# The Estimation of FDI capacity in Iran

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**ABSTRACT:** According to the role of FDI in technology transfer and attraction of foreign capital to developing countries, these countries have been considered it in their plans. Planning to take advantage of this process requires to understand and estimate the capacity of FDI to these countries. Accordingly, in this study we estimate the capacity of foreign direct investment. Therefore, using a panel data model based on data by 11 countries and using the Human Development Index for identifing the oil countries which are closer to Iran, we recognize the factors affecting foreign direct investment since 1996 to 2011. Then we deal with the determination of optimal model for estimating the capacity of foreign direct investment. Based on the results obtained, we reject the assumption that says the potential capacity of FDI is more than its actual quantity.
*Keywords:* foreign direct investment, capacity of direct foreign investment, panel data

## Introduction

Lack of internal financial resources in countries, especially in developing countries, leads the governments to pay attention to foreign financial resources. Therefore, in recent decades, the trend of country's utilization of foreign investment in order to achieve the financial support of projects has increased. On the other hand, the investment has its own criteria, and is not limited to many restrictions such as national borders and economic systems.

In this article, it is focused on a special part of foreign capitals, called the foreign direct investment. Formerly published articles have only discussed the conditions impacting on foreign direct investment. Therefore, the potential and capacity of foreign direct investment are not included.

Recognition of liability and the ability of countries in attracting foreign direct investment makes the authorities and planners of the country plan for a better attraction of foreign investors. In this essay, after considering the factors impacting on attraction of foreign direct investment, and finding an optimum financial model, we estimate the capacity of foreign direct investment in Iran.

## Review Of Literatures

Bajio and Simon (1994) in an article entitled "The Foreign Investment Model for Multinational Companies" introduced a function for foreign direct investment offer in the host country, and concluded that foreign direct investment offer is proportional to GDP, and has an inverse relationship with inflation variables, exchange rate, interest rate, wage index, and trade restriction level.

Erdal and Tatoglu (2002) in a paper titled "Locational Determinants of Foreign Direct Investment in an Emerging Market Economy", by giving an appropriate model, considered the locational effective factors on attraction of foreign direct investment into Turkey since 1980 to 1998, and concluded that the size of the domestic market, infrastructure, market attractiveness of the host country, and economic openness have a positive effect, instability of exchange rate and political instability have a negative effect on attraction of foreign direct investment.

Bajio and Simon (1994) in their article entitled "An Econometric Analysis of Foreign Direct Investment", by representing the foreign investment for multinational companies' model, using the co-integrating method, and the data of 1964-1989 interval in Spain, introduced a model for foreign direct investment offer in the host country, and concluded that the foreign direct investment offer is proportional to

the GDP, and is inversely related to inflation variables, exchange rate, interest rate, wage index, and level of trade restriction.

Baptist (2002) in his paper titled "The Bad government and the low foreign direct investment in Haiti" used the OLS model to consider the influence of bad governing on the foreign direct investment in Haiti. In this way, he applied the 1970-2002 data. The results of the model estimation show that the bad governance, bad governance indicator variables, the shock of the 1991 war, and indicator of financial instability have a negative, and GDP variables, and economic openness, and a type of natural risk have a positive influence on attraction of foreign direct investment.

## The Research Method And Modeling
### The research method
The present investigation is a developed and empirical work. The data are gathered from the information and statistics of the Unctad website, the World Bank, and Heritage Foundation. In this article, the Eviews-7, Minitab-16, Statal-12, and Spss-17 softwares are used.

### The Selected Countries, Reasons to Choose Them, and the Research Time Interval
The selected countries in this study include 11 countries namely: Algeria, Bolivia, Ecuador, Egypt, Iran, Kazakhstan, Oman, Russia, Saudi Arabia, and Syria. This selection is based on the following reasons:
All these countries lie among the countries with high and middle Human Development Index (HDI), based on the World Bank classification in 2011.
All of them are oil producers, and have an oil-reliant economy.
Their information are available and achievable.
The chosen time interval covers a 16-year era including years 1996-2011.

