to explore the impact of interest rate on FDI flows.

　　With all rights given to FDI in Yemen, to see the impact it depicts to the economy of Yemen, which ranges from agriculture, mining, tourism, financial market, labor abundances, etc. (Figure 1).

FDI
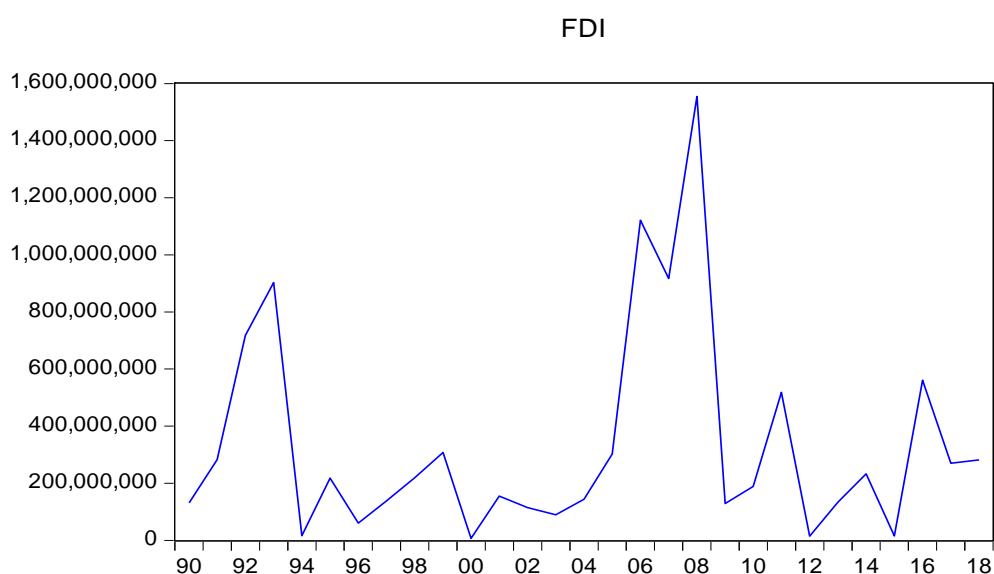
Figure (1): FDI inflow for period 1990-2018

The FDI experienced rapid growth from 1990 to 1993 then dropped in 1994 due to the 1994s war of secession led by some southern leaders. FDI continues to be low from 1994 till 2003, when it picked up gradually until it skyrocketed in 2007, then dropped sharply during 2008-2009, which can mainly attribute to the beginning of the political struggles. From 2009-2018 FDI did not experience any significant improvement due to the government collapse and the constant war until now. This paper intends to examine how interest rate influences FDI in the country to extend reliable policy recommendations to policymakers.

2-Literature Review:

Since there is no scholarly work complete, theory and practices get reevaluated and improved by continuous works of new researches. So, using new econometric methods and better data sets for different countries. As researchers continue to build their concepts on previous actions, the knowledge bank continues to flourish.

Eicher et al. 2012, proved that some determinants of FDI are not affecting the behavior of FDI, although it has established for a long time ago. The research applied in 36 OECD countries. They abstracted that these actions or features may have altered over time. Also, they concluded that among many determinants of FDI, only a few turned out to be substantial, and these determinants are from the perspective of the host country, which is: the currency of the country, trade agreement); how big market size is; taxes; capital and labor productivity rates; and economic development, which measured by the Gross Domestic Product growth.

Faroh & Shen, 2015, revealed that there are other economic variables, such as Inflation, GDP, and interest rate, which were irrelevant to be called the determinants of FDI inflows. In another study, it has proven that the exchange rates, trade openness, and inflation significantly affect FDI inflows (Kizilkaya, Ucler, & Ay, 2015).

Nyarko et al., 2011, study have exposed that free trade, investment environment, and political factors are the determinants of FDI. In contrast, other variables, such as the market size, potential growth, policy distortions have no impact on FDI inflows.

