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The Impact of Human Capital and Natural Resources on the Per capita Income Convergence

Abstract

For hundreds of years, economists and scholars have been captivated by a phenomenon by which countries rich in natural resources regularly cannot utilize the resources for prosperity and economic development, and they may also suffer from stagnant inflation. A review of the classic theories of economics indicates that the abundance of natural resources and human capital leads to economic growth and, as a result, an increase in per capita income. The present study examined the impact of natural resources and human capital on the per capita income convergence of Asian countries which are members of the Economic Cooperation Organization (ECO) from 2000 to 2014. The results of the unit root tests of beta and sigma income convergence showed the per capita income convergence in the studied countries. This rate has increased to 0.28% regarding natural resources and human capital. Therefore, it should be noted that natural resources and human capital can increase the per capita income of the ECO countries and speed up their convergence.

Keywords: *Per capita income, Convergence, Human capital, Natural capital, Beta, Sigma convergence*

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Introduction

For hundreds of years, economists and scholars have been captivated by a phenomenon by which countries rich in natural resources (including countries dependent on oil in the Middle East) regularly cannot utilize the resources for prosperity and economic development, and they may also suffer from stagnant inflation. They are trying to explain that despite having the most natural resources, certain countries cannot convert this abundance into prosperity for their citizens. As far as economic growth and poverty are concerned, these countries' results are worse than those in countries that do not depend on natural resources. In the economic literature, a paradoxical situation in which countries with an abundance of non-renewable resources experience stagnant growth or even economic contraction is called the abundance of natural resources (the disaster of natural resources, the calamity of natural resources, the curse of natural resources) (Shahabadi & Spring 2013).

Alternatively, human capital and its development have long been one of the essential factors contributing to the development and economic growth, as well as the increase of per capita income in different countries.

These factors are associated with the countries economic growth and level of per capita income, and they can also result in per capita income convergence or non-convergence in similar countries. Consequently, examining these two important issues simultaneously may have a clear vision of the convergence of per capita income in the selected developing countries of the Middle East (Ebrahimi & Salarian, 2008).

A review of the classical theories of economics suggests that abundant natural resources and human capital lead to economic growth and increasing per capita income. Regarding the obtained results of studies conducted until the middle of the 20th century, abundant natural resources and increased human capital always facilitate economic growth and per capita income. However, during the last half-century, new studies have been carried out in this area, the results and observations of which are somewhat contrary to the classical view. Some economists, such as Sachs and Warner, found a negative relationship between economic growth and natural resources and regarded it as a natural resource disaster.

Solow Growth Model is a neoclassical growth model considering two-factor production functions with capital and labor as determinants of output. Besides, it added an exogenously determined factor, technology, to the production function. According to the Solow-related growth model assumptions, the long-term equilibrium growth is zero, and also there has been convergence in real per capita incomes across countries. On the other hand, the "endogenous growth theory," a novel theory of growth created in the 1980s, assumes that the equilibrium growth among many nations can be positive. Suppose technological advancement is endogenous and increases productivity. In that case, it can explain why capital frequently flows from poor to rich countries, even though the latter has low capital-to-labor ratios (Shahabadi & Sadeghi 2012).

In the 1990s, emphasis was placed on empirical applications (particularly the relationship between theory and data), including certainty assessments, incremental returns, R&D activity, technological expansion, and human capital. Roderick began working on growth and income bottlenecks in 2003, as well as growth dynamics, which include three geographic classifications, business integration, and institution

establishment, all of which are proximate determinants of growth.

The studies on income convergence can be categorized into two groups: those looking at the factors that influence it and those looking at the introduction of various test methods aimed at calculating per capita income. The latter group of studies has garnered the most interest from economists in recent years.

According to the preceding, no study on per capita income convergence and the impact of two human and natural resources on it has been undertaken in Iran, which has been examined in the current study.

Economic development will suffer if economic growth is improperly managed. Therefore, regarding the influence on reducing poverty, promoting human development, and ensuring sustainability, the quality of growth is just as crucial as the quantity of growth. Human development becomes significant at the level of the entire economy when growth requires an intermediary as a platform upon which the advantages of growth are perceived in people's lives.

