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Investigation the Effect of Foreign Direct Investment on Iran's Export

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Abstract: The object of this study is to investigate the function and impressing the mechanism of technology spillovers from FDI and import goods on Iran's export during1961-2009. The estimation results show that foreign direct investment, foreign R&D stocks, human capital, total factor productivity, have a positive and significant effect on Iran's export and non-oil export. Also the estimation results indicate that coefficient of domestic R&D stocks is insignificant. Based on results foreign direct investment and international trade could have important role in order to increase the competitiveness ability. Without a doubt, our success in reaching development ideals, especially abilities and technical innovation and industrial capacities will be tested in international competition.

JEL Classification: F10 · O30 · C22
Key words: Export · Foreign Direct Investment · R&D Spillovers · Human Capital · Total Factor Productivity

INTRODUCTION

By immediate looking at present world conditions, we can categories countries in two parts: Developed and developing countries. Generally, we consider developed country as an industrial country has a priority technology in comparison with developing countries [1]. Therefore the important point is that technological gap between developed and developing countries caused decline of competitiveness ability and in consequence, decreasing the share of world international trade in developing economies in comparison with developed economies [2].

In other words, most of the export countries in the past were depended on the natural comparative advantages but with technology advancement, main burden of exports in the developed and even developing countries is on the shoulder of acquired comparative Advantages. This matter increase competitiveness ability in developed countries over developing countries. Therefore, we can state because of deep technological gap, the share of developing countries such as Iran in the world exports are declined significantly and instead of main burden of world exports in developed countries are depend on acquired comparative advantage [3]. In developing countries such as Iran sake for increase competitiveness ability at domestic economics and international economics level, should be fill deep technological gap with different ways such as extension the domestic Research and Development (R&D) activities and educational activities at high levels, attracting the foreign R&D activities (via import good and attracting the foreign direct investment), because the technology advancement makes from R&D activities. While developing economies such as Iran spend teenier share of its GNP for R&D activities, so can't expected from this economies to have technology advancement. Also, in order to fill deep technology gap with increase the competitiveness ability beside research activities and inside development, we have to import technology from foreign direct investment (for knowledge transfer, capital, technology, management and financial resources from developed countries to developing countries) and import of goods [4-6].

One of the export determinative is total factor productivity growth which has a positive relationship with export. Because, firms could increase total factor productivity growth therefore increase competitiveness ability and export development through invest in R and D, educational activities and selecting business partners which have high R&D stocks [7].

By reason of TFP growth leads to production costs reduction and increase competition power of producers in markets, there is positive relationship between export and TFP. Because, the TFP growth leads to decrease

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prices (such as factor products price) and it is himself leads to decrease of average cost of goods and services production in market and increase benefits output in firms. The consequence of this evolutionary has a strong influence on demands; importantly leads to increase competition ability of domestic products in foreign markets. This matter leads to extent production and use of maximal production capacities. As a result, content of new investment developed and so export increases [8].

Furthermore, technology and technical knowledge plays important role in goods production. The labor force that has higher technical knowledge and education be able to change a production circle and bring the technologic evolution, this leads to generation of export production capacity and competition ability in international markets. So, we can say human capital is one of the important factors in exports [9].

Therefore, the purpose of this research is to study role and effectiveness comportment of economical knowledge (domestic R&D spillovers, foreign R&D spillovers (spillover via import goods and foreign direct investment), human capital and TFP) on Iran economic export, suggest policy recommendation to policy makers for attraction FDI in order to fill technology gap and increase competitiveness ability for export development.

Review of Empirical Studies: Extension of technology gap between developed countries and developing countries leads to decrease of competitive ability and so share of developing countries world trade in comparison with economies knowledge in developed countries.

Nessabian *et al.* (2009) identify the significant factors in increasing or at least retaining the share of Iran in the world carpet market during the time period of 1980-2005 relying systemically upon "Panel Data" using Seemingly Unrelated Regression (SUR) Model. The results show that the competitiveness trend of this commodity has undergone a decrease and Iranian rivals have been feeding the international markets [10].

Rodrigue (2007) Study the role of foreign direct investment and total productivity on export in Indonesia during (1993-1996). The result shows that the increase in FDI leads to increase in total factor productivity and as a result the increase of competitiveness ability and export development [11].

Harris and Schmitt (2000) in a study examine a role of export situation policy with foreign direct investment and import situation in England during 1998-2000. The results state that relationship between FDI and firm size with export is positive [12].

