Caspian Journal of Environmental Sciences
Online ISSN: 1735-3866
Print ISSN: 1735-3033

The role of environment and social capitals in Iranian economic growth

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ABSTRACT

To date, only labour force and physical capital have been considered as factors of production in neoclassical growth patterns. But recently, the creation of differences in the level of production and income among countries, beyond the difference in physical capital, has led to more dimensions of the variable of capital being investigated. These explorations led to the arrival of variables of human and social capitals into a growth model. This study aimed to analyse the role of various types of capital in the Iranian economy. Hence, the neoclassical growth model and the data of period between 1974 and 2012 were used. Types of capital were added to physical capital, including human, social, and environmental capitals. The environmental capital was considered as carbon dioxide emission costs. The variables representing social capital included access to the internet as well as access to the telephone. In the case of human capital, three variables were used including literacy rate, enrolment rate in elementary school, as well as the students number. It was also assumed that technology, in addition to the workforce, would appear in the form of physical capital. The findings exhibited that physical capital was the most important factor in the growth of Iranian economy. However, a very small role was played by the variables of human and environmental capitals. The role of social capital has been estimated to be relatively acceptable and positive, which is about one- third to one-quarter of physical one.

Keywords: Economic growth, Social Capital, Environmental Capital. JEL classification: O14, O45, R2.

INTRODUCTION

Despite the design of various indicators for human capital, meaning labor power, it is less discussed, while a major challenge for social and environmental capitals is observed. Hence, this section focuses on social capital and environmental issues. Social capital is a network of collective relations that unifies the relationship between human beings and organizations (Order & Yadipour 2008). In general, social capital forms a set of informal norms of institutions and organizations based on social relationships and networks, which have acquired a common knowledge, mutual trust, social norms, and unwritten rules (Ishi & Suuda 2009). Fukuyama (2000) defines social capital as the ability of individuals to work together for public purposes in groups and organizations. Many scholars define social capital as the trust and norms of citizenship groups and others define this concept as cultural values such as compassion, altruism, co-operation, and tolerance (Chou 2006). Putnam (1993) also places social capital as a social organization that has features such as trust, norms, and a network of relationships. With regard to social capital, its abstractness and measurement criteria have been considered more than its role in economic growth. For example, Knock & Kiefer (1997) introduced trust and civil norms as criteria for social capital. While Ishi & Suuda (2009), in addition to the variables of trust, used variables such as newspaper publishing per head, postage per head, and the number of radio networks. Despite the diversity in the indicators of social capital, the positive effect of social capital can be seen in numerous studies. For example, Nawk and the punishment between norms and economic growth evaluated positively. Bugsledik & Smolders (2004) also assessed the impact of

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

social capital on positive production in Europe. Findings reported by Ishi & Suuda (2009) for a diverse group of countries also indicate the positive role of social capital in economic growth.
In Iran, Rahmani & Amiri (2007) evaluated the effects of decreased social capital (trust) on economic growth in Iranian provinces to be negative and meaningful. In another similar study, Safdari *et al.* (2008) evaluated the number of closed cases of casualties, embezzlement and perpetual incitement as social capital indicators of the effect of increasing social capital on positive economic growth. Suri (1993) also evaluated the relationship between unsecured checks and economic growth negatively.
In order to achieve the target growth rate, it is necessary to identify the contribution of each of the determinants and to each of them in proportion to their role. This point is especially important in the Iranian economy, which has a low growth rate. The purpose of this study is to assess the role of capital types, including physical, human, social and environmental ones. So that, the neoclassical growth pattern was used. However, in comparison with the reviewed studies, it has two distinct contributions. First, it uses the environment as a productive input in the production function and explains its role in economic growth. Another contribution to the introduction of capital types in the growth pattern is in a situation where technology, in addition to crystallization in the form of labor, are considered as a skilled labor force in the form of physical capital.

MATERIALS AND METHODS

The first model: the generalization of capital to social and human capitals

The generalized model of Manqué, Roemer, and Weil (MRW) (1992) was used. This template consists of three types of physical, human, and social capitals, as shown herein, respectively. Subsequently, the workforce and the level of labor-intensive technology are added to it. When we use the flexible CES production function with the assumption of constant returns to scale, the Cobb-Douglas production function comes with the variables of physical, human, and social capitals, with parameters, and is obtained. Therefore, the Cobb-Douglas production function is in equation 1.

$$Y(t) = K_k(t)^{\alpha} K_h(t)^{\beta} K_s(t)^{\gamma} (A(t)L(t))^{1-\alpha-\beta-\gamma} \quad \textbf{(1)}$$