On the other hand, economic growth provides resources that enable sustainable improvement in human development. In contrast, human development and improving the quality of people and labor in the economy drive economic growth. In other words, increased freedom and capability development will lead to improved economic performance, and human development plays an essential part in economic progress. On the other hand, a gain in income broadens the options available to households and the government, as well as their capacities. Hence, economic growth raises the level of human development. As can be seen, this is a theoretically significant positive relationship that can be isolated.

According to the concerns raised regarding the impacts of natural resources and human capital on the economy, as well as per capita income in the economic system, it can be seen that human development continually adds to the growth and increase of per capita income. Natural resources, such as oil, can, nevertheless, either positively or negatively affect economic growth and per capita income. The two components of human capital and natural resources are the most significant themes of production and, consequently, income in economic theories. The current study aimed to investigate this issue and the impact of these two sources on the convergence of per capita income in selected developing nations.

Method

A descriptive-applied study was conducted. After reviewing the library resources, the theoretical and research literature that has been developed around the topic in the field of economic science was examined to fulfill the objectives of this study. The World Bank and other readily available, trustworthy sources were utilized in this situation.

The sample size was a selection of Asian developing nations, while the statistical population was the entire world. From 2000 to 2014, the statistical population was gathered, extracted, and examined yearly.

It determined how the independent and dependent variables related to one another. Compound linear regression with the panel data approach was employed in this study. Panel data approach and Stationary tests were used to analyze the data of the current study.

The estimation approach with the highest explanatory power was employed in this study after determining the type of model that was used with panel data for the particular situation.

The Design of Study

Regarding the significance of convergence in per capita income and the cases examined in the previous section on the impact of per capita income convergence, the desired model has been stated using the approach of the ratio of changes compared to the base year. The conceptual model of Solow and Swan was used concerning those natural resources available to the studied countries as a resource.

Human resources have also been proposed as an endogenous development lever due to their prominence in endogenous growth models.

As a result, the experimental model of this study is based on the experiments conducted by Rahio et al. (2015) as follows:

$$\ln(\frac{y_{it}}{y_{i0}}) = \alpha + \gamma \ln y_{it} + \beta_1 \ln k_{it} + \beta_2 \ln L_{it} + \beta_3 \ln NR_{it} + \beta_4 \ln HC_{it} + \varepsilon_{it}$$

where the variable of per capita incomes and its growth is the dependent variable, Y_{i0} is the per capita income of the starting year here (2000) for country i in year t, K_{it} is the amount of physical capital of country i in year t, L_{it} is the number of the labor force of country i in year t, NR_{it} is the value of natural resources of country i in year t, and finally, HC_{it} is the human capital index of country i in year t.

Mekian and Khatami (2013) used the Stationary approach and the unit root test to investigate the economic convergence of the MENA countries as a part of the study of convergence tests in various studies.

As a result, the current study investigated techniques for assessing convergence utilizing the unit root method, as well as beta and sigma convergence, to have a better ability to find convergence in the countries under examination.

Results

The Investigated Variables

All the necessary data for this study were collected from the World Bank website (*www.worldbank.org).* The description of the used variables and their abbreviations are shown in Table (1).

Table1. Variables and Definitions

Variable	Unit of Measurement	Variable Definition	Symbol
Per capita domestic income	Dollar	GNI per capita (constant 2010 US$)	Y
workforce	Person	Labor force, total	L
Formed fixed capital	Dollar	Gross capital formation (constant 2010 US$)	K
Human Capital	Person	Secondary education pupils	HC
Natural resources	Percentage	Total natural resources (% of GDP)	NR

The Sample of Study

The sample analyzed in this study included selected Asian developing countries that are members of the ECO organization and have the most available data from 2000 to 2014, which were utilized to estimate the model.

Figure 1 depicts the situation of per capita income in the nations studied in this study; as can be observed, Turkey, Kazakhstan, and Iran have higher per capita incomes than other countries in the ECO region.