Zhang (2004) Study how does foreign direct investment affect a host country's performance (case study of china) during 1987-2004 and express that the substantial inflows of foreign direct investment plays a significant role on Chinese export. The estimates indicated that real FDI inflow has a determinant effect on china's export (a greatest exporter country in world in 2004). Also, domestic capital is determinant factor of export and the rate of wage has negative and significant effect on china's export [6].

Sharma (2003) investigated the effective factors on Indian's export during 1970-1998. In this study, he examine the effective factors on demand and supply export and express that real effective exchange rate have a negative effect on export demand and national income have a positive effect on export demand. Also the ratio of export goods price to domestic goods price in India has positive effect on export supply and domestic demand has negative effect on export supply. Based on results FDI has no significant impact on export performance although its coefficient has a positive sign [13].

Head and Rise (2003) investigate the role of FDI on Japanese's export in order to efficiency during 1977-1989. They express that asset, skill and unskilled workers have major factors in efficiency. FDI and export with each other increase the efficiency of firms. The result shows positive effect of FDI on export [14]. Ledesma Miguel (2005), in his study focuses on major role of invention and innovation that causes production variety, competitiveness of production in developed countries. He acclaims, if over flow know ledge is existed; knowledge spillover and technology could have a positive effect on country's export performance. Also, he believes that productions quality and variety are effective factors on export [15].

Zhang and Song (2000) studied the role of inward foreign investment on China's growth export during 1997- 1987. The result express the positive and significant role of inward FDI, capital stock, growth rate of gross domestic product on China's export [16]. Jansen (1995) has studied the effect of FDI on Thailand's economic variables (export growth, private investment growth and equilibrium balance of payments) during 1970-1992. The results show that the FDI and private investment affect the export growth positively and equilibrium balance of payments negatively. This is also express that real exchange rate and capital flow are determinant factors in Thailand's export [17].

Shamsadian *et al.* (2010) study the relationship between openness (trade-GDP ratio) and growth in 19 MENA countries (Middle-East and North Africa

countries) during 1985-2005. The result shows that the majority of the sample countries have no significant long-term relationship between their openness and growth. Only four countries (Algeria, Kuwait, Lebanon and Syria) show significant relationship between openness and growth [18].

Taghavi and Nematizadeh (2004) has Studied the effete of macroeconomic variables on the non-oil exports in Iran's economy during 1971-2001. The result express that domestic gross production and exchange rate have a direct effect on non-oil export and inflation rate in terms of statistic perspective has negative effect on non-oil export even though, it's coefficient has positive sign. Also domestic gross production has no significant effect on non-oil export, in long term [19].

Shahabadi (2005) assesses the effect of total factor productivity on non-oil export during 1959-2003 in the Iranian economy. The result of this study expresses positive and significant effect of total factor productivity variable, improvement in real exchange rate and world import level on non-oil export in Iran's economy [8].

Shakery (2005) in his study examined the role of price and non-price effective factors on non-oil export during 1961-2001. The result indicated that the strong effect of competitiveness on non-oil export and it is completely dependents on basic variables and price variables. Exchange rate could not effect significantly on non-oil export in long term and inflation rate only effect significantly on export when between inflation rate and exchange rate does not have any colinearity [20].

Tayebi (2004) examined long-run interaction of investment and non-oil exports in Iran during 1961-2001. This study explains the interaction relationship between investment and non-oil export. The result of this study shows that investment in long term has a positive effect on non oil export growth but in short term it cause limited growth. Also the exchange rate and relative price of export in long term has a positive influence on non-oil export supply but consumption variable in long term has a negative effect on non-oil export [21].

Alavinasab and Jandaghi (2010) study the trend of Iran's foreign trade structure during three development plans during 1989-2004. The result shows that the second plan has the best situation in the share of non-oil exports in meeting necessary foreign exchanges for import but the third plan has the best performance in the share of total export. Also increase in share of non-oil exports in GDP can represent growth of output for the purpose of development and non-oil export boom [22].

MATERIALS AND METHODS

Model Presentation: Development of export doesn't not only depend on exchanging income via good and services export but also it plays an important role as growth strategy and economic development in the world. Today export with additional value in most countries not only sees as an optional way but also as a reason of growth and economic development. In the other word, the government policies in export, procedure of performance and continuity of that policies and also production conduct specially, exporters have an effect on export, so in the following we review the effective factors on export.

Export Determinative Factors

Foreign Direct Investment: It has important part in world economy since early nineteen century. It is also known as an important factor in convergence between centuries. One of the factors that effect on the export of developed countries is foreign direct investment. Because it transfers knowledge, capital and technology from developed countries to developing countries [6]. The sign of this variable is S^{fdi}.