It is assumed that $\alpha, \beta, \gamma \in [0,1)$ and $\alpha + \beta + \gamma \in [0,1)$ and the depreciation rate for all kinds of capital with δ_i and the rate of savings for types of capital is shown with s_i and $i = k, h, s$ (Ishi & Suuda 2009). It is assumed that A and L grow as endogenous at rates of n and g. So we have:

$$L(t) = L(0)e^{nt} \quad \textbf{(2)}$$

$$A(t) = A(0)e^{gt}$$

Hence, effective labor $A(t)L(t)$ will grow at n + g rates (Manico *et al.* 1992). Now we can extract the solo equation for each unit of effective labor as follows.

$$Y(t) = K_k(t)^{\alpha} K_h(t)^{\beta} K_s(t)^{\gamma} (A(t)L(t))^{1-\alpha-\beta-\gamma} \quad \textbf{(3)}$$

The above equation is based on the effective workforce per capita:

$$y = \frac{Y(t)}{A(t)L(t)} = \left(\frac{K_k(t)}{A(t)L(t)}\right)^{\alpha} \left(\frac{K_k(t)}{A(t)L(t)}\right)^{\beta} \left(\frac{K_k(t)}{A(t)L(t)}\right)^{\gamma} \left((A(t)L(t)/(A(t)L(t)\right) \quad \textbf{(4)}$$

In order to simplify the above statement, we delete the following t:

$$y = \frac{Y}{AL} = \left(\frac{K_k}{AL}\right)^{\alpha} \left(\frac{K_h}{AL}\right)^{\beta} \left(\frac{K_s}{AL}\right)^{\gamma} (AL/AL) \quad \textbf{(5)}$$

The above equation in terms of per capita capital is as follows:

$$y = {k_k}^{\alpha} {k_h}^{\beta} {k_s}^{\gamma} \quad \textbf{(6)}$$

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

On the other hand, in the direction of balanced growth, the equilibrium of the types of capital is obtained as follows:

$$s_k f(k_k, k_h, k_s) = (n+g+\delta_k)k_k \qquad s_k y = (n+g+\delta_k)k_k \qquad \Rightarrow k_k = \frac{s_k y}{(n+g+\delta_k)} \tag{7}$$

$$s_h f(k_k, k_h, k_s) = (n+g+\delta_h)k_h \qquad s_h y = (n+g+\delta_h)k_h \qquad \Rightarrow k_h = \frac{s_h y}{(n+g+\delta_h)} \tag{8}$$

$$s_s f(k_k, k_h, k_s) = (n+g+\delta_s)k_s \qquad s_h y = (n+g+\delta_h)k_h \qquad \Rightarrow k_s = \frac{s_s y}{(n+g+\delta_s)} \tag{9}$$

We now put the equilibrium capital values in equation (6). Therefore, effective per capita income in long-run equilibrium is shown below:

$$\tilde{\tilde{y}} = \left((\frac{s_k}{n+g+\delta_k})^{\alpha} (\frac{s_h}{n+g+\delta_h})^{\beta} (\frac{s_s}{n+g+\delta_s})^{\gamma} \right)^{\frac{1}{1-\alpha-\beta-\gamma}} \tag{10}$$

The depreciation rate is assumed to be the same for all types of capital (Ishi and Suuda, 2009). So for every i, $\delta_i = \delta$ and assume that $\ln A(t) = \ln A(0) + g_t$ and $\ln A(0) = \alpha + \varepsilon$ that is $\varepsilon \approx N(0, \sigma_{\varepsilon}^2)$. The logarithm of the per capita income derived from relation (10) will be in the form of relation (11):

$$\ln\left(\frac{Y(t)}{L(t)}\right)^{*} = a + gt + \frac{\alpha}{1-\alpha-\beta-\gamma}\ln(s_k) + \frac{\beta}{1-\alpha-\beta-\gamma}\ln(s_h) + \tag{11}$$

$$\frac{\gamma}{1-\alpha-\beta-\gamma}\ln(s_s) - \frac{\alpha+\beta+\gamma}{1-\alpha-\beta-\gamma}\ln(n+g+\delta) + \varepsilon$$

Equation (11) is the extended mode of the MRW regression equation. This equation states that if a country is in long-term equilibrium in year t, the logarithm of per capita income can be a linear function of the savings rates for each type of capital, the effective labor force growth rate, plus depreciation $(n+g+\delta)$, a intercept $(a+gt)$ and component A randomized prediction is presented (Ishi & Suuda 2009).