The focal concentration in this study is to clarify the impact of interest rate, among other variables, on FDI. The real interest rate is the return on investment (Singhania, 2011). Investors will channel their investments from low-interest rates to higher interest rate because it provides the inducement to foreign investors looking for higher returns. Therefore, the high-interest rate can lead to increased FDI. Furthermore, Interest rate adjusted for inflation is a good measure and an essential variable of FDI inflows (Singhania, 2011). It has known that interest rate is the cost of borrowing and returns on savings, and investors usually will look for lower interest rates or high return investments. Thus, capital will move from flat rate country to high rate country.

Gross and Trevino 1996, declared that interest rate has a positive impact on inward FDI in the host country. Though, the direction of the effect could be in reverse if the foreign investors depend on the host country capital markets for raising FDI funds.

3-Model Specification and Data:

To study the impact of interest rate (INT), gross domestic product (GDP), Inflation (INF), trade openness (TOP), and exchange rate (EXR) on foreign direct investment (FDI), the author used annual data during 1990-2018 periods. The data obtained from the World Bank: World Development Indicators for Yemen. The data transformed into a logarithm. Figure (2) shows the data.
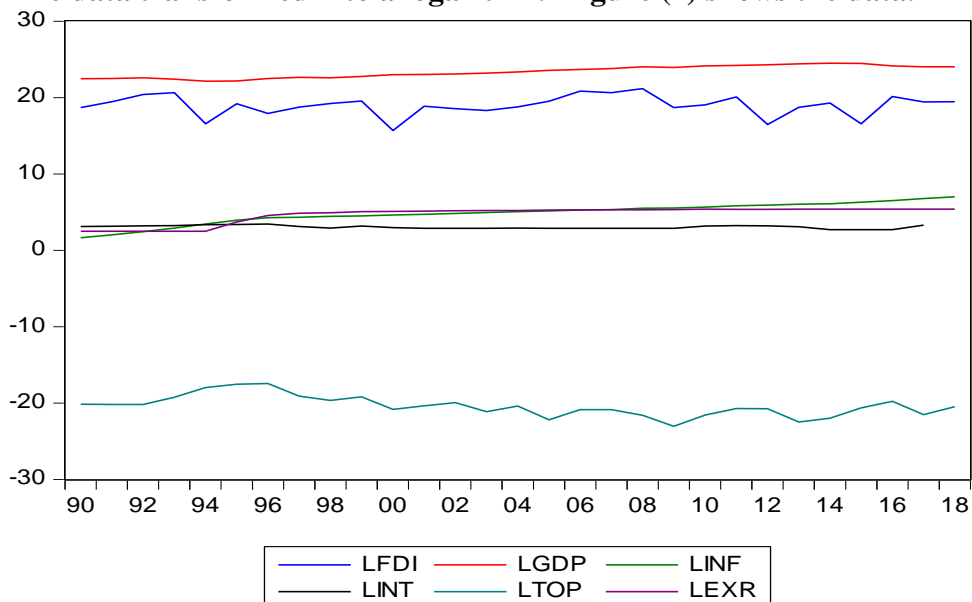

Figure (2): Data Graphical representation

Nelson and Plosser (1982) argued that almost all macroeconomic time series are not stationary at level (have unit root). So, series examined using Augmented Dickey-Fuller (ADF) and Phillips, Person tests.

Auto-Regressive Distributed Lag (ARDL)-Bounds testing approach, which was primarily introduced by Pesaran and Shin (1990), then has extended by Pesaran et al. (2001), used to investigate the presence of Cointegration between two series. Unlike Johansson Joint Cointegration Test (Johansson-Jesulis Test), ARDL does not require the integration of time series at the same order. So, it can be applied using either I(0) or I(1) series or both I(0) and I(1), but not I(2) according to Pesaran et al. (2001), where I(.) indicates the degree of integration for the series. F-test value in the boundary test compared to the values developed by Pesaran et al. (2001), the null hypothesis is: there is no long-run Cointegration between the variables, while the alternative hypothesis indicates that there is Cointegration. If the value of the F-test is higher than the upper limit, the null hypothesis can get rejected. In case it is less than the lower threshold, this indication to the absence of the Cointegration between the variables. If the value of the F-test is in between the upper and lower limits, no decision taken. The error correction term obtained from the ARDL model examined to show the speed of adjustment at which the model reverses to equilibrium after the shocks happened

