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The Impact of Import and Export of Medium Technology Industries on Economic Growth of Iran

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Abstract

Technology spillover from trade channel is important. Absorbing foreign technology by the channel of importation and using the latent technology in those products create export development, increase the quality and quantity of manufactured goods, and modify management, technology improvements and production of goods with high added value; this might favorise optimal allocation of resources. Importation of medium technology commodities is used as a proxy variable for research and development (R&D) spillover effect and technology transfer that would increase the knowledge level in developing countries. Also, this process might increase the share of medium technology industries in gross domestic product (GDP) and improve the exportation of these countries. So, national development is a basis advance of technology and technological change is affected by international relations. International relations by import of society-needed goods lead to competitive advantage increase the high technology industries. In this study, using Romer s endogenous growth model, the impact of import and export of medium-high and medium-low industries have studied on economic growth of Iran during the period of 2002-2012. In this regard, seasonal data were used in an autoregressive distributed lag (ARDL) model to examine the relationship between variables. Results indicated a positive and significant impact of import and export of medium-high and medium-low technology industries on Iran s economic growth. Also, other variables i.e. capital stock, employment and R&D expenditure have had a positive and significant effects on Iran economic growth.

JEL Classification: F14 F43 O14

Keywords: Technology transfer, Medium-high technology, Medium-low technology, Romer s endogenous growth model, Autoregressive distributed lag, Iran.

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1. Introduction

According to Lewis (2002), technology transfer can be defined as the movement of skills, technical knowledge from one organizational setting to another. One way of reducing the technology gap between developed countries and developing countries is transfer of scientific knowledge and technology. In the field of trade channels technology transfer, Coe et al. (2008) believe that foreign trade is a factor in the transfer of knowledge and technology, so that the importance of import in the introducing of newfound technologies is undeniable. In this regard, Grossman, Helpman & Young (1991) emphasize that, based on the theories of international economy and in conditions the open economy, countries use of production possibilities each other and the gains from trade for achieve to technology, technical changes and consequently increase in the rate of economic growth. In fact, trade with the transfer of knowledge and technology to the host country, the speed of technological changes in the host country has increased and technological changes, in turn, affects on the productivity and production (Hasan, 2002). In the meantime, economic, social and environment in the host country, the severity of the impact of technology on economic growth hidden in the import and export are affected.

The report of UNIDO (2016) pointed out the role of technology and equipment investment as the main motive of growth in developed and developing countries. In addition, they emphasize on effectiveness factors such as, environmental energy and natural resources in the intensity of the growth of industries with low and medium technology.

Iran's official statistics show that in recent decades, among the non-oil products, about 56 percent of Iran's industries are medium-technology. As a result, the products have moderately high technology goods has been leading the development of export Iran. Therefore, the exports share of these products from 21.5 percent in 2004 reached to 33.4 percent in 2014. In addition, export of medium-low technology industries is increased so that, the share of these products from 36.2 in 2004 reached to 39.2 percent in 2014. Despite these developments, the value of exports has not changed and this shows that the majority of both medium-high and medium-low technology products are public goods and have no functional characteristics. Also, the composition of imports shows a decline in the share of imports medium-high -tech industry from 48.6 in 2004 to 42.1 percent in 2014. In addition to this, import's share of medium-low technology products decresed of 27.2 percent in 2004 to 14.9 percent in 2014 (Institute for Trade Studies and Research in Iran, 2015).

This research study the effect of import and export of medium-low and medium-high technology on economic growth by using Romer s endogenous growth model, during the period of 2002-2012 based on the seasonal data via Autoregressive Distributed Lag method (ARDL) and hypothesis test.

Accordingly, the paper has been divided into five parts. After introduction, the first part includes the theoretical bases of exogenous and endogenous growth models and relation between import and export of medium-low and medium-high technology industries and economic growth. In the third part, literature subject is reviewed and in the fourth, the econometrics model and findings are illustrated, and finally the conclusion is discussed.

2. Literature Review

In this part, briefly the theoretical bases of exogenous and endogenous growth models are discussed. Beside the limitation of exogenous growth models, on effect of technology, its overflow in endogenous growth models is emphasized. Then, literature review is brought in this part.