Total Factor Productivity: Important factor that could remove the deep gap between economic of developed countries with development countries and obtain possibility of economic development is total factor productivity and its promotion. It causes decrease of production costs and prices level such as production factor price of goods and services. The decrease of factors production price leads to decrease of average cost of goods and services production in the market therefore increase of productions competitive ability in the market, increase level of beneficial productions products. It finally causes to extend accumulation of new investment and total export growth [23]. The sign of this variable is TFP.

Human Capital: The increase of productivity of domestic resources such as educated of skillful human via promote efficient and effective education and activate production capacity without using in country as an export necessity for increase in export production. Without a doubt, labor investment is able to noticeable change in export section. Investment in human capital with increase the proficiency and skills level and their ability, can improve quality and quantity of production and better marketing and increase the efficiency use of material resources. Creating of skill

in an education development and constitute of human capital in production process cause to export and economy growth suddenly increase [24]. The sign of this variable is H.

Internal R&D Spillover: Based on recent theories of an international trade and empirical study by [15, 5, 25, 26]. Invention is called as engine of technological development and they say technology is a result of factory research and development. So non-oil export is function of internal research and development investment spillover, because the activity of internal R&D brings the production of goods and tradable services and effective use of available resources. Also the activity of internal R&D makes an efficient use of internal resources and attracts advanced foreign technology. This factor not only creates technology for manufacturing but also creates new ways for using production component or new primary material. Also most research not only increases the private output but also because of increasing in human knowledge, increase the social output. The sign S^d, is for internal R&D investment spillover.

Foreign Research and Development Investment Spillover: Science and technology proceeds from research activities. If research activities via science production and change it to technology and combined with other social, economical and cultural activities, certainly the stable development will be created [26]. Investment in research in each country has a direct relation with export. Based on international economic theories, if countries have transactions among each other, the export of each country depends on the research and development investment spillover [4]. So international trade increase of access to the inductor and capital goods cause to increase the export [15]. The sign of this variable is $S^{f\text{-}CH}$.

War: In order to examine the effect of suddenly Iran/Iraq war (1980-1988) on export, we add dummy variable (DW) in model

So we have:

$$X = f(S^{fdi}, S^{f\text{-}CH}, H, TEP, DW) \quad (1)$$

$$S^{fdi} \geq 0, S^{f\text{-}CH} \geq 0, H \geq 0, TEP \geq 0 \quad (2)$$

$$\text{In } X = \alpha + \beta_1 * \text{In}S^{fdi} + \beta_2 * \text{In}S^{f\text{-}CH} * \text{In}H + \beta_4 * \text{In } TEP + \beta_5 * DW + \varepsilon \quad (3)$$

Some Important Point in Data

- In this study, statistical society means macro statistic related to non-oil export and total export, total factor productivity, foreign direct investment and foreign research and development spillover (good import spillover and foreign direct investment inward) and human capital, (practitioners with tertiary education) that shows in the form of time series during 1961-2009 and with constant price (basic year 2000).
- In order to examine the role of foreign direct investment on export we use following index from [4]. To measure technology spillover effects from FDI channel in host country:

$$K_{f1} = \sum_{i=7} \frac{FDI}{FI} * S^d \quad (4)$$

In this index, FDI represent a foreign direct investment. FI as constitution domestic gross capital with fixed price in 2000. S^d is internal R&D spillover in 7th group countries (G7) (i = 7 is G7 of countries).

- TFP calculated by following index:

$$TEP = \frac{Y_t}{K_t^{\alpha} * L_t^{\beta}} \quad (5)$$

Or:

$$\text{Log}TEP = \text{Log}Y - \beta \text{Log}K - \alpha \text{Log}L$$

TFP, Y, K, α, β, t, these are total factor productivity, production, physical capital stock, labor, physical capital, elasticity domestic gross production over work forces and time, respectively.