Second Pattern: Physical Capital Functional Technology

In this generalization of technology, in addition to working in the form of labor, it is itself a function of physical capital. In other words, relation (2) will be as follows (Rao 2010):

$$A(t) = B_t K_{kt}^{\phi}$$

$$B(t) = B(0)e^{gt} \tag{12}$$

$$A(t) = B(0)e^{gt} K_{kt}^{\phi}$$

Now, for Equation (1), in which the environmental input of carbon dioxide emissions is not present, and inputs include types of capital and labor, the production function can be written as follows:

$$Y(t) = K_k(t)^{\alpha} K_h(t)^{\beta} K_s(t)^{\gamma} (B_t K_{kt}^{\phi} L(t))^{1-\alpha-\beta-\gamma} \tag{13}$$

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395 Received: Feb. 22. 2020 Accepted: July 06. 2020
DOI: 10.22124/cjes.2020.4283 Article type: Research

$$Y(t)=\frac{K_k(t)^{\alpha}K_h(t)^{\beta}K_s(t)^{\gamma}}{BL^{\alpha}BL^{\beta}BL^{\gamma}}(K_{kt}^{\phi})^{1-\alpha-\beta-\gamma}BL$$

The basic solo equation for each unit of effective labor will be based on Equation (14):

$$\left(\frac{Y(t)}{BL}\right)=(\frac{K_k(t)^{\alpha}}{BL^{\alpha}})(\frac{K_h(t)^{\beta}}{BL^{\beta}})(\frac{K_s(t)^{\gamma}}{BL^{\gamma}})K_{kt}{}^{\phi(1-\alpha-\beta-\gamma)}(\frac{BL}{BL}) \quad \textbf{(14)}$$

So

$$\dot{\tilde{y}}=k_k^{\alpha}k_h^{\beta}k_s^{\gamma}K_{kt}{}^{\phi(1-\alpha-\beta-\gamma)} \quad \textbf{(15)}$$

Now, in order to reach the variable capital per capita, the effective labor force of K is divided into effective labor force as follows:

$$\dot{\tilde{y}}=k_k^{\alpha}k_h^{\beta}k_s^{\gamma}\left[K_{kt}{}^{\phi(1-\alpha-\beta-\gamma)}\right]/\,BL^{\phi(1-\alpha-\beta-\gamma)}.BL^{\phi(1-\alpha-\beta-\gamma)} \quad \textbf{(16)}$$

$$\dot{\tilde{y}}=k_k^{\alpha}k_h^{\beta}k_s^{\gamma}k_k^{\phi(1-\alpha-\beta-\gamma)}.BL^{\phi(1-\alpha-\beta-\gamma)}=k_k^{\alpha+\phi(1-\alpha-\beta-\gamma)}k_h^{\beta}k_s^{\gamma}.BL^{\phi(1-\alpha-\beta-\gamma)}$$

$$\dot{\tilde{y}}=k_k^{\alpha+\phi(1-\alpha-\beta-\gamma)}k_h^{\beta}k_s^{\gamma}.BL^{\phi(1-\alpha-\beta-\gamma)} \quad \textbf{(17)}$$

In long-term equilibrium, effective per capita income in long-term equilibrium will be as follows:

$$\dot{\tilde{y}}=\left((\frac{s_k}{n+g+\delta_k})^{\alpha+\phi(1-\alpha-\beta-\gamma)}(\frac{s_h}{n+g+\delta_h})^{\beta}(\frac{s_s}{n+g+\delta_s})^{\gamma}\right)^{\frac{1}{(1-\alpha-\beta-\gamma)(1-\phi)}}BL^{\frac{\phi}{1-\phi}} \quad \textbf{(18)}$$

Also, given that $B(t)=B(0)e^{gt}$ we will:

$$\dot{\tilde{y}}=\left((\frac{s_k}{n+g+\delta_k})^{\frac{\alpha+\phi(1-\alpha-\beta-\gamma)}{(1-\alpha-\beta-\gamma)(1-\phi)}}(\frac{s_h}{n+g+\delta_h})^{\frac{\beta}{(1-\alpha-\beta-\gamma)(1-\phi)}}(\frac{s_s}{n+g+\delta_s})^{\frac{\gamma}{(1-\alpha-\beta-\gamma)(1-\phi)}}\right)(B(0)e^{gt}L)^{\frac{\phi}{1-\phi}} \quad \textbf{(19)}$$

Based on the above equation, we can write the equation corresponding to equation (11) as follows:

$$\ln\left(\frac{Y(t)}{L(t)}\right)^{*}=\frac{\phi}{1-\phi}\ln B(0)+\frac{\phi}{1-\phi}gt+\frac{\alpha+\phi(1-\alpha-\beta-\gamma)}{(1-\alpha-\beta-\gamma)(1-\phi)}\ln(s_k)+\frac{\beta}{(1-\alpha-\beta-\gamma)(1-\phi)}\ln(s_h)+$$

$$\frac{\gamma}{(1-\alpha-\beta-\gamma)(1-\phi)}\ln(s_s)-\frac{\alpha+\beta+\gamma}{(1-\alpha-\beta-\gamma)(1-\phi)}\ln(n+g+\delta)+\frac{\phi}{1-\phi}\ln L+\varepsilon \quad \textbf{(20)}$$

The third model: the generalization of capital to social, human and environmental capitals

In this model, in addition to the three types of capital presented in equation (1), the environment is also introduced as another type of capital. The generalization of the model (1) based on environmental capital can be written as follows:

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

$$Y(t) = K_k(t)^{\alpha} K_h(t)^{\beta} K_s(t)^{\gamma} BZ^{\lambda} (A(t)L(t))^{1-\alpha-\beta-\gamma-\lambda} \quad \textbf{(21)}$$

where BZ is an effective emission distribution that z is measured in terms of the physical input, and B includes technological reductions in emissions. Comparison of the above relation with relation (1) suggests that, in addition to capital and labor, there is another source that regulates the growth of production. This component BZ^{λ} is the same as itself consisting of two sentences Z, as well as component B, which modifies the decaying technology of propagation. This component is different from the technology component of the workforce. In fact, Z can be regarded as an environmental role in production, which has been introduced as an input into the production function. This means that a part of the production is environmental contribution. So that, the environment can also be regarded as a kind of natural capital (Zwolkas *et al.* 2007). In the absence of an optimal tax rate, the share of the publication can not be obtained through tax data. In these conditions, the share of publication in GDP can be considered to be equivalent to the share of carbon dioxide emissions. Therefore, if the final cost of the carbon dioxide emissions loss is equal p_z to, then the share of GDP's distribution for the year t will be as follows (Zooulkas *et al.* 2007):

$$s_{zt} = \frac{p_z Z_t}{GDP_t} \quad \textbf{(22)}$$

By describing the contribution of the publication and following the equations (5) and (6), we can now re-write equation (11) as follows:

$$\ln\left(\frac{Y(t)}{L(t)}\right)^{*} = a + gt + \frac{\alpha}{1-\alpha-\beta-\gamma-\lambda}\ln(s_k) + \frac{\beta}{1-\alpha-\beta-\gamma-\lambda}\ln(s_h) + \quad \textbf{(23)}$$

$$\frac{\gamma}{1-\alpha-\beta-\gamma-\lambda}\ln(s_s) + \frac{\lambda}{1-\alpha-\beta-\gamma-\lambda}\ln(s_z) - \frac{\alpha+\beta+\gamma+\lambda}{1-\alpha-\beta-\gamma-\lambda}\ln(n+g+\delta) + \varepsilon$$

In this way, the estimated equations of the study are equations (11), (20) and (23).

Variables and data

In this study, two variables such as Internet access rates and telephone rates were used as criteria for social capital. Also, for the human capital variable, three variables including literacy rates, initial enrollment rates and the number of students were used. These indicators are also presented in Samadi *et al.* (2012). The study period is from 1974 to 2012. The data used include capital investment rates, consisting of physical, human and social capital, per capita labor productivity, gross domestic product, and carbon dioxide emissions. To calculate the carbon dioxide emissions losses, the approximated losses were estimated by the World Bank (2004). The data used include the time series of the mentioned variables which was obtained from the central bank's database and Iran's Statistics Center.

RESULTS AND DISCUSSION

The study findings consist of three patterns. In the primary model, production factors include labor, physical, human, and social capitals. In the second model, the same production factors used in the first model are employed, except that technology is also a function of physical capital. In addition to the above mentioned types of capital, the environment is also considered as a type of capital. The second and third patterns are in fact a kind of extension of the first pattern. As mentioned earlier, for the human capital variable, three indices have been used, while in the case of social capital variable, two indicators were employed. Thus, each model has six different attributes, the difference being in the variable representing human and social capitals. At first, statistical behavior of the variables used was evaluated statically using root unit test. The stationary test results exhibited that all the variables used have a static behavior. The results of the aforementioned patterns are presented in Tables 1 - 3. Notably, the results of tables include the coefficient values of production function per capita, as well as the amount of production stroke relative to each type of capital. The coefficients illustrated in the upper part of the tables exhibit the contribution rate of return on each type of capital per capita production, while the production tension

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283
Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

amounts relative to types of capitals, including physical (α), human (β), social (γ) and environmental (λ) capitals are illustrated in the lower part of the tables. Considering that the purpose of growth pattern analysis is to achieve the tensions of production relative to each capital factors, therefore, focus has been made in the analysis of coefficient values of elasticity. Using the first-order interruption of the dependent variable, the generalized moment estimation method (GMM) was used because the dependent variable was interrupted leading to boredom (Baltaji 1995).