2.1. Theoretical Foundations

Most theories of economic growth consider technology as factor in economic development. There are two approaches in the context of technology effects on economic growth of countries. The first one is neoclassical growth models. In this approach, most works have been performing based on the Solow growth model. Solow and Swan (1956) believe that, technology advancement is an exogenous factor in production growth that is based on general characteristic of science. In other word, using science in a firm will not prevent other firms from using it. They say that countries, despite the complete competition in market, use of their resources efficiently. In addition, the Cob-Douglas function has constant productivity to scales. In these models same technological chances and long-term convergence of countries development has mentioned, and it is because of content productivity relation to scale and final decreasing productivity in investment that will result in higher growth in poor countries than rich countries. So, the Solow model emphasizes on balanced and constant growth rate of variables. In this balanced growth rate, technological progress is as a factor in growth rate of output per worker (Romer, 2012).

In reply to the deficiencies of neoclassical models, the second approach, endogenous growth models based on exclusive rent and endogenous technology advance as a general product and people achievement were developed in 1980s. They rejected the assumptions of neoclassic about perfect markets (complete competition) and decreasing productivity of reproducible factors especially capital and consider the external consequences of production factors (Romer (1986) & Lucas (1988)). On the other hand, different technological opportunities and conditions in countries and parts are the most emphasized parts of this approach (Wang et al., 2013: 1990).

Generally, endogenous growth models are divided into two groups: AK and R&D (Jones, 1995). The first wave of these models, are, Romer model (1987), Reble (1987, 1991), Barro (1991), Benhabib and Jovanic (1991) that Charles Jones defiined them as AK models. These models are in the form of Y=AK which A, is main factor of technology and K is physical and human capital. This model does not decrease returns to capital because of two reasons: the first, because of some externalities that are created by the hidden technology in capital and neutralizes the tendency to decreasing productivity. The second, increasing diversity or improving quality of machineries or intermediate factors neutralizes the tendency to decreasing productivity. In this interpretation, K represnts diversity or quality of agents. To reach this diversity, R&D is necessary and firms assign skilled labor to these activities. The firms that work in exclusive competitive markets pay the expenditure of R&D (Romer (1990); Grossman & Helpman (1991)).

The second wave of models is based on R&D, which emphasize on endogenous tehnology for long-term growth. This pattern presents the combination of capital and labor using storage of knowledge and instead of following the assumptions of neoclassic theory and effects of exogenous technological changes, has a benefit that seeks to describe the effective forces and technological changes. In these models for a specific level of technology, returns to scale is constant for L_y and K and for a certain amount of firms; they result in more production level. Technological innovation in human resources and R&D effects on storage of knowledge. Storage of knowledge is used in production of final product that results in increment of production growth rate (Haji Mohammadi, 2015). In these models, innovation is the motive for growth and technological investment via business and direct external investment as the approaches for technology transfer. Also, the overflow of R&D will increase potentials of technology imitation, productivity and growth.

Generally, the expenditure of R&D for increasing diversity and quality of products stimulates and improves growth in two ways: Direct (innovation) and indirect (increasing the ability of absorption and transfer of technology) (Rahnamaie Gharamaleki et al., 2012).

In this study, the export and import of high-tech industry, which is embedded in part A, of Romer s function, is a way of technology and expenditure of domestic R&D transfer and as a storage of knowledge will increase the productivity.

Romer equation has the following form:

$$Y = K^{\alpha} \, (AL_y) \, \alpha - 1 \qquad (1)$$

$$\frac{A^0}{A} = \partial L_A \qquad (2)$$

In which, Y is production, A is productivity or knowledge and K is capital stock. Labor force is used in both activities, production (L_y) and innovation (L_A). So L= L_A+L_y is the total labor in economy. In these models, the labor in R&D (L_A) is related with rate of technological knowledge (A_0 /A).

