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Analyze of The Effect of Exchange Rate Fluctuation on Foreign Direct Investment

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ABSTRACT

The aim of this research is to study the relationship between foreign direct investment and exchange rate fluctuation, Inflation, interest rate, GDP, economic openness and freedom index during the years 1995 – 2012. Statistical societies of research are oil producing countries including Iran, Venezuela, Ecuador, Nigeria, and Kuwait and Non-oil countries including Malaysia, Singapore, Chile, Thailand and Brazil. Data analysis has been done as panel data using Eviews software and in order to estimate of the model, panel data has been used. Required tests to check the conservation of variables, panel data, and tests required for studying of the model with fixed or random effects using the Hausman test and test required to detect multicollinearity have been preformed. According to the results, we found that foreign direct investment has a significant inverse relationship with exchange rate fluctuation and it has been also shown that there is a significant and positive relationship between other variables such as GDP, inflation, and a degree of freedom.

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INTRODUCTION

Production is one of the major economic topics. Q = F (L, K) production is the function of labor, capital. Nowadays, fundraising to produce is one of the main concerns of the countries. The fundraising can be from inside or abroad. Inflows of capital from outside the country can be a useful tool for development of most countries, especially the least developed or developing countries. Hence, the government should try to make their plans more attractive by reducing the risks arising from investments, including exchange rate fluctuations. Exchange rate plays a major role in the countries. In fact, it can be a key variable in determining the general price level of domestic goods and services. Therefore, these rate fluctuations can affect unfavorably on the economy (National production, Price level, etc) and foreign direct investment (FDI).

Because of its special importance and impact in the host country, FDI is considered among the most important economic factors. Countries, due to a lack of domestic capital sources or lack of high technical knowledge to produce and lack of competitiveness due to lack of capital advantage, are seeking to attract international capital sources outside their territorial integrity. Such countries have usually been rich in human or natural resources, but they have either little domestic capital for huge investments or capital scattering. Sometimes domestic investors due to lack of long-term horizon and uncertainty in taking over of international markets and lack of ability to export, reluctant to do this kind of long-term investments, and spend their scattered capitals in small industries as well as taking over of local and small markets. Hence, large enterprises including multinational corporations invest in industries that monopolize the market and maximize their profit.

Since FDI leads to domestic investment, fundraising, employment, exports, and production, and also provides the possibility of access to resources such as management of skilled labor, international production networks and supply brand, therefore, FDI can be considered as the engine of economic growth in the host country. In today's world FID has been one of the main symbols of globalization. Economists and government all agree on the critical importance of this type of investment. Basically, FID takes place when the country has abundant natural resources but lacking sufficient funds or technical knowledge required to extract and sell the raw materials.

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An exchange rate fluctuation (ERF) in many countries is problematic. To avoid ERF many countries stabilize the exchange value of their currency against the currencies of most important. However, it can be seen that some countries accept ERF by refusing to stabilize the exchange rate and accepting the floating exchange rate system, however, observations show that In some countries ERF will cause problems such as negative effects on economic growth (due to the rule of a floating exchange rate system).

The research hypothesis is that there is a significant inverse relationship between ERF and FDI.

1 - as the main research question states: is there a significant inverse relationship between ERF and FDI?

The approach to data collection is to use library and internet and use data and statistics of the central bank and the World Bank and IMF, Heritage, the UNCTAD STAT.

In this article, we first mentioned definition of the concepts related to FDI, exchange rate, interest rate, inflation, economic freedom and openness and GDP and draw diagrams of the variables in the period 2012-1995, and then the economic is estimated, afterwards the results and findings will be analyzed and recommendations have been discussed in the end .

FDI:

IMF introduces FDI as follows: FDI is an investment that is done by investors to gain a stable interest in a country other than their home and the purpose of this type of investment is to have an important role in the management agency.

Exchange rate:

Exchange rate is the most important economic variables that can affect on many of the basic variables. Both the demand side and the supply side will be influenced by ERF. Demand will be influenced by ERF through exports and imports, and changes in reserves, and on the other hand the supply will be influenced by ERF through imported intermediate goods. Many economic researchers have focused on the changes in exchange rate due to its major role in the price of a set of economic variables, and its interaction. In addition, the real exchange rate as a measure of equity value of the national currency against the currencies of other countries and reflect a country's economic situation compared with other countries. In this research the effect of ERF on FDI are examined and to explicit the model, affective auxiliary variables such as GDP, degree of economic openness, interest rate, inflation, economic freedom index is added to the model.

