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The Effects of Technology Spillover on the Economic Growth of Iran's Sports Industry

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ABSTRACT

Background. The sports industry plays an important role in the progress of the economy in developed countries. The role of technology is remarkable in the enhancement of the economy. **Objectives.** The present study investigates the effects of technology spillover on the economic growth of Iran's sports industry through import of intermediate and capital goods for the period from 1974 to 2012. **Methods.** The research method was econometrics and autoregressive distributed lag model was used. To do so, the following categories of data was analyzed by Eviews software: value added to cultural, recreational and sports services; current and construction expenditures of the government compared to the GDP (government size); import of intermediate and capital goods; capital stock of sports and active economic population of the sports section. **Results.** The results of model estimation showed that technology spillover has a significant and positive effect on the economic growth of Iran's sports industry ($p<0.05$) both in the short and the long term. The error correction model also indicated a speedy movement of distortions and imbalances towards the long-term equilibrium. **Conclusion.** The findings show that import of capital and intermediate goods creates the context for increased productivity in Iran's sports sector by facilitating access to the required intermediate agent and global technologies for organizations.

KEY WORDS: ***Sports Industry, Economic Growth, ARDL, Technology Spillover, Value Added.***

INTRODUCTION

Scrutinizing the role of technology on economic growth has probably been the most important economic issue in the years after World War II, especially in developing countries; therefore, the main objective of economic growth theories is to explain the determinants of economic growth. Economists have constantly tried to explicate the process whereby growth rate is affected through various channels and policies. An in-depth analysis of the economic structure of developed countries reveals the fact that they owe their current economic power to some factors other than mere physical structures. The economic growth of these countries did not result from physical agents, but human resource and creativity (1). On one hand, based on new theories of economic growth, research and development activities of business partners via import of intermediate and capital goods can play an essential role in economic growth (2); consequently, the transfer of appropriate technology provides the context of growth in less developed countries. In other words, the development of trade and economy of a country

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relies on technological and industrial progress which depends on overflow of international research and development via import of immediate and capital goods (1). Imports are one of the most important variables affecting the economies of developing countries such as Iran. Most developing countries require import of raw materials, manufacturing machineries, capital goods and consuming goods to expand industries and meet the needs of the people. In addition, the required technology for developing countries to move from traditional manufacturing to industrial production and economic development processes are provided through latent technology in imports. Looking back on the process of Iranian imports, it can be said that imports in Iran have always seen a rising trend with same draft before the Revolution because oil has been the main income source of the country (3). Sports and active recreation can make a significant contribution to a country's economy. Sports creates direct economic benefits in the form of jobs, income and taxation revenue. It also benefits the economy indirectly by improving the people's health and well-being, which can reduce healthcare costs and increase labor productivity. Sports also generates economic benefits by contributing to the tourism and entertainment industries (4). As a lucrative industry, the sports industry has a high economic importance because of growing tendency of the people to opt for sports and as a result, the need to use sports goods and services. Sports goods have the lowest share among the components of Iran's GDP and these items should be produced more frequently in order to shift the demand from imported goods to domestic products. Therefore, creating the required facilities in this field is necessary (3). Sharp fluctuations in the rate of economic growth, low competitiveness, high dependence on oil revenues, double-digit inflation, high unemployment, and disproportion between imports and exports have led to a huge technological gap between Iran and developed countries, especially in the sports sector. As a result, it is essential to consider the impact of imported technology on economic growth of the sports industry in order to achieve the goals of economic advancement in Iran.

The relationship between technology spillover and economic growth. Some economists know technology as an independent factor in production. Some others consider it as a dependent factor of time. Some of them consider it as a dependent factor of investment; finally others know it as the expositor factor of residual growth which cannot be created by other factors of the product (5). According to the neoclassical growth model, which was initiated by Solow (1957), technology agent is considered exogenous; however, an endogenous growth model emphasizes that technology is the product of performance of the economic system and it must be inserted into the growth model endogenously (6). Now, the theory of endogenous growth provides a theoretical framework for analyzing economic growth. The main motivation for the new growth theory is to explain determinants of growth and differences in growth rates among countries. Exogenous growth models of Lucas (1988), Grossman and Helpman (1990) and Romer (1986), which are in contrast to neoclassical models, emphasize the central role of research and development as the main driving force of economic growth. Grossman and Helpman (1997) and Romer (1986) argue that economic growth depends on research activities, accumulated domestic development, and accumulation of research capital, foreign development and storage of knowledge (7-10).