### Analysis Tools and Data Collection Method
This investigation is an empirical and developed study. The library data are gathered from the information and statistics of the World Bank, and Heritage Foundation and Unctad Website. Data analysis and hypotheses testing is implemented by Eviews 7, Minitab 16, Statal 12, and Spss 17 softwares.

### The Applied Model
The model used in this article is as follows:
$$FDI = f(LGDP, REER, G, LGNIPC, TDF, IVMF)$$
The variables are as follows:
FDI is the foreign direct investment inflow, and is assumed to be a dependent variable in the model.
L is logarithm of the gross domestic product, and is a substitution for the size of the market.
REER indicates the real effective exchange rate, and an index of compatibility variation of countries or currency areas. Also, the increase in the rate of real effective exchange indicates the enhancement of the value of the national currency or currency strengthening.
G stands for the percentage of gross domestic product growth per capita, and is taken into account to control the market growth and its potential ability in the model.
LGNIPC is the logarithm of the income per capita. The applied method is the equality of purchasing power.

### TDF introduces the trade freedom index.
### IVMF represents the investment freedom index.
The statistics related to foreign direct investment inflow is received from Unctad website; The statistics of GDP variables, real effective exchange rate, and income per capita are extracted from the World Bank website; The statistics of trade and investment freedom variables are copied from the Heritage Foundation website.

## Econometric Methods of this study

Firstly, to avoid the spurious regression problem, the maintenance of variables was inspected, and if a variable was indurable, it was transformed into a durable variable by using an appropriate transform. Then, the model was fitted to the ordinary least square methods and the panel data separately. The Chow test was used to choose between the combined data model and the constant effects model, and the Hausman test to choose between the constant effect model and random effects. After, solving the self-correlation and variance dissimilarity in the final model, normality of the remaining was considered.

## Estimation Of The Model
## Durability of the Variables

Logarithm of GDP, logarithm of GDP per capital, the real effective exchange rate, the trade freedom, and percentage of annual growth of gross domestic product are durable in 5-percent level, and the investment freedom index is durable in 10-percent level.

To make the dependent variable (inflow and foreign direct investment) durable, we used the Johnson-4 transform in Minitab software. The resulting transform function is

$$FDIN = -1.60937 + 0.589002 * A \sinh(\frac{(FDI - 10.2664)}{139.986})$$

## Determining the Fitting Method for Data Model
## Chow or F-Limer test

Due to the obtained p-value in Chow testing (0.00), the zero assumption related to the equality of all the special influences of countries in the model are rejected, and so the panel data method must be applied.

## Hausman test.

Table 1. Hausman test

| Zero assumption ($H_0$) | Statistics $\chi^2$ | p-value | Test result |
|---|---|---|---|
| The random effect model is appropriate | 88.68 | 0.00 | The zero assumption is rejected |

Source: research computations

According to the upper result, the zero assumption is rejected, meaning that the constant effect model must be used.

## Representation of model estimation in constant effects method

$$FDIN = \beta_0 + \beta_1 LGDP + \beta_2 REER + \beta_3 G + \beta_4 LGNIPC + \beta_5 TDF + \beta_6 IVMF$$

After fitting the model to the constant effects method, it was observed that the value of probability of meaningfulness of the F-statistics equals 0.00. This value is less than 0.05, so the zero assumption saying the multiplier are zero in 95-percent certainty level is rejected.

## Testing the existence of self-correlation in the model

To detect the existence of self-correlation in the model, the AR(1) variables are added to the model variables, and the model is fitted again with the constant effect model. Since the value of T-statistics, the multiplier of variable AR(1), is less than 0.05 (0.00), so the zero assumption based on vanishing the multiplier of AR(1) is rejected, and the model includes a self-correlation.

## Results of the adjusted generator test to detect the non- homogeneity of the variance

In this study, to consider the existence of the variance non- homogeneity problem, the adjusted generator test is used. The calculated p-value is less than 0.05. There is the variance non- homogeneity problem in the model.