Exchange rate is divided into two types: official and unofficial. The official exchange rate is set by the government according to the specific conditions governing the economy and it will be announced and supported by the central bank under a system of fixed exchange. In contrast, there is a parallel market. The unofficial market is known as open or black market that is based on supply and demand, a surplus on the official market and the rate is usually higher than the official one.

Interest rate:

Interest rate plays a key role as a monetary factor in economic fundamentals. The interest rate can be defined in various ways. From the macro perspective and economic enterprises: Interest rate is the price paid to get credit or money, and some called it costs money to rent, then the interest rate is cost of holding money. Interest rate is a price that is paid to use a certain amount of value in a period of time, French economist A.R.J.Turgot believes. Keynesian economists believe that Interest is a premium for regardless of the liquidity or delaying purchasing power and the interest rate is determined in the money market. Interest rate is known as compensation for the cost of inflation in the economy. It also shows if return on investment in a specific project is appropriate or not? Interest rate is the most important factor affecting the currency exchanges. In general, higher interest rates will boost the value for money of a country. Also, with holding constant other factors, lower interest rates in a country undermine the value for money of the country However, investors should focus on the real interest rate than nominal interest rate. Simply stated nominal interest rate, in contrast to the real interest rate, brings inflation within its account.

Inflation:

One of the main goals of any economic system is to achieve low and stable inflation and sustained economic growth. Achieving this goal will provide improved living standards. In terms of economics: inflation refers to increase the general price level of goods and services in a given time period (one year). Inflation generally is considered as a disproportionate rise in the general price level.

Index of economic freedom:

The index of economic freedom is an annual index and ranking created by The Heritage foundation and the Wall Street journal in 1995 to measure the degree of economic freedom in the world's nations. The creators of the index took an approach similar to Adam Smith's in the wealth of nations, that "basic institutions that protect

the liberty of individuals to pursue their own economic interests result in greater prosperity for the larger society"

Index of Economic Freedom, measured on a scale of 0 to 100, this number represents economic freedom, with 0 as the lowest score, 100 as the highest. The numeric value is determined by grades in ten categories, which are averaged together for the overall score.

Economic liberalization, which is part of the structural adjustment policies, includes a series of measures to reduce government intervention in financial markets, goods and services, labor and foreign sectors, and ultimately leaving it to the market mechanism.

The most important of these are:

- Reduction in government intervention in financial markets
- Reduce price controls and transfer pricing to market forces of supply and demand
- Elimination of subsidies and make adjustment for price subsidy
- Biased towards floating currency system
- Liberalization of foreign trade and make adjustment for trade tariffs and quantitative restrictions
- Liberalization of interest rates paid on bank deposits

In overall, economic freedom is nothing but the emphasis on individual or private ownership, and specifies an area where the economy is based on market acts, so people own their assets in use, exchange or maintenance, and no obstacle such as government should limit them.

Degree of economic openness:

The pure theory of international trade suggests that complete global free trade and economic openness lead to increased production and income levels of trade and financial relations. The free trade also enables greater consumption and production in every country. Accordingly, believers in free trade, including Edwards and Barro et al, are opposed to the adoption of any trade policy that leads inevitably impact on foreign trade, because they believe that in this case (the complete free trade) the comparative advantage of countries in various commodities is normally specified, and based on this the trade takes place between them, and this will be the most lucrative way. In this case, the liberalization - by reducing restrictions and partial removal of tariffs - minimizes trade barriers, and provides the context of economic integration, and causes economy to act more dynamic in relation to other countries. Along with the increasing economic exchanges, the country would be benefited from technology and innovation in other countries, and with increasing efficiency, increase motivation and stimulate the investment which causes financial development. Economic openness index, which is estimated and reported by the Fraser Institute, involving 68 institutions in 68 countries, is a suitable tool for the investigation of the concentration, exclusivity and openness of a country for economic activity. The root of this index originated from the index of economic freedom that was presented for the first time in the conferences of Michael Varker in the Institute of Milton Friedman, in the Nobel foundation, in the years 1994-1986. The criteria used to determine how policies and institutions relate with economic freedom in countries had been examined in the conference.