The first pattern

The results of the first model specification are presented in Table 1. The first pattern is of particular importance because the second and third ones are based on the generalization of the first one. In the first pattern, the physical capital tension was obtained at (-0.46) – (-0.028). In other words, by 1% increase in physical capital, production will be elevated at least 0.28%. In addition, physical, in comparison with other types of capital, leads to further aid in production. Unlike the physical capital, all three variables representing human capital have exhibited a negative contributions to the production in the Iranian economy. The absolute value of the human capital variable is higher at a higher level when used at primary school enrollment rates, but still exhibits a negative contribution. The absolute coefficient value of production stroke relative to human capital at the highest level is less than 0.18. A sample of such a relationship is reported by Modal (2011) for a group of developing countries, and also Manggi *et al.* (2009) and Taheri *et al.* (2012). Possible reasons for this may be the lack of conformity of the training with the production structure. This means that there may be a lack of adaptation between the training and skills that individuals acquire and also the production structure. Particularly in literacy, this will be truer because it is not expected that this training level will change into functional skills and showcase its production. Another reason could be a defect in the employment and unemployment systems in the relevant field. So that, there may be some evidence. For example, in terms of labor skills, the GTAP (World Trade Analysis Project) trade analysis matrix also highlights the proportion of unskilled workforce to skilled labor (2006, GTAP). Another example is the low share of the workforce with higher education in the country's employment. In the same vein, Jalil & Edris (2013), while referring to human capital expressive variables similar to those used in the present study, which exhibited a relatively small relationship between education and growth economics, considered effective economic growth in reaching different results about the impact of human capital on economic growth. In the case of the human capital variable, the highest sensitivity of production to this variable is obtained in the conditions that have been used for the rate of enrollment in elementary schools (recitals 5 and 6). Contrary to human capital, in the first model of social capital, in all the provisions, positive effect was observed by the coefficient in the range of 0.04-0.0. Therefore, social capital can be regarded as more important than human one. Relatively, the coefficients obtained for the phone access variable are higher than internet access. In all explanations, in order to reduce the level of self-correlation of sentences, the disturbance of the first-order interruption of the dependent variable is also used. The values of the coefficients of the Q statistics for the first and second order autocorrelations of the distorted sentences indicate that in all the assertions, self-correlation is acceptable. According to the good fitting factor, the sixth note can be distinguished from the other elements of the first model, since it is capable of substantially outlining other changes in the per capita production of labor force using the variables used. An important feature of this statement is that, in comparison with other definitions, it is relatively important for human capital, while reduces the role of physical one.

The second pattern

The second model clauses have a slight difference with the first group or first model specification. This means that in addition to being classified as a workforce, technology can also be realized in the form of physical capital. This assumption about the model ultimately leads to the creation of a new labor force variable. Given the similarity, the second model specification has been compared with the first one. The second model, which is, in fact, the very first model under the premise of "technology nationality of physical capital" has very different results. Thus, the physical capital efficiency is very low and at the highest level is less than 0.16 (Table 2), while in the first specification it is at least about 0.28 (Table 1). However, the role of human capital is low and not worthy of attention, and it is even less and less negligible than the first one. The role of social capital has been reached at a level below 0.05, and its role has declined in comparison with the first pattern. Thus, the assumption of "technology nationality from physical capital" in the Iranian economy has led to a decreased role of various

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283
Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

types of capital, i.e. physical, human and social ones, playing a more balanced role in effective labor force. Roemer (2012) and Ishi & Suuda (2009) reported that the return on physical capital is much higher for emerging economies and, therefore, should be treated with caution in dealing with the findings of the second model. The application of the above hypothesis in the second model leads to an increase in the explanatory power of the clauses. In this way, comparing the results of the tables 1-2, the increased coefficients can easily be obtained.

The third pattern

There is now another group of columns exceeding the first-order ones by adding only the environmental variable, compared to the first model. So that, once analyzing the results of the justifications in this model, the corresponding corrections of the first model are also employed. The findings of the third pattern are presented in Table 3.

In the third model, with the entry of the environmental capital variable, the fluctuation in the physical capital variable has also been increased, while in the third specification, the tensile of production relative to the physical capital or the return on physical capital is only about 0.13 in the fifth clause which increased about 0.25. However, in other column n it is in the range of 0-0.33, somewhat similar to the first pattern. In the fifth and sixth declarations, the return on physical capital is higher than the first one, while in other columns it is lower or at the level of correlation corresponding to the first pattern. In addition, in the fifth and sixth declarations, the return on physical capital is about 52. 0 and 0.40, respectively, above all other claims. The return on physical capital in the sixth form is important because of the good fit of this attribution. Human capital in this pattern is similar to the first one, but in some cases it is not statistically significant and, in addition, its absolute coefficient is low. In the case of most of the assertions, the absolute value of the coefficient of this variable is even lower than 0.05. Therefore, in the third model, the variables indicating human capital are of low importance. The role of the variables representing social capital is also generally strengthened in tandem with the first model, and its coefficient absolute value has slightly been elevated, except that of the first specification in other columns. Therefore, in the third model, which is also used as an environmental variable, in contrast to human one, the role of social one has been slightly strengthened. In any case, the increased social capital is expected to bring about 10% lower than 1% increased production in the Iranian economy.