Based on recent theories and studies of economic growth and international trade by Romer (1990), Grossman and Helpman (1990), Coe and Helpman (1995), Coe, Bayoumi and Helpman (1990), Lichtenberg and Potterie (1998), Kinoshita (2000), Cebrian and Lopez (2005), and Perez-Sebastain (2007), in the case of international trade among countries, economic growth depends on accumulation of research capital and foreign development through the import of capital and intermediate goods. This is because international trade enhances economic growth by providing access to intermediate goods (2, 8, 11-16).

Literature Review. Few empirical studies have been conducted on the effects of imports on economic growth; the first one is Krueger's study (1983), which mentioned that reduction in import of capital goods will reduce GDP growth rate (17). Mohsenkhan and Reinhart (1990), while investigating export and import variables along with capital and human resources

variables, stated that in addition to export, import of capital and intermediate goods can also have a positive and significant effect on economic growth (18). By studying the effects of import of capital goods on economic growth of 89 countries, Lee (1994) revealed that higher the proportion of imported capital goods in comparison to domestically produced capital items, the more positive the impact on the per capita income of developing countries and increase in imports of capital goods in developed countries will lead to lower economic growth (19). Marchionatti & Usai (1998) investigated the effects of imported technology spillover on economic growth of Italy from 1963 to 1995; they stated that the coefficient variable of technology spillover had a positive impact on the economic growth of Italy by import of capital goods (20). Perez-Sebastian (2007) reviewed and estimated non-linear model of economic growth in 22 countries of the OECD from 1968 to 1980; he found that domestic research and development expenses play a more decisive role in the economic growth of a country in comparison to foreign domestic research and development expenses (16). Ugur (2008) analyzed the relationship between import and economic growth of Turkey from 1994 to 2005 in an experimental study; according to the results of his study, while there is a mutual relationship between GDP and import of capital goods and raw material, there exists a one-way relationship between GDP and import of consumable and other goods and the mainstream is from GDP to the import of consumer goods (21). Chen and Dang (2012) investigated the impact of import and export on economic growth using nonparametric estimates and panel data of 31 provinces in China; the results showed a positive and significant relationship between import and export as well as economic growth (22). Shahabadi & Sadjadi (2011) investigated the effects of technology spillovers through the import of intermediate and capital goods. Based on the findings of their study, the accumulation of foreign research and development through import of capital and intermediate goods has a positive and significant impact on economic growth (1). Safdari, Mehrizi and Elahi (2012) investigated the effects of imported technology on the economic growth in Iran for the years 1975 to 2008. Findings of their study showed that export has a negative effect on the gross domestic product. Also, net capital stock, employment, raw materials and intermediary goods have a positive relation with the gross domestic product (5). Bagheri et al. (2016) investigated the export and import of sports goods in Iran in the year 2014. Their findings showed no significant relationship between export and import of sports equipment. However, the imports should be controlled to support new established firms. It results in job creation and reduces foreign currency exit. Consequently, we should export sports goods and find consumer countries (3).

MATERIALS AND METHODS

Method. Research method of this study is econometrics and the model used in this study is based on the model of Romer, Mankiw, and Weil (1992) and is an extension of the Solow growth model (23):

$$Y_t=AK_t^{\alpha}H_t^{\beta}(G_te^u)^{\gamma} \quad (1)$$

If we take the logarithm of both sides of the equation (1), the linear model is as follows:

$$LnY_t= LnA + \alpha LnK_t + \beta LnH_t + \gamma LnG_t \quad (2)$$

In the above equation, LnYt is the log of the value added to sports in Iran, LnA is the log of technology spillover through import of intermediate and capital goods, Lnk is the log of Iran's capital stock in the sports section, LnH is the log of the active population in the sports section, and LnG is the log of the size of the government (current and construction expenditures of the government to GDP). Data on the variables of the study was collected from the Statistical Center of Iran, the Central Bank of the Islamic Republic of Iran, and the World Bank for the period time between 1974 and 2012.