Romer, Grossman, Helpman, Aghion and Howitt assume that the amounts of labor is constant so economy is in monotonic condition and it follows the balanced growth path when the share of employed labor force in R&D is constant. In this growth path, per capita product and the rate of capital to work increases with same rate and these rate with rate of total productivity growth are:

$$g_y = g_A = g = \delta s^* l \qquad (3)$$

In which S*, is the shares of labor work in R&D in monotonic condition, and L, is total labor force in economy.

Romer (1990), Grossman and Helpman (1991), Aghion and Howitt (1992), Delong and summers (1991), Fagerberg, Verspagen and Caniels (1997) examined R&D model in some cases, the results show, this model isn't confirmed by experimental analysis.

After Romer, Falk (2007) is one of the economists who added high-tech industries to shortage of knowledge, in addition to the expenditure of R&D to Romer model and achieved its positive effects on per capita GDP.

Also, Grossman and Helpman (1991), Aghion and Howitt (1992), Co and Helpman (1995), Howitt and Mayer-Foulkes (2005) and Ha and Howitt (2007) performed abundant cross-country estimates and studies on the overflow of R&D.

Therefore, international relations of a country make the simulation of foreign technology and transfer it based on domestic conditions. They increase productivity indirectly by developing new technology (Yadollahzade Tabari et al., 2013).

In this study, technology levels are classified based on OECD. In this classification, R&D expenditure intensity criterion is used. R&D intensity is domestic R&D expenditure to turn over in that period. When this value is less than 1%, R&D intensity is low, between one to four percent it is medium and larger than 4% R&D intensity is high (OECD, 2007). This classification has been shown in table1:

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Table 1: OECD classification of manufacturing industry

Coded based industries ISIC four-digit code	Average rate annual growth (Percent)	Industry	Industries according to intensity of technology
3530, 3312, 3220,2423, 3000 3230, 3210, 3320, 3330, 3311 3313	13.8	Pharmacy	High-Tech Industries
	7.9	Scientific measuring instruments	
	7.2	Communications, television, radio	
	6	Airplane and spaceship	
	4.4	Computers and machinery	
2421, 2422, 2424, 2411, 2412, 2413 2429, 2430, 2923, 2924, 2912, 2926 2911, 2927. 2922, 2913, 2915, 2919 2921, 2930, 2914, 2925, 2929, 3130 3190, 3140, 3110, 3120, 3150, 3420 3410, 3430, 3591, 3599, 3592, 3520 3530	7.4	Transport and railway equipment	Medium-High-Tech Industries
	7	Motor vehicles	Medium-High-Tech Industries
	6.5	chemical materials	
	6.2	Electrical machinery	
	5.2	equipment and machinery	
2320, 2310, 2330, 2520, 2519 ,2511 2611, 2696, 2697, 2698, 2612, 2692 2691, 2699, 2694, 2695, 2721, 2710 2732, 2722, 2731, 2723, 2812, 2811 2891, 2892, 2813, 2893, 2899, 3511, 3512	12.2	oil refining	Medium-Low-Tech Industries
	7	Shipbuilding	
	6.8	Plastic and rubber	
	6.5	Metal products and basic metals	
	4.7	Non-metallic minerals	
1516, 1542, 1519, 1520, 1512, 1514 1515, 1543, 1544, 1545, 1546, 1517 1518, 1531, 1551, 1552, 1532, 1553 1555, 1533, 1556, 1547, 1548, 1600 1721, 1723, 1724 1725, 1726, 1712 1729, 1731, 1732, 1711, 1820, 1810 1912, 1911, 1920, 2029, 2010, 2023, 2221, 2212, 2021,2022, 2101, 2102, 2109, 2213, 2219, 2211, 2222, 2230 3691, 3693, 3610, 3692, 3699, 3694 3710, 3720	3.5	Of clothing and textiles	Low-Tech Industries
	3.5	Paper and printing	
	4.2	Food, beverages and tobacco	
	4.3	Wood	
	6.3	Other products	

SOURCE: OECD, STAN. (2007), Indicators Database, International Trade by Commodity Statistics, www.oecd.org/sti/stan/indicators.