The model applied as follow:

$$\Delta LFDI = \partial_0 + \sum_{i=1}^{p} b_1 \Delta LFDI_{t-i} + \sum_{i=1}^{q} b_2 \Delta LGDP_{t-i} + \sum_{i=1}^{q} b_3 \Delta LINF_{t-i}$$

$$+ \sum_{i=1}^{q} b_4 \Delta LINT_{t-i} + \sum_{i=1}^{q} b_5 \Delta LTOP_{t-i} + \sum_{i=1}^{q} b_6 \Delta LEXR_{t-i}$$

$$+ \delta_1 LFDI_{t-1} + \delta_2 GDP_{t-1} + \delta_3 LINF_{t-1} + \delta_4 LINT_{t-1}$$

$$+ \delta_5 LTOP_{t-1} + \delta_6 LEXR_{t-1} + \varepsilon_t$$

Where,

δ_1 , δ_2 , $\delta_3, \delta_4, \delta_5, \delta_6$ show the coefficients of the long-run relationship between the series;

∂_0 is the constant term

$b_1, b_2, b_3, b_4, b_5, b_6$ Show the coefficient of the short-run relationship between the series.

L: natural log
FDI: foreign direct investment
GDP: gross domestic product
INF: inflation rate
INT: real interest rate
TOP: trade openness
EXR: real exchange rate
Δ Represent the first difference operator.
Null hypothesis H_0: $\delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_4 \neq \delta_5 \neq o$
$\qquad\qquad H_1$: $\delta_2 = \delta_3 = \delta_4 = \delta_4 = \delta_5 = o$
"P" impersonates the lag length of the dependent variable (LFDI) series, and "q" impersonates the lag length of all the independent variables (LGDP, LINF, LINT, LTOP, and LEXR) series.

The error correction model has established as follow:

$$\Delta LFDI = \partial_0 + \sum_{i=1}^{p} b_1 \Delta LFDI_{t-i} + \sum_{i=1}^{q} b_2 \Delta LGDP_{t-i} + \sum_{i=1}^{q} b_3 \Delta LINF_{t-i}$$
$$+ \sum_{i=1}^{q} b_4 \Delta LINT_{t-i} + \sum_{i=1}^{q} b_5 \Delta LTOP_{t-i} + \sum_{i=1}^{q} b_6 \Delta LEXR_{t-i}$$
$$+ \varphi ECM_{t-i} + \epsilon_t$$

Where
ECM is the error correction term,
φ represents the speed of adjustment at which the model reverts to long-term equilibrium after the shocks happened in the short-run.

4-Empirical results:

ADF, P.P. tests used to investigate the stationarity of series. And null hypotheses claim that series contains a unit root (non-stationary); the result is summarized in table (1) for LINT, LINF, LEXR, LFDI, LTOP, and LGDP, respectively.

Table (1). ADF Test Results for LINT, LINF, LEXR, LFDI, LTOP, and LGDP.

Variables	Level/ΔLevel	ADF Statistics	Probability Values	Inference
LFDI	Level	-5.137696	0.0003	I(0)
LINT	Level	-2.306559	0.1772	I(1)
	ΔLevel	-3.729073	0.0096	
LGDP	Level	-0.833280	0.7939	I(1)
	ΔLevel	-3.508583	0.0156	
LINF	Level	-4.108717	0.0036	I(0)
LTOP	Level	-2.173177	0.2198	I(1)
	ΔLevel	-6.026476	0.0000	
LEXR	Level	-5.109276	0.0004	I(1)
	ΔLevel	-2.063379	0.2600	

The results indicate that LINT, LGDP, and LTOP are not stationary at level, but after taking the first difference, they became stationary at 5%. In contrast, LFDI, LINF, and LEXR are stationary at first order.