Key elements of economic freedom are:

1. Freedom of individual choice
2. Regulated exchange through markets
3. Freedom of entry into markets and exit from markets
4. Protect citizens against encroachment by others

Gross Domestic Product (GDP):

GDP: is the total market value of goods and services at market prices within a country during a given period (usually 1 year). GDP is one of the ways for measuring a country's national income and product. Another definition of GDP is the total value added at all stages of production of all goods and services produced in a country during a particular period of time, and its value is expressed in a particular currency.

Way of measuring GDP is:

GDP = consumption + gross investment + government spending + (exports - imports)

(Exports - Imports = Net Exports)

GDP = C + I + G +NX

The word "Gross" means not to take account of the depreciation of capital in the equation. Determination of GDP compared to other countries is done in two ways: First, GDP is calculated based on the currency exchange rate of countries in the global market to a global currency like the dollar. Second, calculation based on the purchasing power of the local currency in the local market compared to a global currency like the dollar. Depending on the method of calculating the GDP of each country, position in the table rank countries may drastically change. In general it can be said that the first way provides a better picture of the purchasing power in the global market, and the second way provides a better picture of the domestic purchasing power. On this

basis, GDP growth makes a country's per capita income and living standards go up. Great merit of using per capita income for measuring a country's standard of living is its continuous and extensive measurement worldwide among different countries and also the fact that all countries use a unique technique to measure. The model assumes a positive relationship between FDI and GDP.

Research method:

Here the model that is used to evaluate the ERF on FDI flow has been considered as follows:

lFDI = F (lERER + lR + lP + lFE + lIFE + lGDP) (1)

In this study the research variables are as follows: for variable dependent on FDI = lfdi, and independent variables: official exchange rate = lerer, Interest rate on deposit = lr, inflation = lp, degree of economic freedom = ldf, economy openness = life, and GDP = lgdp.

The practical test:

Combined Data is the combination of sectional and time data. In case of time series data we observe the value of one or more variables over a period of time. In case of sectional data, the values of one or more variables for a couple of typical units or cases are collected at the same time.

Conservation test:

Conservation test is mainly done to prevent spurious regressions. To avoid spurious regression variables must be conservative otherwise, the difference of variables, that are usually conservative, should be used.

Why conservation test is necessary?

Conservation definition: conservative data are the ones with constant mean, constant variance and covariance for any given interval. Conservation or non-conservation of a time series can have a serious impact on its behavior and properties.

Test on conservation of variables

Not to suffer from the spurious regression in the above estimates, we must first ensure if the variable are conservative. If the variables are conservative, the problem of spurious regression would not be in the above estimates. For this purpose, we first use panel unit root test to investigate if variables are conservative or non-conservative.

Table 1: the conservation test on level

Variable	Level	Probability
LFDI	-2.88712	0.0019
LERER	-3.75330	0.0001
LGDP	4.18255	1.000
LR	-3.92794	0.0000
LP	-6.70524	0.0000
LIFE	-1.61738	0.0529
LDF	-3.04645	0.0012

Source: Calculations of the research

The results show that all data, except lgdp which has been constant with a difference, are conservative.

Table 2: the results of the unit root test, LLC

Variable	Level	Probability
D(LGDP)	-7.01934	0.0000

Source: Calculations of the research

The constant coefficients model:

this model is related to both the slope and the intercept. If there is no significant relationship at unit and time, ordinary least squares model is used. In this model, time effects and units are not considered. Most of the time such a model, is called the combined regression.

Fixed effects model (least squares with imaginary variables): take sectional data with the same slope into consideration. At the same time, it considers different intercepts for sectional observations.

Should fixed effects or combined regression model be used for combined data?

To answer to the above question we use F test with chi square test, so that R^2 must be obtained by both methods and put in the following equation:

$$F = \frac{(R^2_{FE} - R^2_{POOL})/(n-1)}{(1-R^2_{FE})/(nt-n-k)} \quad (9\text{-}3)$$

Where: R^2_{FE} : determining coefficient for regression model with fixed effects

R^2_{POOL} : determining coefficient for combined regression model.

n: number of sectional observations

t: Number of years of research (research period)

k: number of explanatory variables (estimators)

In fact, the mentioned statistic is compared with F-table and the following hypothesis is tested.