The role of environmental capital has a positive tendency, which in most cases its coefficient is not significantly high. Nevertheless, auspicious assistance seems to be important although with a positive tendency of environmental capital variable. In sum, in the neoclassical growth model emerging as a technology in the form of labor, the role of environmental and human capitals are at a very low and negligible levels compared to the other types of capital, and in particular physical one. Among the clauses in the third model, the sixth statement could be described with higher explanatory capability, which according to this definition, would clearly indicate the sources of Iranian economic growth including physical and social capitals.

Conclusions and suggestions

This study aimed to analyze the role of capital types in the growth of Iranian economy. So that, the neoclassical growth model was used, while several cases of generalization and model development were also considered. At first, all types of capital were considered to be added to physical one, including human and social ones. In addition, in another part of the study, the role of the environment was considered as another type of capital called environmental one. From other aspects of the study, we considered technology as a function of physical capital. That is, technology, in addition to being fashioned in the form of labor, also appears in the form of physical one.

Despite the fact that the environment is of particular importance, this study revealed that it is currently not possible to take into account a very important role based on the defined variable, on recommended alternative variables. In this study, only for the positive effect of the variable environmental capital in the whole economy was partially defensible, but its statistical analysis and the magnitude of its coefficient were not significant. The environment shows the characteristics of public goods (Rosetta-Palma *et al*. 2010).

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

Table 1. The results of specifying the factors affecting Iran's economic output per capita - the first model.

variable		Specify1		Specify 2		Specify 3		Specify 4		Specify 5		Specify 6	
		Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation	Coefficient
intercept		***1.370	0.220	***1.373	0.185	*0.526	0.272	***0.301	0.130	285.1***	0.193	***2.29	0.033
Physical Capital Savings Rate		***0.779	0.051	***0.770	0.044	***0.467	0.056	***0.771	0.061	***0.727	0.021	***0.357	0.018
Human Capital Savings Rate (Literacy Rate)		-0.007	0.057	-	-	-0.113***	0.035	-	-	-	-	-	-
Human Capital Savings Rate (Student Change)		-	-	-047.0***	002.0	-	-	-0.064***	0.022	-	-	-	-
Human Capital Savings Rate (Elementary School Registration)		-	-	-	-	-	-	-	-	-0.261***	0.084	-0.226***	0.011
Social Capital Savings Rate (Internet Access)		-	-	-	-	075.0***	020.0	078.0***	010.0	-	-	150.0***	007.0
Social Capital Savings Rate (Telephone Access)		145.0***	036.0	158.0***	010.0	-	-	-	-	096.0***	010.0	-	-
First-time interruption of per capita production		362.0***	100.0	387.0***	070.0	850.0***	069.0	721.0***	043.0	547.0***	040.0	486.0***	008.0
Head-to-head investment variable		-917.0***	053.0	-880.0***	051.0	-429.0	058.0	-784.0	052.0	-562.0***	077.0	-281.0***	019.0
	R^2		-	753.0	-	683.0	-	469.0	-	340.0	-	877.0	-
Stats	Q(1)		-	60.2(27.0)	-	34.2(13.0)	-	73.3(06.0)	-	76.1(19.0)	-	77.1(19.0)	-
	Q(2)		-	51.2(11.0)	-	46.3(18.0)	-	78.4(10.0)	-	78.1(41.0)	-	85.1(40.0)	-
parameters	α	406.0***	017.0	409.0***	012.0	327.0***	028.0	432.0***	022.0	466.0***	030.0	279.0***	010.0
	β	-003.0	029.0	-025.0***	001.0	-080.0***	026.0	-036.0***	011.0	-167.0**	061.0	-176.0***	010.0
	γ	076.0***	019.0	084.0***	003.0	052.0***	015.0	043.0***	005.0	061.0***	006.0	117.0***	006.0

Source: The findings of the study, **, and ** were significant at 10, 5 and 1% respectively.

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

Table 2. The results of specifying the factors affecting Iran's economic output per capita - the first model.