According to the results above, LINT, LGDP, and LTOP are integrated at the level order I(0), and LFDI, LINF, and LEXR are integrated at first order I(1). Since the variables integrated at I(0), and I(1), and none of them is I(2), then we can apply ARDL as follow:

4-1-ARDL model

Since all variables integrated at I(0) and I(1), the ARDL model used and the results reported in the table (2) bellow;

Table (2) represents the ARDL bound testing outcome while LFDI is the dependent variable, and LINT, LGDP, LINF, LTOP, and LEXR are independent variables, the selected model was: ARDL (1, 0, 0, 1, 0, 0), figure (3).

Table (2). F-Bound Test, long-run coefficient, and error correction term.

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT	-1.553972	1.859462	-0.835710	0.4137
LGDP	0.804374	1.066520	0.754205	0.4600
LINF	-0.823447	0.859442	-0.958117	0.3500
LTOP	0.007086	0.354579	0.019983	0.9843
LEXR	0.184596	0.674518	0.273670	0.7873
C	8.175720	19.91465	0.410538	0.6860
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.668076	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINT)	0.926924	1.413548	0.655743	0.5199
CointEq(-1)*	-1.127948	0.194056	-5.812479	0.0000
EC = LFDI - (0.8044*LGDP -0.8234*LINF -1.5540*LINT + 0.0071*LTOP + 0.1846*LEXR + 8.1757)				

*significant at 5%

The value of the F-test (3.668076) is firmly higher than the upper limit at 10% and 5% significance levels. The results indicate the presence of long-run Cointegration between the Foreign Direct Investment (LFDI) and interest rate (LINT)

Furthermore, the long-run coefficient of LINT is statistically insignificant (prob-value =0.4137 > 5%), and the error correction term is negative (-1.127948) and statistically significant. The error correction factor of -1.12 indicates that there is a very rapid error correction factor for the system to return to equilibrium of 112% annually, meaning it is possible to return to the long-term equilibrium (less than a year) after the short-term shocks occur.

The coefficient of ECM indicates the speed of LFDI to come back to long-run equilibrium with LINT, and the rest of the explanatory variables.

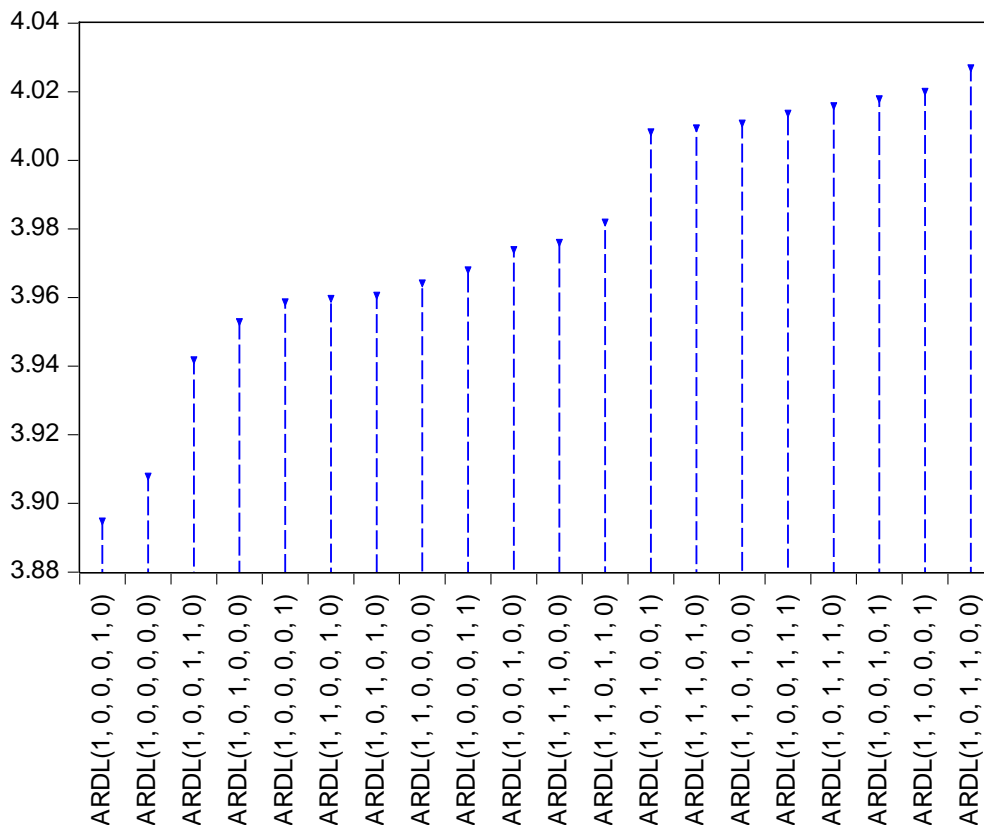Akaike Information Criteria (top 20 models)