Model estimation and analysis. The reliability of variables is necessary for econometrics when the data is in the form of time series; therefore, the present study has used the augmented Dickey-Fuller test in order to assess the reliability of variables; the results of this test are shown in Table 1. As Table 1 shows, the absolute value of the augmented Dickey-Fuller statistics for the variable of the

government size shows that if this variable is constant, then is I(0). The results for other variables show that they were steady at 1th difference (type of these variables: I(1)). Thus, since variables were a combination of I(0) and I(1), the ARDL method was used.

Table 1. Augmented Dickey-Fuller test

	level		1st difference	
variable	Test value	Test critical vlues	Test value	Test critical vlues
LnYt	-2.50	-2.94	-7.22	-2.94
LnH	-2.03	-2.94	-7.60	-2.94
LnG	-3.18	-2.94	-	-
LnA	-1.22	-2.94	-4.91	-2.94
Lnk	-1.06	-2.94	-7.74	-2.94

RESULTS

Optimal lag is selected based on the Schwartz -Bayesian, Akaike, and Hannan-Quinn criteria for each variable in the ARDL method. Due to limited time period and higher effectiveness of the Schwartz - Bayesian criteria in comparison to other criteria in smaller samples, this norm was used to select the optimal lag of the model; consequently, the ARDL (1, 1, 0, 3, 0) model was selected and short-term results are provided in Table 2. As shown in Table 2, the adjusted R^2 is 0.98, which shows that almost 98% of changes of the value-added variable are explained by the independent variables in the sports section. High value of R^2 also signifies high explanatory power of the research variables. After the estimation of the dynamic pattern, the presence or absence of co-integration must be checked and ensured among research variables; to do so, sum of the coefficients of the dependent variable with lag in the model must be less than 1; this method is known as Banerjee, Dolado, and Mester test, and the assumptions are as follows:

$$H0 = \sum_{i=1}^{p} ai - 1 \geq 0$$

$$H1 = \sum_{i=1}^{p} ai - 1 < 0$$

The following equation is used to calculate the statistics of this test:

$$t = \frac{\sum_{i=1}^{p} a - 1}{\sum_{i=1}^{p} SEai}$$

Since dependent variable includes one lag, we have:

$$\mathrm{t} = \frac{(0.45)-1}{0.09} = -6.11$$

Table 2. ARDL Cointegrating (1,1,0,3,0)

Variable	Coefficient	Std. Error	t-Statistic
LNYT(-1)	0.45***	0.09	4.62
LNH	0.97***	0.03	2.35
LNH(-1)	-0.45***	0.04	20.83
LNK	0.09**	0.10	-4.46
LNG	0.12*	0.06	1.75
LNG (-1)	0.04ns	0.07	0.55
LNG (-2)	0.20**	0.07	2.73
LNG (-3)	-0.18***	0.06	-2.85
LTEC	0.10***	0.02	4.34
C	0.03ns	0.35	0.10

* %90, **%95, ***%99

Since the obtained absolute value is larger than the critical value (-4.45) on a certainty level of 95%, Null hypothesis, which states that there is no co-integration among variables, is rejected. So, there is a long-term equilibrium relation among the research variables. After confirming the co-integration relationship among variables, CUSUM and CUSUMQ tests were used to check the structural stability of the model; results of these tests are shown in chart 1 and 2. As you can see, the graphs obtained reside in between interim of 95%, which signifies stability of the model's structure. After conducting the test and ensuring the long-term relationship, it is possible to estimate the long-term model.