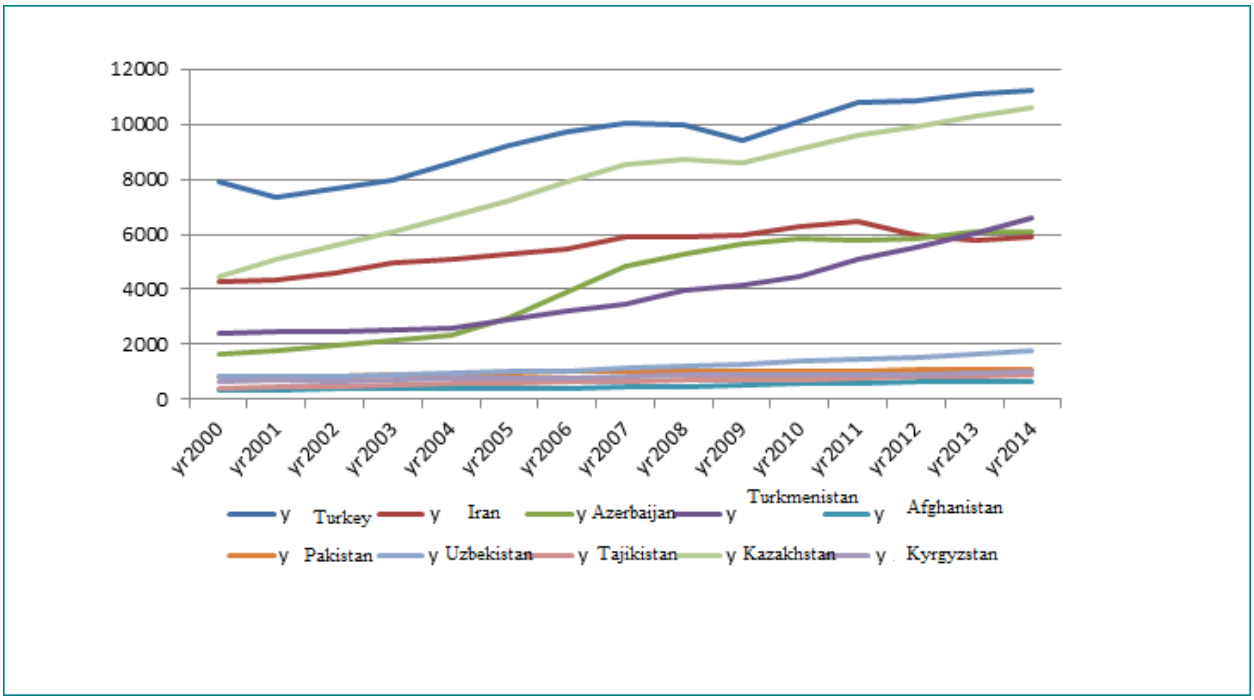

Figure 1. Per capita Income Series of Studied Countries

Unit Root Test of Panel Data (First Convergence Test)

The results of the mean test of the variables are shown in table 2.

Table 2. The Results of the Stationary Test of Variables by Lin and Levin Method (level)

Variable	Statistic Value	Test Probability
LOG(Y)	98-1.	20.0
LOG(K)	- 1.48	60.0
LOG(L)	- 4.28	000.
LOG(HC)	- 3.35	0.00
LOG(NR)	- 1.64	50.0

The Levin-Lin-Chu (LLC) Test results showed that all of the analyzed variables are significant, and there is no need to check for collinearity in these data. Furthermore, according to Levin, Lin, and Chu's unit root test, the stationary of the per capita income variable LN(y/y0) confirms the convergence theory.

Panel Data Diagnostic Tests

Using diagnostic tests, the type of model is first chosen before estimating the model (Chu and Hausman). The time constant effect model has first been estimated for Chu's test. The use of

the pooled least squares method was then disproved using Chu's test and Limer's F statistic. Additionally, the model is first estimated as a random effect before the Hausman test is carried out. The test results are summarized in table (3).

Table 3. Chu and Hausman Test Results

Fixed effects test (Chu)	The calculated value of F	P-Value	Result
	9.53	0.0000	Data based on panel approach
Hausman test	The calculated value of F	P-Value	Result
	66.25	0.0000	Fixed approach panel

Beta Convergence Test (Second Convergence Test)

The findings of the convergence study are shown in table (4), and it is evident that the estimated coefficient is negative and significant and indicates that the per capita income of the chosen countries is what is causing the fastest convergence rate.