In addition, this classification of industries by OECD, Khalil (2000) believe medium- technology are puted between high-level (Superior) and low-level technologies. Also, he says the phrase of medium-technology usually uses for adult technologies that more than other technologies are subject to transfer. For example, consumable products and automotive technologies are in this class. MT (medium-technology) products can be divided into three categories MT_1 (car), MT_2 (mainly chemicals and base metals), MT_3 (other products) (Lall, 2000). In these industries, the distribution of knowledge is basis for innovation and creating new ideas and scientific techniques in these industries (Robertson & Smith, 2008). Robertson and Patel (2007) state that these industries constitute the major part of GDP and are widely affect employment and investment. In the meantime, the importance of MT industries to increase productivity in high-tech industries is indirect (Lall, 2000).

It should be noted, in developing countries and developed countries are different mechanisms of production and creation of knowledge. Industries in developed countries often leading industries in their activity and hence innovation, from R&D in this environment for these industries, it will be vital; While firms in the same industry activity gives a developing country, because of issues such as the path-dependent industry's knowledge, lack of activity by government on subject of science and institutional problems and etc, Instead of relying on research and development, its strategy is focused on the transfer of knowledge and technology. In other words, the firm in developing countries, primary production of knowledge replaced by learning (Center for Modern Industries of the Ministry of Industry and Mines,2009).

2.2. Leatirature Review

Young (1991) emphasized that in order to technology development, the export products must have increasing technology. In addition, Mody & Yilmaz (2002) believe that innovation is the least need for being a competitive country that can be achieved by imported technology and in time should be replaced by domestic technology. Awokus (2007) stated that interantional trade is the main cause of science and technology transfer and it can be converted to domestic technology. Then by creating the conditions for use of technology, the foundation for increment of production and productivity will be built.

Hatzichronoglou (1997) through classification industrial production in OECD countries according to the intensity's technology assessed indirect R&D. In his estimation, used the flow of technologies matrix for the period 1995- 1998. In this classification, industries, based on the intensity of R&D expenditure and value- added are classified. This classification includes high, medium-high, medium-low and low technology that is done by OECD and cooperation Eurostat. Hatzichronoglou pointed to the high value-added industries, introduced it as a tool for knowledge spillovers to other sectors, and promote economic growth and an increase in competition in the trade.

Cuaresma & Worz (2005) investigated the relation between factroy indusries export and growth based on infrastructure of factroy indusries. In the study, the hypothesis of diffrect qualities between export of high and low-tech factory industries in relation to growth were investigated via panel data method for 54 developed and developing countries in the period of 1981-1997. The results showed that export of high-tech indsuries has positive and significant effect on GDP while export of factory indusrty with low technology has an insignificant effect.

Kilavuz & Altaytopcu (2012) studied the effect of export and import of difrrent technology levels on economy growth in 22 developing countries for the period of 1998-2006 via pandel data method and by two models. Results from the fisrt model showed that between the export and import of high and low-tech industries, investment and population, only high-tech export and investment had positive effects on production. In the second model, in addition to export, import was included and results showed that high-tech export, low-tech import and investment had positive effects on production and population, low-tech export and high-tech import had negative effects on growth.

Maleki (2010) investigated the effect of technological combination of export on economic growth by using Feder s model,. which needs to convert the coordinated customs system codes to international standard codes of industrial activities and then to technological codes (high, medium high, medium low, low and non-technological), in the economy of Iran, which is performed for a period of 69 seasons (1992 spring to spring of 2009). The results of two methods, simple and generalized least squares, proved the assumption of different productivity by using of production factors in technological section and stated that the export of high-tech products has more effects on growth such that the effect of high and low-tech is positive and significant; specifically, this effect is larger in low-tech industries. In addition, he mentioned the negative and significant effect of non-industrial export.

Fatahi and Rezaie (2015) by using the panel data method and GMM algorithm investigated the effect of export and import of different levels of technology on factory industries growth in Iran during the period of 1991-2011. The results showed that because Iran is a developing country, high-tech import does not have a positive effect on growth. However, high-tech export has a positive and significant effect on growth. Beside the import and export of high-tech industries, low-tech import has a positive and significant effect. However, low-tech export has a positive but insignificant effect on growth that implies in low-tech industries import has a more important role compared to export.