Figure (3): ARDL (1, 0, 0, 1, 0, 0)

Figure (3) shows the results of the top 20 ARDL estimations of the   Null Hypothesis: No levels relationship, which came consistent with the F-Bounds Test reported in table 2 above.

4-2-Residual tests

To study the model quality, we examined the Serial Correlation, Heteroscedasticity, and Stability of relationship in the long-run. The results showed that there is no Serial Correlation in the model. The probability of the Breusch-Godfrey Serial Correlation L.M. Test was higher than 5%. So, we cannot accept the null hypothesis of the Breusch-Godfrey Serial Correlation L.M. Test, which indicates the presence of serial correlation. In the other furthermore, the results showed the absence of Heteroscedasticity in the model.   The probability of F in the ARCH test was higher than 5%. So, we cannot accept the null hypothesis.

Results of the Breusch-Godfrey Serial Correlation L.M. Test and ARCH test for showed in the table (3).

Table (3): Serial Correlation and Heteroscedasticity.

Breusch-Godfrey Serial Correlation L.M. Test			
F-statistic	0.896960	Prob. F(1,18)	0.3561
Obs*R-squared	1.281577	Prob. Chi-Square(1)	0.2576
Heteroscedasticity Test: ARCH			
F-statistic	1.425236	Prob. F(7,19)	0.2526
Obs*R-squared	9.296091	Prob. Chi-Square(7)	0.2321