Table 4. Beta Convergence Test

Explanatory variable	Coefficient	T statistic	Probability
C	0.40052	0.112391	3.563639
LOG(Y(-1))	-0.046308	0.014753	-3.138907

Sigma Convergence (Third Convergence Test)

The dynamics of the cross-sectional standard deviation of real per capita income in sigma convergence are studied to assess convergence directly. Figure 2 illustrates how the cross-sectional standard deviations of the countries under consideration have converged and decreased. According to Kovah and Forsiri's method, the hypothesis of Sigma convergence is thus supported because the actual per capita income cross-sectional standard deviation is falling.

This has helped to align and lower the ECO nation groups per capita income variance. The fact that the cross-sectional deviation has decreased and the fluctuations have also aligned in this figure further supports the idea of convergence.

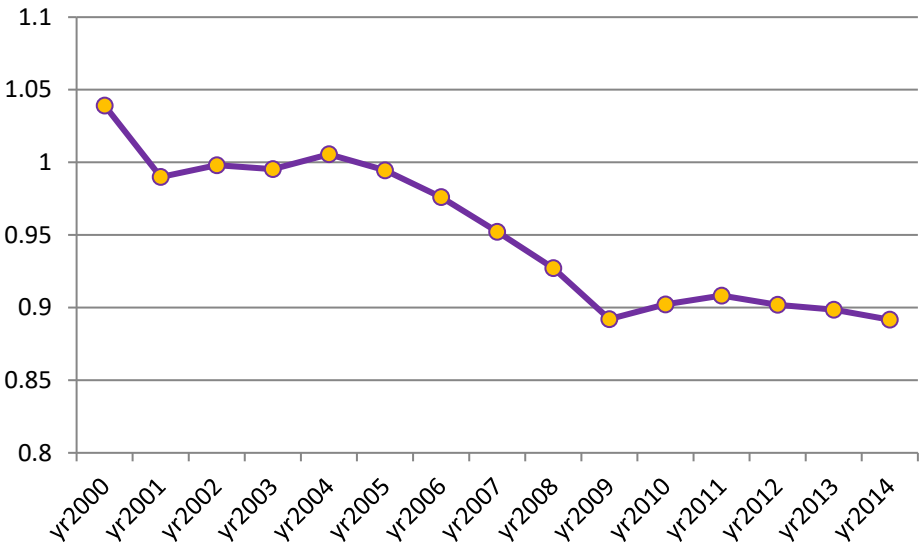

Figure 2. Sigma Convergence Test based on Cross-sectional Standard Deviation

The Solow and Swann approach, which is influenced by the production function, is used to continue the investigation of the convergence test using the sigma method. The primary goal of this study is to investigate this crucial issue as this model allows for the inclusion of production factors, including the human capital factor and natural resources. The Solow and Swan function model is applied in this study as follows:

$$\ln\left(\frac{y_{it}}{y_{i0}}\right)=\alpha+\gamma\ln y_{it}+\beta_1\ln k_{it}+\beta_2\ln L_{it}+\beta_3\ln NR_{it}+\beta_4\ln HC_{it}+\varepsilon_{it}$$

where the variable of per capita incomes and its growth is a dependent variable, Y_{i0} is the per capita income of the beginning year here (2000) for country i in year t, K_{it} is the amount of physical capital of country i in year t, L_{it} is the number of the labor force of country i in year t, NR_{it} is the value of natural resources of country i in year t, and finally, HC_{it} is the human capital index of country i in year t.

In this regard, the estimated coefficient of convergence rate and convergence speed over the research period equals the natural logarithm of the estimated coefficient of convergence rate.

The estimation results of the model in table 5 are estimated by the stationary effects method considering the variables of natural resources and human capital.

The estimated model's explanatory value is 99%, indicating that the independent variables can explain 99% of the fundamental per capita income changes, and the measured values for Durbin Watson and F-statistics, respectively, confirm the absence of autocorrelation among the model's residuals and the significance of the entire regression.

Table 5. Model Estimation Results

Explanatory variable	Coefficient	T statistic	Probability
LOG(Y(-1))	0.755	18.833	0.000
LOG(K)	0.039	3.136	0.002
LOG(L_F)	0.174	2.726	0.008
LOG(HC)	0.030	1.938	0.056
LOG(TNR)	0.020	2.576	0.012
C	-1.517	-2.266	0.026
Convergence rate	-0.28051		
$R^2 = 0.99$		Prob (F-statistic) =	
Durbin and Watson 1.7			

The convergence coefficient's value has turned positive and significant in this study, indicating a rate of convergence of 28% per period. Indicating the convergence in the per capita income of the countries examined in this research based on the inclusion of human capital and natural resources, the speed of adjustment has turned negative.