As the research literature shows, in most studies, industries with medium- high and medium-low technology put in high and low technology class, respectively. However, the nature of these two classes is different and lack of separation may lead to bias in the results. For this reason, in this study, these two classes, in separate models, have been studied.

3. Econometrics Algorithm and Results

In this section, the statistical population and data gathering tools are introduced and in the second part in order to assess the stationary of parameters and necessity of using ARDL method, the generalized Dickey-Fuller hypothesis is used and finally the evaluation of model and results are evaluated.

3.1. Statistical Population and Data Gathering Tools

This study is performed by an analytical-descriptive method and using Romer R&D based model, which were explained previously, Iran s economy growth model for seasonal data in the period of 2002-2012 is evaluated. In choosing the parameters, the studies in the literature review (Maleki, Fatahi & Rezaie, Cuaresma & Worz) and theoretical bases (the endogenous growth model and technology overflow from business way) sections were used.

Time series data of parameters including GDP, capital stock in the price of the base year 1997 (the central bank website), employment in industry section (statistical centre of Iran), R&D expenditure (Management and Planning Organization of Iran) were used. Classified ISIC301 Data related to the value of medium-high and medium-low technology import and export (MHTI, MHTE, MLTI, and MLTE) are extracted from annual statistic of Iran customs, and calculations are performed by MS-EXCEL. In addition, Eviwes is used to analyze existing investment and R&D expenditure data.

3.2. Generalized Dickey-Fuller Hypothesis

In the next step, to recognize the type of model in time series data, stationary test is used. Augmented Dickey-Fuller test is one of the common tests, which are used to recognize stationary data. In this test, if the absolute value of ADF statistic is larger than the absolute values of critical MacKinnon then H_0 hypothesis is rejected and data is stationary.

The results of this test is presented for medium- high and medium-low technology industries in Table 2:

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Table 2: Evaluation of the stationary of variables using augmented Dickey-Fuller tests

	Medium-low		Medium-high					
Variabl	**LMLT**	**LMLT**	**LMHT**	**LMHT**	**LR&**	**LL**	**LK**	**LGD**
ADF	−7.755	−6.643	−6.483	−3.839	−6.21	−7.07	−18.4	−24.1
%1	−3.615	−3.615	−3.615	−3.615	−3.61	−3.61	−3.61	−3.61
%5	−2.941	−2.941	−2.941	−2.941	−2.94	−2.94	−2.94	−2.94
%10	−2.609	−2.609	−2.609	−2.609	−2.60	−2.60	−2.60	−2.60
Status	I(1)	I(0)	I(1)	I(0)	I(1)	I(1)	I(1)	I(1)

Source: Research results

The results show that some variables including LGDP, LK, LL, LR&D, LMHTE and LMLTE are unstationary and will be stationary by once differencing.

Time series parameters in the model are persistent in different levels I (1) and I (0). So the estimation method will be ARDL, which is an auto-descriptive model. Analysis in this model is based on three dynamic short-term, long-term and error correction equations. In the current study the first, the short-term equation will be Estimate for models, and then long-term coefficients and error correction models will be Estimate by their long-term equations. It should be mentioned that in this method before estimating the long-term coefficients, bound test developed by Pesaran & Pesaran, (1996) must be used to evaluate long-term convergence and the long-term equation derived by this method is not false. In this method, the presence of a long-term relation between the parameters is tested by F statistics for testing the significance of levels. The point here is that the above-mentioned F distribution is non-standard. Pesaran and Pesaran (1997) calculated the appropriate critical values corresponding to the number of repressors despite or not the y-intercept and trend of the model.

They presented two groups of critical values: the first one is based on the fact that all parameters are stationary and in the second one all data is non-stationary (they become stationary after one differencing). When the calculated F is out of this bound, one certain decision is made without knowing if the parameters are I (0) or I (1). When the calculated F is beyond the upper bound of H0 hypothesis, lack of a long-term relation is rejected and when it is under bound, the H0 hypothesis will be accepted. If the calculated F be between two the bound, the results are uncertain and dependent on if the parameters are I (0) or I (1) (Tashkini, 2005).