variable		Specify1		Specify 2		Specify 3		Specify 4		Specify 5		Specify 6	
		Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation		Coefficient	Standard deviation	Coefficient
intercept			420.0	-984.2***	-984.2***	-988.2	399.2	-985.2	627.2	-985.2***	534.0	-984.2***	2481
Physical Capital Savings Rate			022.0	389.0***	389.0***	385.0***	044.0	388.0***	044.0	388.0***	024.0	390.0***	054.0
Human Capital Savings Rate (Literacy Rate)			013.0	-	-	019.0	067.0	-	-	-	-	-	-
Human Capital Savings Rate (Student Change)			-	-001.0	-001.0	-	-	-001.0	009.0	-	-	-	-
Human Capital Savings Rate (Elementary School Registration)			-	-	-	-	-	-	-	-001.0	049.0	-001.0	085.0
Social Capital Savings Rate (Internet Access)			-	-	-	062.0	048.0	067.0**	025.0	-	-	067.0***	027.0
Social Capital Savings Rate (Telephone Access)			010.0	066.0***	066.0***	-	-	-	-	067.0***	004.0	-	-
First-time interruption of per capita production			017.0	166.0**	166.0**	165.0*	091.0	166.0	119.0	166.0***	034.0	166.0***	044.0
Head-to-head investment variable			042.0	878.0***	878.0***	875.0***	209.0	878.0***	164.0	878.0***	041.0	878.0***	115.0
		R2	043.0	-288.0***	-288.0***	-301.0*	163.0	-288.0**	137.0	-288.0***	057.0	-288.0***	090.0
Stats	R^2	857.0	-	799.0	-	843.0	-	801.0	-	822.0	-	809.0	-
	Q(1)	62.1(21.0)	-	60.1(21.0)	-	02.0(89.0)	-	02.0(90.0)	-	28.1(26.0)	-	03.0(85.0)	-
	Q(2)	63.2(27.0)	-	37.3(19.0)	-	29.0(87.0)	-	30.0(87.0)	-	21.3(21.0)	-	31.0(86.0)	-
parameters	α	103.0***	021.0	153.0***	026.0	150.0*	083.0	153.0**	075.0	153.0***	010.0	153.0**	059.0
	β	035.0***	009.0	-001.0	020.0	013.0	045.0	-001.0	006.0	-001.0	034.0	-001.0	058.0
variable	γ	041.0***	006.0	046.0***	005.0	042.0	032.0	046.0***	016.0	046.0***	003.0	046.0**	018.0

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DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
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Table 3. Results of Affirmation of Effective Factors on Iranian Economy Production Per capita - Third Model.

variable		Specify1		Specify 2		Specify 3		Specify 4		Specify 5		Specify 6	
		Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation	Coefficient	Coefficient	Standard deviation		Coefficient	Standard deviation	Coefficient
intercept			342.0	081.1*	539.0	627.0	0.410	812.0***	145.0	235.1	481.1	982.2***	173.0
Physical Capital Savings Rate			101.0	889.0***	190.0	164.0***	029.0	602.0***	048.0	203.1*	711.0	702.0***	076.0
Human Capital Savings Rate (Literacy Rate)			093.0	-	-	-042.0	130.0	-	-	-	-	-	-
Human Capital Savings Rate (Student Change)			028.0	-050.0***	008.0	-	-	-015.0***	003.0	-	-	-	-
Human Capital Savings Rate (Elementary School Registration)			-	-	-	-	-	-	-	-138.0	363.0	-133.0	111.0
Social Capital Savings Rate (Internet Access)			-	-	-	**0.074	028.0	100.0***	010.0	-	-	202.0***	011.0
Social Capital Savings Rate (Telephone Access)			-	**0.152	0.059	-	-	-	-	214.0***	043.0	-	-
First-time interruption of per capita production			0.126	0.137	0.227	0.079	0.145	**0.062	0.022	0.041	0.652	0.001	0.102
Head-to-head investment variable			0.184	*0.533	0.260	***0.882	0.234	***0.480	0.080	0.470	0.835	0.086	0.084
		R2	0.208	-1.124*	0.105	-0.274***	0.068	-0.748***	0.052	-1.320	0.989	-0.772***	0.099
Stats	R^2	590.0	-	700.0	-	783.0	-	589.0	-	289.0	-	0.835	-
	Q(1)	82.2(10.0)	-	31.2(13.0)	-	39.1(24.0)	-	85.5(02.0)	-	31.1(26.0)	-	75.2(10.0)	-
	Q(2)	45.3(18.0)	-	32.2(31.0)	-	83.1(40.0)	-	88.5(06.0)	-	31.1(52.0)	-	35.3(19.0)	-
parameters	α	329.0***	018.0	417.0***	024.0	128.0***	020.0	344.0***	019.0	519.0***	090.0	396.0***	025.0
	β	095.0**	040.0	-023.0***	003.0	-033.0	101.0	-009.0***	001.0	-059.0	132.0	-075.0	061.0
variable	γ	011.0	013.0	072.0*	038.0	058.0**	022.0	057.0***	006.0	092.0*	051.0	114.0***	007.0
		113.0**	049.0	064.0	119.0	062.0	111.0	035.0***	012.0	018.0	273.0	000.0	057.0

Source: The findings of the study, **, and ** were significant at 10, 5 and 1% respectively.