H0: there is no significant difference for determining coefficient of two methods.

H1: there is significant difference for determining coefficient of two methods.

And finally:

Random intercept model for sectional observations (random effects model): one way of applying regression is to assume the intercept randomly. According to what previously mentioned, after the generalized F -test, choosing between fixed effects and random effects models, it turns. Hausman specification test enables us to choose between fixed effects and random effects model using correlation coefficient test for specified variables, i.e. if there is any correlation between random effects and explanatory variables, we use the random effects model, and otherwise we use the fixed effects model. The test statistic is as follows:

$$\Psi^2 = (b-B)'.\left[\left(VAR\ (b)\ -\ VAR\ (B)\right)^{-1}\right].(b-B) \qquad (10\text{-}3)$$

b: estimated coefficients of the fixed effects model

B: estimated coefficients of the random effects model

Degrees of freedom of Hausman statistic equals to the number of explanatory variables. The above calculated chi square is compared to the chi square of the table, and if it is significant, the fixed effects model would be used.

{H_0 = Pooled model

{ H_1 = Panel model

Table 3: F- Lymr test

Applied statistic	Statistic amount	Probability
F-statistic	62.835700	0.0000
Chi square- statistic	248.04493	0.0000

Source: calculations of the research

Hausman test:

Table 4: Hausman test

Applied statistic	Statistic amount	Probability
Chi square- statistic	174.83874	0.0000

Source: calculations of the research

The results of Hausman test indicate that the estimated model by means of panel pattern with fixed effects has more efficient coefficients than panel pattern with random effects, and thus the fixed effects model is selected.

Variance anisotropy Test:

{H0 = Variance isotropy

{H1 = Variance anisotropy

Table 5: test on variance isotropy

White's test for Ho: homoskedasticity against Ha: unrestricted heteroskedasticity
chi2(27) = 85. 07 Prob > chi2 = 0.0000

Source: calculations of the research

The result of Stata software implies that the null hypothesis of equal variances at the level 5% has been rejected and variance anisotropy occurs.

Elimination of variance anisotropy:

After identifying variance anisotropy in the model using likelihood ratio (LR) test as well as the method of weighting White, we have estimated the model. After weighting, White test showed that the variance anisotropy has been removed as shown in the table (6).

Table 6: elimination of variance anisotropy

Weighted Statistics

R-squared	0.875013	Mean dependent var	29.53388
Adjusted R-squared	0.859863	S.D. dependent var	11.67463
S.E. of regression	0.730283	Sum squared resid	70.39733
F-statistic	57.75687	Durbin-Watson stat	1.421649
Prob(F-statistic)	0.000000		

Source: calculations of the research

Autocorrelation test:

Autocorrelation occurs when the errors are related to each other. In other words, the error of an observation is affected by the error of another observation. In case of sectional data, it is often expected that independent variable of an observation only affect on the dependent variable of the same observation and has no relation with other observations. There are some reasons for autocorrelation test as below:

a) In some cases, an important variable is omitted, so that the autocorrelation will occur.

b) In some cases, data conversion into different components makes the autocorrelation.

c) In cases where the form of the model is wrong, and we suffer from explicit bias in the model form, autocorrelation arises.

One of the autocorrelation detecting methods is to use Durbin-Watson statistic which is calculated according to the following formula:

$$d = \frac{\sum_{t=2}^{n}(e_t - e_{t-1})^2}{\sum_{t=1}^{n}(e_t)^2} \qquad (15\text{-}3)$$

e_t : The error at time t,

e_{t-1}: The error at time t-1,

After calculating Durbin-Watson statistic, comparison with relevant table which is based on the number of observations (n) and the number of independent variables (k) in the form of the lower limit (d_l) and the upper limit (d_u) is made and the following conditions will decide:

if	$0 < D.W < d_l$	There is positive autocorrelation
if	$d_l < D.W < d_h$	There is uncertainty about the positive autocorrelation
if	$d_h < D.W < 4 - d_h$	There is not autocorrelation
if	$4 - d_h < D.W < 4 - d_l$	There is uncertainty about the negative autocorrelation
if	$4 - d_l < D.W < 0$	There is negative autocorrelation

It is obvious that if Durbin-Watson statistic is close to two, it would indicate the absence of autocorrelation in the model. Another method of detecting autocorrelation is LM test with Eviews software, so that in order to perform the test, we specify the order of autocorrelation which is by default two. Then, based on the probability of F statistic and the calculated P-valu test (at the five percent level), there is no autocorrelation if test is more than 0.05.