3.3. Patterns Estimation and Results

According to the method of estimation, ARDL form for this study based on Romer pattern of growth is as follows:

$$LGDP = \alpha_0 + \sum_{i=0}^{n} \alpha_i LGDP_{t-i} + \sum_{j=0}^{n} \beta_{1j} LK_{t-j} + \sum_{j=0}^{n} \beta_{2j} LL_{t-j} + \sum_{j=0}^{n} \beta_{3j} LR\&D_{t-j} + \sum_{j=0}^{n} \beta_{4j} LMHTI_{t-j} + \sum_{j=0}^{n} \beta_{5j} LMHTE_{t-j} + u_t \quad (4)$$

$$LGDP = \alpha_0 + \sum_{i=0}^{n} \alpha_i LGDP_{t-i} + \sum_{j=0}^{n} \beta_{1j} LK_{t-j} + \sum_{j=0}^{n} \beta_{2j} LL_{t-j} + \sum_{j=0}^{n} \beta_{3j} LR\&D_{t-j} + \sum_{j=0}^{n} \beta_{4j} LMLTI_{t-j} + \sum_{j=0}^{n} \beta_{5j} LMLTE_{t-j} + u_t \quad (5)$$

The result of estimation models using ARDL method is showed in the table (3) and (4). The estimation of first model shows capital stock, employment in the industrial sector, R&D expenditure and import & export of medium-high technology industries have a positive and significant effect on economic growth in Iran. Also, the estimation of second model, represents evidences of a significant and positive effect of variables including capital stock, employment in the industrial sector, R&D expenditure and import and export of medium-low technology industries on economic growth in Iran. It should be noted that in both models, the second lag of capital stock has a significant and negative effect on economic growth, which it could be due to the depreciation of capital equipment and the loss of theirs efficency over time.

However, it is important to say that in the first and second models, respectively, the third and second lag of import has a significant effect that this could be for the following reasons:

1. The long duration of the clearance of imports of commodity due to issuing Successive circulars and instructions in Iran.
2. Problems including getting Iran-code in order stage, testing the product in the standard and health organization, Lack of cash to pay duties, absence of the owner of the goods to customs, having lawsuits, missing documents, Switch business owners, having financial problems for Clearance and the disagreement owner of the goods with the bank.

The mentioned parameters will make the process of importing and creating abandoned products time-consuming and also, will erode the products in custom and make the modern technology inaccessible comparing to other countries. In the other hand, country in its production circle always uses the technology of previous year and this will affect the growth.

Table 3: The results of the first model: medium-high

Variable	Coefficient	Std. Error	t-Statistic
LGDP(-1)	0.302***	0.013	23.2
LGDP(-2)	-0.137***	0.014	-9.99
LK	1.199***	0.056	21.3
LK(-1)	3.051***	0.021	147.7
LK(-2)	-3.733***	0.062	-60.3
LL	0.312***	0.022	14.19
LR&D	0.078***	0.007	11.57
LMHTI(-3)	0.016***	0.002	6.577
LMHTE	0.020***	0.005	4.177
LMHTE(-1)	-0.006**	0.002	-2.497
C	-0.661**	0.311	-2.127
R^2			0.99
D.W			1.89
F			294.9

* P-value< 0.1 ** P-value< 0.05 *** P-value< 0.01

Source: Research results

Table 4: The results of the second model: medium-low

Variable	Coefficient	Std. Error	t-Statistic
LGDP(-1)	0.309***	0.040	7.635
LGDP(-2)	-0.152***	0.030	-5.089
LK	1.244***	0.159	7.807
LK(-1)	2.951***	0.120	24.611
LK(-2)	-3.696***	0.222	-16.653
LL	0.398***	0.110	3.607
LR&D	0.068***	0.017	4.052
LMLTI (-2)	0.007**	0.003	2.387
LMLTE	0.020***	0.005	4.048
C	-0.378	0.405	-0.933
R^2			0.99
D.W			2.04
F			426.1

* P-value< 0.1 ** P-value< 0.05 *** P-value< 0.01

Source: Research results

To overcome probable difficulties, autocorrelation tests, the assumption that distribution of residuals is normal, heterogeneity of variance and Ramzi test for evaluation of regression error or accuracy of subdominant form of the model were performed. The results have been shown in table-5.