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These characteristics may result in non-optimal allocation and, ultimately, the lack of statistical significance of the environment. In particular, as the primary part of the study has pointed out, in terms of environmental degradation and carbon dioxide emissions, environmental use in Iran is currently at a very high level. Another possible reason is the employed index type. Although carbon dioxide emissions are commonplace as a benchmark, it can be suggested as a recommendation for further studies to use alternative indicators. A review of studies shows that there is a challenge to select a representative variable in relation to the social capital over human one. It can be said that all the variables introduced for human capital are inherently desirable to express the qualitative nature of the workforce characteristic. However, in this study, human capital has not been found to play an important role. This could be due to inadequate training, or even lack of suitable field for utilizing the skills of the workforce. The small role of human capital can be a reflection of a revision in the educational system because in most of the clauses, though not statistically significant, the role of human capital was negative. This level of difference between the impact of social and human capitals on low production level is expected, but it exhibits the disproportion between the pattern of production and the qualitative characteristics of the workforce. In general, physical capital can be considered an important factor, and its returns are often highlighted in most of the clauses. This level of return, along with the promise of a high potential for economic growth, can be seen from the low accumulation of capital in the Iranian economy. In most of the claims, the return on physical capital was 0.3-0.4. Rahmani *et al.* (2007) have also evaluated similar efficiencies of the variable expressing physical capital. This finding is based on expectations. To date, generally, in wealthy economies, this figure is lower than 0.3, while in countries with a low capital accumulation rate is over 0.3 (Romer 2012). Accordingly, the potential for attracting foreign capital may also be referred to as a policy recommendation. In the neoclassical growth model, the estimated returns are assumed to be consistent with the fixed scale, and this assumption is applied in the form of a constraint. Therefore, variable returns may create differences in the explanation of the results. Under the aforementioned assumption, in most of the claims, over half of the production returns are attributed to the effective workforce, hence the workforce also plays a very important role in the production under the assumption. So that, Iishi & Suuda (2009) reported that the return on total capital types in different countries was about half the total return. However, in the present study, the return on physical capital was higher than the former study, such that lower human capital returns were achieved. Nevertheless, in studies such as Salehi (2002); Thinker Azar *et al.* (2009) and Rabiei (2009), a greater role was found for capital types. Thus, labor, has little effect on the economy, although its qualitative role, in the form of human capital, is doubtful. However, Anbi *et al.* (2011) believe that reducing the number of labor force in the economy is necessary for the increased human capital accumulation. Part of the labor role in the form of technology variable is crystallized, suggesting that a positive role for the sum of capital variables can implicitly explain the positive role of technology. In particular, it was found in the second model that the assumption of "functional technology of physical capital" is not acceptable and does not support the results obtained from this assumption.

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Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
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Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283

Received: Feb. 22. 2020 Accepted: July 06. 2020
Article type: Research

نقش محیط زیست و سرمایه‌های اجتماعی در رشد اقتصادی ایران

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(تاریخ دریافت: ۹۸/۱۲/۰۳ تاریخ پذیرش: ۹۹/۰۴/۱۶)

چکیده

تا کنون تنها نیروی کار و سرمایه فیزیکی به عنوان عوامل تولید در الگوهای رشد نئوکلاسیک در نظر گرفته می‌شدند. اما اخیراً ایجاد تفاوت در سطح تولید و درآمد در بین کشورها ، فراتر از تفاوت در سرمایه فیزیکی، باعث شده است تا ابعاد بیشتری از متغیر سرمایه مورد بررسی قرار گیرد. این کاوشها منجر به ورود متغیرهای سرمایه‌های انسانی و اجتماعی به الگوی رشد گردید. این مطالعه با هدف تحلیل نقش انواع سرمایه در اقتصاد ایران انجام شده است. از این رو، از مدل رشد نئوکلاسیک و داده‌های دوره بین ۱۹۷۴ تا ۲۰۱۲ استفاده شده است. انواع سرمایه از جمله سرمایه‌های انسانی ، اجتماعی و محیط زیستی اضافه شدند. سرمایه محیط زیستی به عنوان هزینه انتشار دی اکسید کربن در نظر گرفته شد. متغیرهای نشان دهنده سرمایه اجتماعی شامل دسترسی به اینترنت و همچنین دسترسی به تلفن بودند. در مورد سرمایه انسانی ، از سه متغیر شامل میزان سواد ، میزان ثبت‌نام در دبستان و همچنین تعداد دانش آموزان استفاده شده است. همچنین فرض بر این بود که فناوری علاوه بر نیروی کار ، در قالب سرمایه فیزیکی نیز ظاهر می‌شود. این یافته‌ها نشان می‌دهد که سرمایه فیزیکی مهمترین عامل رشد اقتصاد ایران است. با این حال، نقش بسیار کمی توسط متغیرهای سرمایه انسانی و محیط زیستی ایفا شد. نقش سرمایه اجتماعی نسبتاً قابل قبول و مثبت تخمین زده شده است، یعنی تقریباً یک سوم تا یک چهارم سرمایه فیزیکی.

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Bibliographic information of this paper for citing:

Zarei, S, Moosavi, N, Motamed, M.K. 2020, The role of environment and social capitals in Iranian economic growth. Caspian Journal of Environmental Sciences, 18: 383-395

Caspian J. Environ. Sci. Vol. 18 No. 4 pp. 383~395
DOI: 10.22124/cjes.2020.4283
Received: Feb. 22. 2020 Accepted: July 06. 2020
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