- In order to calculate foreign R&D capital spillover we use following formula that presented by CH:

$$S^{f\text{-}CH} = \sum (m_{ij} / m_i) * S_i^d \qquad j = 1,..., \quad (6)$$

Where:

m_{ij} = Represent import inflow from G7 countries
m_i = Represent Iran's total import from G7
S_J^d = Internal R&D capital spillover

- Also, initially domestic R&D accumulation calculated according to the (Griliche, 1990) formula [27]:

$$S_{\circ} = \frac{R_{\circ}}{(g + d)} \quad (7)$$

In above equation, R_0, g and ä are cost of R&D in first year, log of the annual growth average of R and D's cost in a period that statistic cost of R&D is exists and depreciation rate, respectively. Also, domestic R&D spillover in each year equal to:

$$S_t = I1 - \delta)S_{t-1}+R_t \quad (8)$$

RESULTS AND DISCUSSION

Estimation and Results: Public belief is that more of time series variables are non-stationary. So before using of these variables we have to be sure of their stationary or non-stationary. For test the stationary of variable, we use Augmented Dickey-Fuller unite root test (ADF) [28]. This is one of the common tests for stationary recognize in determine the process of time series.

The result of these test are reported in Table 1. According to the Table 1, we see none of the variables are don't stationary in level and in first difference became stationary. Also, it is necessary to say that human capital variable is become stationary in second difference.

In Order to Avoid Spurious Regression: First, variables have to be stable variables then we can estimate regression. For example, instead of use amounts of variables we use first difference but this cause loses of information about main amounts of variables. Another method introduced in order to keep this valuable information use of main amounts of variables and avoid spurious regression. This method is cointegration, which we examine to the residuals of estimation by Dickey-Fuller test. The results express that residual's cointegration at in regarded estimations and demonstrate variable's linear order are stationary and there is a long-term relationship between dependent variable and independent variable. Amount of Dickey-Fuller statistics is -6.10 that their absolute value is more than critical values at level of 1, 5 and 10%, so we can express when variables enter equation together it causes equation at first level stationary with all variables (Table 2). Also considering results of the Johansen Test (Table 3) the convergence of the model reaffirmed. After that, in order to investigate short-run relationship among variables error corrections model is used after determining convergence of the model among these very variables. The results show that there is coordination between estimation of error correction equation and endogenous variables and these equations are so appropriate due to the quantity of Adjusted R-square (Table 4). Table 4 shows the vector error correction estimation for export, foreign direct investment, internal R&D spillovers, foreign research and development investment spillover, human capital and total factor productivity 61, 51, 92, 75 and 84 per cent respectively explain total variance.

Table1: The ADF test results of model's variables

		Mac-Kinon critical values		
Series name	Dickey-Fuller statistic	1%	5%	10%
LnS^{fdi}	2/16	-3/68	-2/97	-2/62
$D\ (LnS^{fdi})$	4/01	-3/69	-2/97	-2/62
LnTFP	-2/39	-3/61	-2/93	-2/60
D(LnTEF)	-3/48	-3/61	-2/93	-2/60
LnX	-2/17	-3/58	-2/92	-2/60
D(LnH)	-4/36	-3/58	-2/92	-2/60
LnH	2/26	-3/59	-2/93	-2/60
D(LnH)	-1/84	-3/59	-2/93	-2/60
D(LnH,2)	-8/06	-3/59	-2/93	-2/60
LnS^{f-ch}	-1/49	-3/58	-2/92	-2/60
$D(LnS^{f-ch})$	-8/14	-3/58	-2/92	-2/60
LnS^{d}	-1/81	-3/61	-2/93	-2/60
$D(LnS^{d})$	-1/88	-3/61	-2/93	-2/60
$D(LnS^{d},2)$	-6/64	-3/61	-2/94	-2/60

Table 2: cointegration test

	Critical values		
Dickey-fuller statistic	1%	5%	10%
-6.10	-3.61	-2.93.	-2.60

The estimation results for the Iran's export equation are given in Table 5. These results state that:

- Foreign direct investment have a positive and significant effect on export, because FDI by transfer of knowledge, capital, technology, management and financial recourses from developed economy to developing economy have a effect on other economic components such as export [6].
- One of other factor that has a positive and significant effect on export is total factor productivity. If total factor productivity increased, it leads to production development and use of maximum capacities of production. So amount of new investment will be expanded and it leads to increase of export [7].