Table 5: Results of diagnostic tests

		Normality Test	Ramzey Test	White test	LM Test
First model	**Test Statistic**	2.81	5.14	0.49	0.378
	P-value	0.24	0.05	0.88	.688
Second model	**Test Statistic**	6.72	3.20	0.446	0.059
	P-value	0.035	0.083	0.898	0.942

Source: Research results

As shown in table-5, because the level of significance of all statistics are larger than 0.05, in 95% confidence level, there is no heterogeneity of variance and autocorrelation in esteemed model and there is no evidence of non-normality of residuals and error in model. After estimation of ARDL model and making sure of classic assumptions, co-integration of model should be assured. For convergence test of model and finding the long-term relation between pattern parameters the bound test, which is developed by Pesaran and Pesaran (1996), is used. Results have been shown in table-6. F- Statistic in all levels is larger than critical values in two groups and H0 hypothesis, i.e. non-existence of a long-term relation is rejected, and it can be concluded that there is a long-term relation between pattern parameters.

Table 6: Result of Bounds Test

	Second model		**First model**	
	F statistic= 9.19		**F statistic= 10.045**	
Significance	**I0 Bound**	**I1 Bound**	**I0 Bound**	**I1 Bound**
10%	2.26	3.35	2.26	3.35
5%	2.62	3.79	2.62	3.79
2.50%	2.96	4.18	2.96	4.18
1%	3.41	4.68	3.41	4.68

Source: Research results

After assuring the existence of a long-term relation, it is estimated and evaluated. Results of estimations of a long-term relation have been shown in table-7 and 8. The results of both models indicate that capital stock has a positive coefficient and rather than other variables have the greatest effect on GDP in Iran. So that, 1% increase in this variable increases GDP almost 0.61%. After capital stock, employment in the manufacturing sector is most important variable affecting on economic growth. A percent increase in this variable causes GDP growth almost 0.37 percent.

The third important variable affect GDP is R&D expenditure. An increase 1% in R&D expenditure will increase 0.09%, GDP in Iran. Import and export of Medium-high and medium-low technology industries also have a significant and positive effect on GDP. So that, 1% increase in import and export of medium-high industries will increase GDP to the 0.019% and 0.016 respectively. Also, 1% increase in import and export of medium-low industries will increase GDP to the 0.008% and 0.023 respectively. This result shows that export of these industries such as: basic chemicals, fertilizers and nitrogen, refined petroleum products, petrochemical products, automobiles and auto have competitive advantage.

In other words, they are competitive in the region and the benefits of exporting them is more than the cost of production of this industry within the country. It can be said that these industries have high economies of scale and by increasing the volume of production, with decreased the average cost of production per unit of the goods. Also, the manufacture of plastics and rubber, nonferrous metals, nonferrous metals, fabricated metal, oil refining and shipbuilding, mainly industries in the country in the third and fourth development program (period of this study) emphasis to produce them. As a result, in Iran by relying on resources and raw materials, trained human resources with creating a comparative advantage in commodities mentioned and using of advantage of economies of scale is been possible to produce and export of medium technology industries to the region.

Import of medium-low and medium-high industries in order to improve the quality of production, replacement of old equipment, absorption of domestic technology, improvement of productivity level of production parameters like labor and the necessity of using the modern technology in creation of new production methods is needed for the country and has positive effects on growth.

Table 7: Long-run coefficients in the first model

Variable	**Coefficient**	**Std. Error**	**t-Statistic**
LK	0.619***	0.032	19.03
LL	0.373***	0.033	11.35
LRD	0.093***	0.006	16.06
LMHTI (-3)	0.019***	0.003	5.69
LMHTE	0.016**	0.008	2.06
C	-0.791*	0.392	-2.01

* P-value< 0.1 ** P-value< 0.05 *** P-value< 0.01

Source: Research results

Table 8: Long-run coefficients in the second model

Variable	Coefficient	Std. Error	t-Statistic
LK	0.591***	0.045	13.13
LL	0.471***	0.131	3.58
LRD	0.08***	0.019	4.11
LILMT(-2)	0.008**	0.003	2.54
LELMT	0.023***	0.005	4.27
C	-0.44	0.494	-0.91