4-3-Stability Tests

To study the stability in the long-run, the CUSUM and CUSUM of squares tests applied. The results of recursive residuals the CUSUM and CUSUM of squares tests indicate stability (Figure 4 &5).
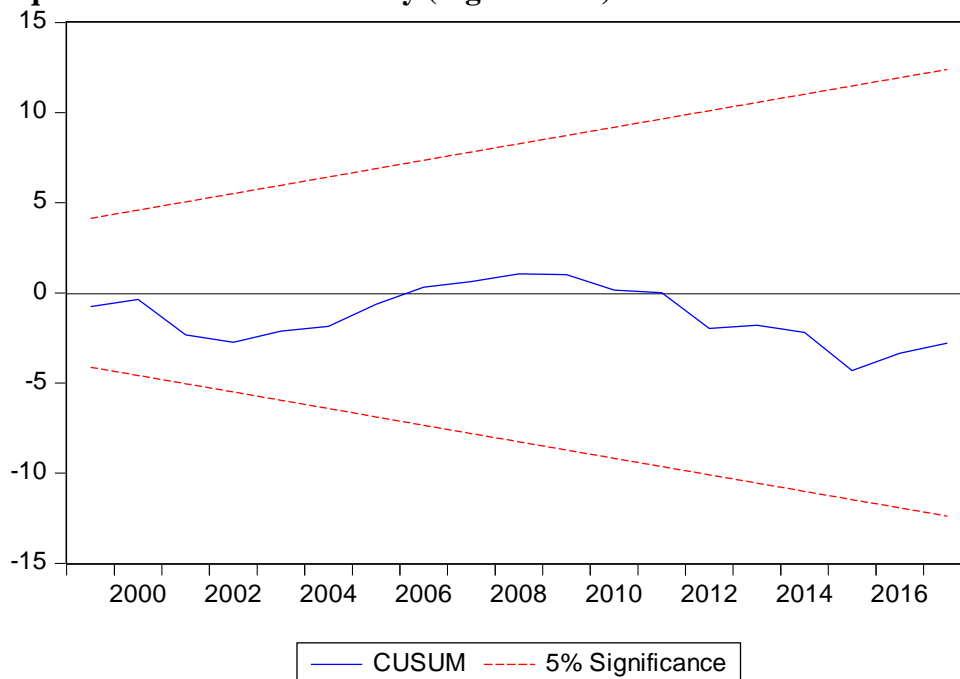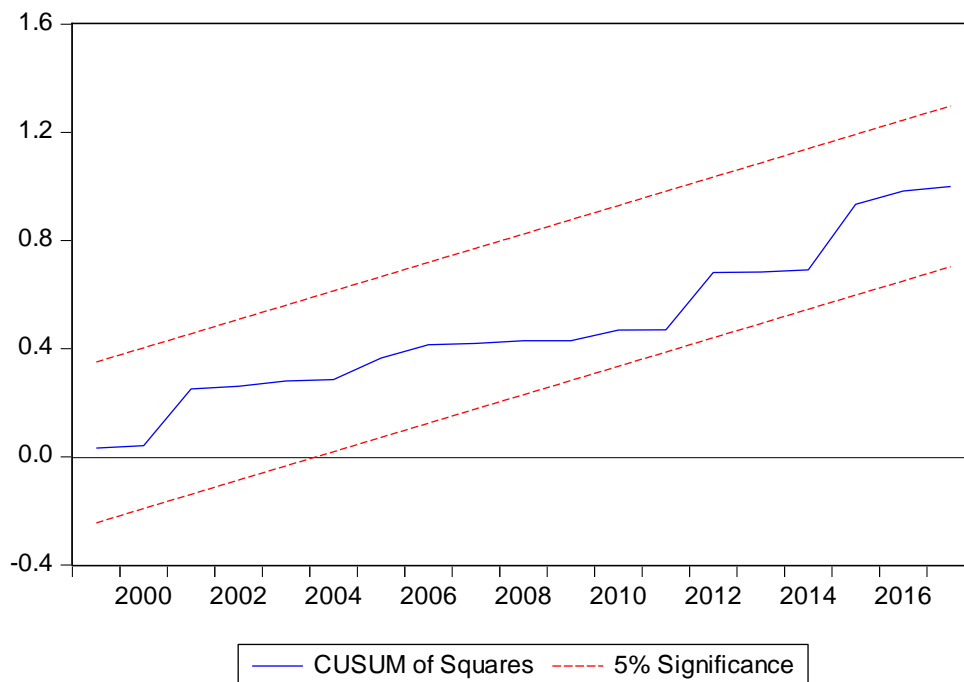

Figure (4): CUSUM Test

Figure (5) CUSUM of Squares

5- Conclusion:

This study aimed to develop an empirical framework to identify the effective interest rate has on Foreign Direct Investment introductions to Yemen by using time series data from 1990 through 2018. Based on the literature reviewed, the five essential indicators that generally influence the Foreign Direct Investment introductions; real interest rate, trade openness, Foreign Direct Investment growth rate, inflation, and exchange rate.