## Estimation of the feasible generalized least square regression model

To remove the variance non- homogeneity and auto-correlation in the model, we used the estimation of the generalized least squares in Stata software.

$$FDIN = \beta_0 + \beta_1 LGDP + \beta_2 REER + \beta_3 G + \beta_4 LGNIPC + \beta_5 TDF + \beta_6 IVMF$$

Table 2. Estimation Results

| p-value | T-statistics | Index | Explanation |
|---|---|---|---|
| 0/000 | -7/96 | -18/347 | $\beta_0$ |
| 0/000 | 3/9 | 0/4131 | LGDP |
| 0/002 | 3/11 | 0/0102 | REER |
| 0/022 | 2/3 | 0/02027 | G |
| 0/000 | 5/29 | 0/07341 | LGNIPC |
| 0/032 | 2/15 | 0/01049 | TDF |
| 0/001 | 3/47 | 0/01038 | IVMF |
| | p-value | wald $\chi^2$(6) statistics | |
| | 0/0000 | 154/03 | |

Source: research computations

As it is inferred from the table IV-B-6, the value of meaningfulness of Wald $\chi^2$ (6) statistics is 0.0000. This value is less than 5 percent, so the zero assumption based on vanishing the multipliers in level 95 of certainty is rejected meaning that a meaningful model is available in 95 percent level of certainty. All the variables are meaningful in 95 percent level.

FDIN = -18,347 + 0,4135 LGDP + 0/0,1021 REER + 0,02237 G + 0,7341 LGNIPC + 0/,01049 TDF + 0,01038 IVMF

## Normality test of the residuals
Since, the value of probability in Jacobera test obtained bigger than 0.05 (0.177), the zero assumption based on the normality of the residuals values is accepted.

## Testing the hypothesis
The main part of any study is the inspection and testing the assumptions of the investigation. The zero and one assumptions in this research are as follows:
$H_0$: The attraction capacity of foreign direct investment in Iran, is not more than the attracted investment.
$H_1$: The attraction capacity of foreign direct investment in Iran, is more than the attracted investment.
In this way, firstly the fitted values of the dependent variable is calculated in the optimized model, and then by determining the inverse transform of Johnson test, the fitted values of the dependent variable are obtained.
Two variables namely the foreign direct investment inflows (FDI), and the fitted values of the foreign direct investment inflows ($\widehat{FDI}$) of Iran, are the variables considered in the hypothesis test.

Table 3. Potential FDI of Iran

| YEAR | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|
| FDI | 20/5 | 43 | 37/6 | 15/6 | 193/6 | 1084/5 | 3657/1 | 2697/9 |
| FDIhat | 157/61 | 202/89 | 278/1 | 196/59 | 229/85 | 381/46 | 571/84 | 1133/17 |
| YEAR | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| FDI | 2863/4 | 3135/6 | 1646/6 | 2005/1 | 1909/2 | 3047/6 | 3647/5 | 4150 |
| FDIhat | 1552/2 | 2199/2 | 1504/88 | 2697/16 | 3993/05 | 5839/18 | | |

Source: research computations

Using the T-test with independent samples, the averages of the two samples since 1996 to 2009 were compared. Normality of the two variables is the required conditions of this test. First, using the Bera-Jarque test, normality of the two variables was inspected. The two variables are normal in 95 percent of certainty.

Because of the value of T-statistics, the zero assumption based on the equality of the averages of two variables FDI and $\bar{FDI}$ is accepted. Therefore, the claimed hypothesis telling that the capacity of foreign direct investment in Iran is not more than the real invested value is not accepted.

## Conclusion

Regarding the presented optimum fitting model, and the positive impact of the model variables on attraction of foreign direct investment, the following suggestions are issued:

Submission of factories and workshops to people in order to enhance the gross domestic product.

Reduction of tariffs and limitations of imports and exports to rise the trade freedom.

Investment of foreign investors to rise the investment freedom.

Increasing the capital or work forces, increasing the efficiency of the production indexes, and applying the probably empty capacities in finance in order to enhance the economic growth rate.

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