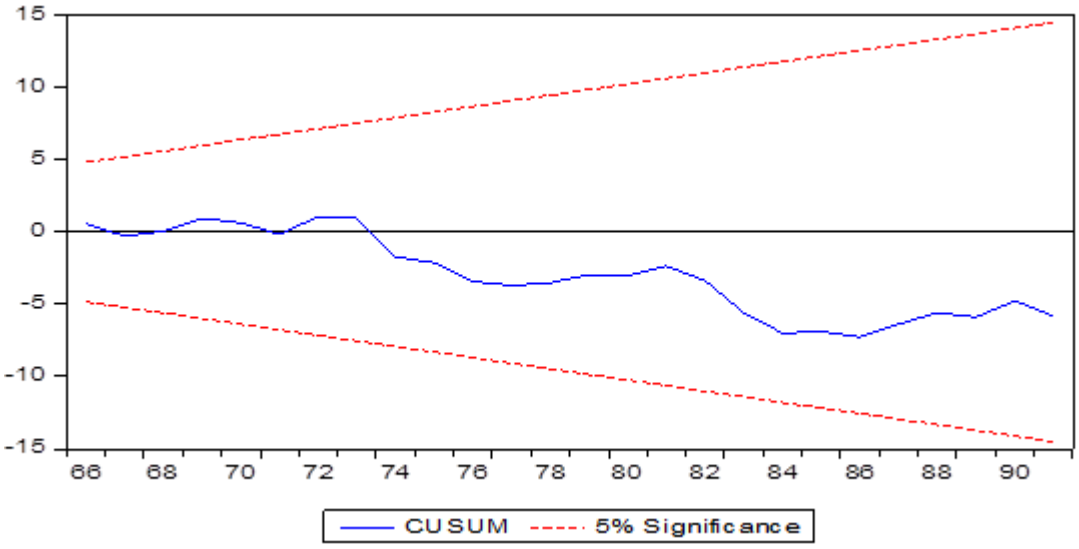

Chart 1. CUSUM test

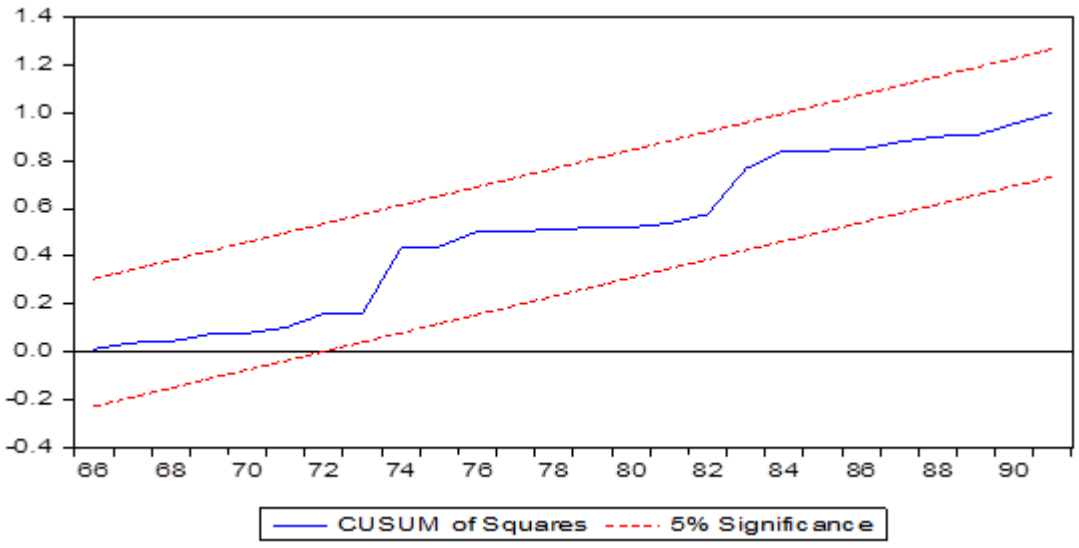

Chart 2. CUSUM of squares test

The results of the model estimation are shown in Table 3. According to the results shown in Table 3, research variables have positive coefficients and are statistically significant at a confidence level of 99%. Coefficient of technology index is 0.19, which shows that 1%

increase in the import of intermediate and capital goods as technology spillover index increases the value added to the sports section by 0.19%. After estimating the long-term equilibrium relationship, the short-term error correction model is estimated to compare the behavior of the short-term variable with their long-term rates. Coefficients of the estimation of error correction model are shown in Table 4. Error correction coefficient is 0.54, which is statistically significant. Therefore, the presence of a long-term relationship among research variables is confirmed and it can be stated that 0.54 of the short-term disequilibrium is mitigated annually to achieve long-term equilibrium.