* P-value< 0.1   ** P-value< 0.05   *** P-value< 0.01

Source: Research results

Existence of co-integration between groups of economic parameters prepares the statistical base for using error correction patterns. These patterns have good reputation in experimental works. The main reason is the reputation of error correction patterns, which relate the short-term fluctuations to the balanced long-term values (Nofarsati, 1999). Error correction model for Iran s economic growth is:

$$LGDP = d\alpha_0 + \beta_1\, dlk + \beta_2\, dll + \beta_3\, dlR\&D + \beta_4\, dlMHTI + \beta_5 dlMHTE + \beta_6\, dlECM(-1) \quad (6)$$

$$LGDP = d\alpha_0 + \beta_1 dlk + \beta_2 dll + \beta_3 dlR\&D + \beta_4 dlMLTI + \beta_5 dlMLTE + \beta_6\, dlECM(-1) \quad (7)$$

Estimation coefficients of error correction pattern, which explain the relation between GDP per capita and explaining parameters, have been shown in table-9. According to the table, all the coefficients relating to capital stock, employment in industry section, R&D expenditure, import and export of medium-low and medium-high industries are significant. In these relations, elasticity of growth to capital stock is larger than other parameters. The Coefficient of CointEq (-1) in both approximately is -0.84 and show in each period almost 84 percent of the imbalance in the model is adjusted.

Table 9: estimation of error correction model - first model

Variable	Coefficient	Std. Error	t-Statistic
D(LGDP(-1))	0.137***	0.014	9.99
D(LK)	1.199***	0.056	21.3
D(LK(-1))	3.733***	0.062	60.3
D(LL)	0.312***	0.022	14.2
D(LRD)	0.078***	0.007	11.6
D(LMHTI (-3))	0.016***	0.002	6.6
D(LMHTE)	0.020***	0.005	4.2
CointEq(-1)	-0.836***	0.025	-33.8

* P-value< 0.1 ** P-value< 0.05 *** P-value< 0.01

Source: Research results

Table 10: estimation of error correction model - second model

Variable	Coefficient	Std. Error	t-Statistic
D(LGDP(-1))	0.152***	0.030	5.089
D(LK)	1.244***	0.159	7.807
D(LK(-1))	3.696***	0.222	16.653
D(LL)	0.398***	0.110	3.607
D(LRD)	0.068***	0.017	4.052
D(LMLTI (-2))	0.007**	0.003	2.387
D(LMLTE)	0.020***	0.005	4.048
CointEq(-1)	-0.843***	0.063	-13.487

* P-value< 0.1 ** P-value< 0.05 *** P-value< 0.01

Source: Research results

4. Conclusion

The aim of this study was to investigate the effects of export and import industries with medium-high and medium-low technology on economic growth in Iran. This paper has used two separate model to test these effects (medium-low model and medium-high model).

The results of estimation the first model (medium-high) show that export, import of medium-high technologies has a positive, and significant effect on GDP, but the effects of import is higher than export. Also, in the second model, both exports and imports medium-low technologies has a positive impact on GDP, but the effects of exports higher than imports that indicates presence of economies of scale and competitive advantage in these industries. In short and long-run, import of medium-low technologies has positive and significant effect on GDP.

Since both exports and imports of medium technology has a significant and positive effect on economic growth can be concluded that foreign trade of such commodites will lead to increased economic growth in Iran. Our findings are promising and support the view that there is a direct relationship between trade openness and economic growth. Therefore, the removal of tariffs and trade barriers would help to promote economic growth

In the final conclusions must also be said that the export of high-tech did not suitable situation in Iran. High-tech industries have two fundamental problems: on the one hand the low and declining share of export volume and on the other hand, the lack of diversification and focus on more than 80 percent of its value, to a particular product (such as medicine), is faced the export of these industris with serious challenges. Thus, the need for policies to diversify the composition of exports based on technology levels in Iran is strictly necessary.

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