Table 7: autocorrelation test

R-squared	F-statistic	Durbin-watson stat	Prob(F-statistic)
0.0875013	57.75687	1.421649	0.0000

Source: calculations of the research

The model is auto correlated and in order to eliminate it, we apply an explanatory pause.

Table 8: the elimination of autocorrelation

R-squared	F-statistic	Durbin-watson stat	Prob(F-statistic)
0.913176	69.91104	2.010548	0.0000

Source: calculations of the research

Estimate of the final model and the discussion and analysis of results:

The final obtained model is as follows in Table (9).

Table 9: estimate of the model after removal of anisotropy and autocorrelation

Probability		t-statistic	Estimated coefficients	Variables
-		-	-	LFDI
0.0000		24.67174	21.06985	C
0.0014		-3.275358	-0.626876	LERER
0.4353		0.782962	0.099343	LR
0.0945		1.686543	0.119280	LP
0.5797		0.555496	0.045390	LIFE
0.0050		-2.861458	-1.481931	LDF
0.0376		2.103853	2.601962	D(LGDP)
0.0000		5.628211	0.993602	LT
0.0102		2.612396	0.225017	AR(1)
DW=2.010548	R2=0.913176	0.865252=R-2	F=69.91104	(prob= 0.0000)

Source: calculations of the research

According to the results indicated in Table (9), explanatory variables LR (0.4353) and LIFE (0.5797) which have specified probability, have not a significant effect in the model and we shall remove them from the model. The final model is obtained as follows in Table (10).

Table 10: the final estimation of the model after omitting anisotropy and autocorrelation and insignificant variables in the model

Probability		t-statistic	Estimated coefficients	Variables
-		-	-	LFDI
0.0000		24.67174	21.06985	C
0.0014		-3.275358	-0.626876	LERER
0.0945		1.686543	0.119280	LP
0.0050		-2.861458	-1.481931	LDF
0.0376		2.103853	2.601962	D(LGDP)
0.0000		5.628211	0.993602	LT
0.0102		2.612396	0.225017	AR(1)
DW=2.010548	0.913176=R2	0.865252=R-2	F = 69.91104	Prob = 0.0000

Source: Calculations of the research

Results:

The results of the relationship between FDI and effective variables in Iran during 2012-1995 using panel data can be analyzed as follows:

The R2 statistic indicates that 0.91 of Changes in the variable FDI is explained by the variables included in the model. Also, according to obtained amount of F statistic and the associated probability, the significance of the model is confirmed.

According to the results in Table (10), It can be seen that in the observed countries the log of FDI increases by 2.60 percent with an increase of one percent in GDP growth rate (from 3% to 4%), and FDI increases by 1.118% with increasing of one percent in domestic inflation (with regard to the selected countries, the obtained pattern is not compatible with economic theories), and FDI is reduced by 0.62% $ with increasing one percent in the official exchange rate. In the estimation of the coefficient related to the degree of economic openness it was also shown that FDI will decrease by 1.48 percent with increasing of one percent in the degree of economic openness of the selected countries (with regard to the selected countries, the obtained pattern is not compatible with economic theories).

The average intercept for oil-exporting countries is negative, while is positive for non-oil countries. Therefore, the attraction of foreign investment in oil producing countries is more than non-oil countries as shown in Table 11.

Table 11: estimate of intercept for the selected countries

Intercept	Country
2.022021	Iran
0.178121	Nigeria
1.552224	Ecuador
-3.422382	Venezuela
-6.254633	Kuwait
-0.027278	Malaysia
2.576667	Singapore
2.092977	Thailand
-1.631416	Brazil
2.307108	Chile

Source: Calculations of the research

Conclusion:

In this section we present the results of testing hypotheses. The present study attempted to test the following hypothesis.

1- There is a significant inverse relationship between ERF and DFI.

Research hypotheses based on panel data of ten observed oil and non-oil countries panel data approach were analyzed during 1995-2012. Accordingly, the first hypothesis that states a significant relationship between ERF and FDI is confirmed.

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