Table 3: Johansen Cointegration Test

Max-Eigen Statistics			Trace Statistics		
Hypothesized No. of CE(s)	Eigenvalue	Critical Value 99%	Hypothesized No. of CE(s)	Eigenvalue	Critical Value 99%
$r = 0$	53.59	40.07	$r = 0$	135.62	95.75
$r \leq 1$	34.44	33.87	$r \leq 1$	82.02	69.81
$r \leq 2$	28.77	27.58	$r \leq 2$	51.58	47.85
$r \leq 3$	25.65	21.13	$r \leq 3$	30.81	29.79
$r \leq 4$	17.18	14.26	$r \leq 4$	16.16	15.49
$r \leq 5$	3.97	3.84	$r \leq 5$	3.97	3.84

Table 4: Error correction mechanism

Equation	$D(LnS^{fdi})$	$D(LnS^{f\text{-}CH})$	$D(LnS^{d})$	D(LH)	D(LTFP)	D(DR)	D(DW)
Ec_{t-1}	0.637685	-1.411224	8.89E-05	0.509758	1.32E-05	-2.07E-05	-3.41E-06
	(0.49943)	(2.36057)	(0.00015)	(1.74432)	(1.9E-06)	(9.0E-06)	(1.1E-05)
	[1.27683]	[-0.59783]	[0.60494]	[0.29224]	[6.99671]	[-2.31698]	[-0.31773]
R^2	0.612831	0.519280	0.922405	0.754325	0.845519	0.431247	0.603328
Log likelihood	-388.8810	-447.9025	-79.90438	-436.4060	85.50934	26.42303	19.59296
S.E	7450.580	46515.37	7.208541	48080.79	0.065743	0.162221	0.232495

* Standard errors in ( ) & t-statistics in [ ]

Table 5: The estimation results of Iran's export equation

Variable	Total export equation	Non oil export equation	Total export equation	Non oil export equation
C	7001.714 (3.51)	-5323.089 (-3.32)	6324.34 (1.76)	-3198.57 (0.86)
LnS^{fdi}	0.409876 (4.28)	0.678954 (0.88)	0.067 (0.67)	0.05 (1.44)
LnTFP	8.976523 (16.8)	56.89763 (0.38)	38.28 (0.8)	77.94 (0.6)
$LnS^{f\text{-}CH}$	0.034569 (3.64)	0.098546 (3.65)	0.0007 (1.06)	0.032 (1.05)
LnS^{d}	-	-	9.85 (1.82)	8.43 (0.71)
LnH	0.289765 (0.9)	2.327861 (4.18)	61.81 (1.08)	3.68 (3.06)
DW	-3.435468 (-6.10)	-16.7522 (-1.64)	-48.50 (-3.08)	-17.977 (-1.87)
DR	-	-	-37.98 (-2.5)	-55.967 (-2.8)
R^2	0.94	0.96	0.95	0.93
DW	2.01	0.87	2.03	1.86

*The numbers in the parenthesis show *T-statistics*

- Based on the results of estimation we can say that R&D spillover from developed trade partners to Iran's economy is significant. R&D stocks variable has positive role on Iran economy's export [15].
- Another effective factor on export is human capital. Increase domestic sources productivity such as educated skilled labor via promoting efficient educating and activate useless production capacities of country imagine as a necessity of export for increase of export's production and undoubted, labor investment can create salient changes in export section. In Iran despite of expectations, human capital has an insignificant coefficient, which this is because there has no cooperative between economic policy by educational policy and relative price deviation due to adoption wrong economic policy [24].
- In order to investigation the effect of Iran/Iraq war the Dummy variable entered to the export model that has a negative effect on export.
- In this estimation Adjusted R-square is too high and it may lead to multicollinearity in the model due to resolve this problem we use klein (1950) test. Then the results of klein test show that if we omit the dependent variable and use the endogenous variables instead of dependent variable at different states in the estimation Adjusted R-squares of sporadic states are lower than the Adjusted R-square of original model so this model does not have any multicollinearity [29].

CONCLUSION

For Iran's economy that has large distance with latest world Industrial and technological consequence, foreign direct investment and international trade could have important role in order to increase the competitiveness ability. Without a doubt, our success in reaching development ideals, especially abilities and technical innovation and industrial capacities will be tested in international competition. One of the important goals in economic programs is decrease of dependency on oil income and increase share of Iran economic export in international trade.

On the other hand, we can see deep technological gap in Iran economy in comparison with developed

countries and consequently less competitiveness ability and less export especially in non-oil export of Iran economy in world trade. Because of foreign direct investment transfer knowledge, capital, technology, management and financial resources from developed countries to developing countries and it can affect other economic component such as export, so in order to reach the goals of economy programs and document prospect, we have to take serious attention to amend economy structure to be able to develop foreign direct investment and total factor productivity and human capital and appoint a appropriate partner in order to attract more research and development stocks of trade partners.

If foreign direct investments manage appropriately, it can increase ability competitiveness that leads to export growth. The policy maker has to examine important factors in foreign direct investment precisely. Foreign direct investment inwards is one of the ways to finance, knowledge, management and technology transformation.

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