The empirical analysis of the data reveals that;

a) Gross Domestic Product growth has a positive effect (0.804374) on Foreign Direct Investment and is statistically insignificant. As strong Gross Domestic Product growth leads to larger market size, maintaining the momentum in Foreign Direct Investment growth is necessary for Yemen to attract Foreign Direct Investment inflows.

b) Exchange rate has a positive impact (0.184596) on Foreign Direct Investment However, it is statistically insignificant (0.275560) in the short-run model.   The evidence suggests that the study supports the exchange rate-led Foreign Direct Investment hypothesis.

c) The trade openness positively (0.007086) influences Foreign Direct Investment inflows into the economy. However, it is statistically insignificant (0.019983), and this implies that more excellent trade liberalization policies should enhance Foreign Direct Investment inflows into Yemen.

d) The rate of inflation (which used as a proxy for the indicator of economic stability) in Yemen negatively (-0.823447) impacts Foreign Direct Investment and is statistically insignificant (-0.958117), which means to increase Foreign Direct Investment inflows, a low rate of inflation is vital for Yemen.

e) The interest rate, the primary variable in this study, reveals a negative (-1.55397) impact on Foreign Direct Investment. This result showed that in the long term, a focus should be placed on reducing the interest rate to attract foreign direct investment in Yemen.

f) The error correction coefficient of -1.12 indicates that there is a very rapid error correction factor for the system to return to equilibrium of 112% per year, meaning it is possible to return to the long-term equilibrium (less than a year) after short-term shocks occur.

Finally, it can conclude that there is a long-run equilibrium between the Foreign Direct Investment and the five explanatory variables. However, Trade openness is not statistically significant in the long-run, and this demonstrates that trade openness has not been an essential factor in attracting FDI in Yemen. Furthermore, the significant factors influencing, positively, FDI in Yemen are Growth domestic product, Exchange rate, and Trade openness. In contrast, both the Interest rate and Inflation rate have a substantial negative impact on Foreign Direct Investment.

As for the recommendations of the research, for the state policymakers, the Yemeni government advised reconsidering many of the general state policies, including investment policies, financial and administrative governance, and monetary policy that focuses on maintaining a balanced interest rate and reduce the rate of inflation. All that, to improve trade openness, and improve the Investment environment. As a result, this will enhance FDI inflows to Yemen.

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استخدام طريقة التباطوء الموزع في الانحدار التلقائي للتحقق من أثر سعر الفائدة على الاستثمار الأجنبي المباشر في اليمن للفترة 1990ـ2018

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الحديدة/ الجمهورية اليمنية

مستخلص البحث:

شهد الاستثمار الأجنبي المباشر اهتماما متزايدا في جميع أنحاء العالم ، وخاصة في الاقتصادات النامية. ومع ذلك ، أظهرت الإحصاءات أن اليمن تلقت تدفقات متقلبة من الاستثمار الأجنبي المباشر خلال الفترة قيد الدراسة. على هذه الخلفية ، يسعى هذا البحث إلى تحديد العلاقة وتأثير أسعار الفائدة على تدفقات الاستثمار الأجنبي المباشر. ووجدت الدراسة أيضا محددات أخرى أثرت بشكل كبير على تدفقات الاستثمار الأجنبي المباشر في اليمن للفترة 1990-2018. بيانات الدراسة التي تم جمعها من قواعد بيانات البنك الدولي وصندوق النقد الدولي. كما تأكد من أن السلسلة الزمنية تم جعلها متوازنة ومترابطة ، ثم طريقة التأخر الموزع الانحداري التلقائي المستخدمة في التحليل. وأظهرت النتائج أن أسعار الفائدة ومعدلات التضخم أضرت بتدفقات الاستثمار الأجنبي المباشر ، وبالتالي ، لا يمكن استخدامها لأغراض صنع السياسات. كما اكتشف البحث أن نمو الناتج المحلي الإجمالي والانفتاح التجاري هما المحددان الرئيسيان للاستثمار الأجنبي المباشر في اليمن. ينبغي تشجيع سياسات الانفتاح التجاري ، وتسهيل نمو الناتج المحلي الإجمالي إذا كان للاقتصاد أن يحقق تدفقات طويلة الأجل للاستثمار الأجنبي المباشر.