Table 3. Long Run Coefficients of model

Variable	Coefficient	Std. Error	t-Statistic
LnH	0.95***	0.08	11.47
LnK	0.16***	0.05	3.06
LnG	0.34***	0.05	5.87
LTEC	0.19***	0.05	3.77
C	0.06ns	0.64	0.10

* %90, **%95, ***%99

Table 4. Error correction model

Variable	Coefficient	Std. Error	t-Statistic
D(LnH)	0.97***	0.04	20.83
D(LnK)	0.09**	0.03	2.35
D(LnG)	0.12*	0.06	1.75
D(LnG (-1))	-0.20**	0.07	-2.73
D(LnG (-2))	0.18***	0.06	2.85
D(LTEC)	0.10***	0.02	4.34
CointEq(-1)	-0.54***	0.09	-5.53

* %90, **%95, ***%99

DISCUSSION

Knowledge accumulation in richer countries provides them with comparative advantage in higher-productivity products. The countries that import the higher-productivity intermediate products and capital equipment produced in the richer countries derive benefits from knowledge spillovers. The main objective of the present study was to investigate the effects of technology spillover, realized through the import of capital and intermediate goods, on economic growth of the sports section in Iran. For this purpose, value addition in sports is considered as a dependent variable that indicates the economic growth of the section, and import of capital and intermediate goods is used as an index for technology spillover. Government size (current and construction expenditure of the government to GDP), sports capital stock and active economic population of the sports section are other independent variables. Data on the variables of the study was collected from Statistical Center of Iran, the Central Bank of the Islamic Republic of Iran, and the World Bank. First, the augmented Dickey-Fuller test was used to assess the stability of variables; considering that research variables were a combination of I(0) and I(1), the ARDL method was used for model estimation. The research model was estimated according to the Schwartz-Bayesian criteria and considering 1 lag for the dependent variable. The long-term model and error correction model were estimated after assessing and validating the model based on the data. According to results of the study, human resource and the size of the government have the greatest impact on economic growth in the long term. Moreover, technology spillover has both short-term (0.10) and long-term (0.19) impact on value addition of the sports industry in Iran; however, long-term impact is much more striking. Since the estimated model is in the logarithm style, these coefficients indicate that if technology

spillover increases by 1 percent, then the value added to sports will increase 0.1 percent in the short term (less than one year), and 0.19 percent in the long term.

The results of this study coincide with the results of Krueger's study (1983), Khan and Reinhart (1990), Lee (1994), Marchionatti & Usai (1998), Sebastian (2007), Ugur (2008), Shah Abadi & Sadjadi (2011), and Mehrizi and Elahi (2012). Krueger's study (1983) mentioned that the reduction in import of capital goods will reduce the GDP growth rate. Khan and Reinhart (1990) stated that in addition to export, import of capital and intermediate goods can also have a positive and significant effect on economic growth. Lee (1994) revealed that the higher proportion of imported capital goods leads to positive and significant impact on per capital income of developing countries. Marchionatti & Usai (1998) stated that the variable of technology spillover has had positive impact on economic growth in Italy by import of capital goods. Ugur (2008) found that while there is a mutual relationship between GDP and import of capital goods and raw material, there exists a one-way relationship between GDP and the import of consumer and other goods and the mainstream is from GDP to the import of consumer goods. The results of Chen and Dang (2012) showed a positive and significant relationship between import and export and economic growth. Shah Abadi & Sadjadi (2011) investigated the effects of technology spillovers by import of intermediate and capital goods. Based on the findings of their study, the accumulation of foreign research and development through import of capital and intermediate goods has positive and significant impact on economic growth. Safdari et al. (2012) found that export has a negative effect on the gross domestic product. Also, the intermediary goods have a positive relation with the gross domestic product. On the other hand, the results of this study are consistent with the results of Lee's study (1994), as he stated that increase in imports of capital goods in developed countries will lead to lower economic growth. Comparison and analysis of these coincide and consistent studies reveal that import of capital and intermediate goods in developed and developing countries has different effects on economic growth.

CONCLUSION

The findings show that import of capital and intermediate goods creates the context for increased productivity in Iran's sports sector by facilitating access to the required intermediate agent and global technologies for organizations. By facilitating the import of capital and intermediate goods, manufacturers of the sports section can have access to international knowledge both tangibly (in the form of capital goods) and intangibly (in the form of designs). Shortage of skilled manpower, lack of appropriate infrastructure for innovation, and insufficient technology for the production of sports products (compared to developed countries) are the main reasons for technology import to Iran. Although import of consumable goods may have negative effects on economic growth of the sports industry in Iran, the import of capital and intermediate goods can result in considerable economic growth.

APPLICABLE REMARKS

- Based on the results, it can be suggested that technology spillover should increase through the import of equipment and raw materials for the production of sports goods.
- However, spillover technology has a positive impact on economic growth. It is suggested that import of consumable goods must decrease.

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