In the following, the hypotheses examined in this study have been interpreted separately.

Human capital positively and significantly impacts per capita income convergence in several developing countries.

In investigating the first hypothesis, the estimate model findings suggest that human capital increases per capita income and helps per capita income convergence in the analyzed countries. The estimated value of this coefficient is 0.3, indicating that per capita income in the analyzed countries rises by 0.3% for every unit increase in human capital.

By improving the workforce's capabilities and level of knowledge, investing in human resources can boost output in terms of quantity and quality while also maximizing the use of material capital. The majority of production factors and the knowledge-based economy are composed of skilled labor with knowledge and talents. A healthy and educated staff (human capital) can play the planning and directing function while contributing to the final product's quality. Higher-skilled workers are better equipped to change the production cycle's dynamics and technical advancements, boost output, grow their businesses, and generate higher economic growth as well as higher per capita income.

Natural resources have a positive and significant effect on the per capita income convergences in the selected developing countries.

Furthermore, the variable of natural resources in the studied countries has a positive and increasing effect on the per capita income and its convergence in such a way that with each increase of one unit in this variable, under stable conditions, the amount of per capita income increases by 0.2% and converges towards the long-term per capita income.

Since a significant portion of the gross domestic product and national income in the studied countries are derived from natural resources and their abundance, it is also important to note that the estimated coefficient is lower than that of human capital, demonstrating the unquestionable contribution of human capital to rising per capita income in the studied countries.

It is also evident that the labor force influences certain developing countries' per capita income convergences in a favorable and significant way.

The development of physical capital has a favorable and considerable impact on the convergence of per capita income in several developing nations.

Conclusion and Discussion

One of the requirements for trade liberalization is "regionalism," which, in its advanced stages, leads to economic and monetary cooperation before convergent political and security policies. Additionally, regionalism acts as deterrence and controls the peace and security of the region by facilitating the availability of peaceful solutions to potential member issues. As a result, the Economic Cooperation Organization (ECO), one of the key regional agreements, has set goals for reducing tariffs and expanding regional commerce. Based on the ECOTA trade agreement, ECO member nations are dedicated to removing trade barriers in the ECO region as soon as possible, developing intra-regional and inter-regional commerce, and eventually having all members join the World Trade Organization and integrate into the global trading system according to the notion of convergence, developing economies grow more quickly than developed ones. As a result, the per capita income in every economy equalizes. The concepts of the neoclassical growth model are the source of convergence in the literature on growth in economics. Neoclassical growth theory assumes that technology is a global public good and that all nations should experience the same long-term rate of

technological growth. This theory predicts a long-term trend towards convergence in production, per capita income, and total factor productivity among global economies. The law of diminishing returns slows investment in wealthy nations, but in impoverished nations, where capital returns are more significant, wealth is still being accumulated and concentrated. Additionally, commerce in products and the globalization of capital and labor mobility (inputs of production) enable market forces to converge toward global wage and profit rates and, consequently, towards a worldwide standard of living.

Based on this, it was attempted to investigate the convergence test in the chosen Asian countries of the ECO region in this study which concentrated on human capital and natural resources. The following hypotheses were looked at in this study based on the findings of the model's estimation.

The findings of Limer's F test indicated that the test data of the study were panel data, so the Hausman test was used to determine if stationary or random effects were present. The null hypothesis was rejected because, as previously noted, the calculated value of this test was less than the significance level of 5%. As a result, the panel variables confirmed by the Hausman test had stationary effects.

Four different tests were used to investigate convergence in the studied countries.

In the first investigation of the per capita income convergence, the unit root approach was used. Levin, Lin examined the reliability of the tested data, and Chu (LLC) test and the obtained results show the convergence in the per capita income of the studied countries. Also, in this section, the significance of other investigated variables was confirmed.

In the second investigation of convergence, the beta convergence approach was used, and the obtained results show the appropriate convergence rate in real per capita income.

The cross-sectional deviation approach is utilized in the third investigation of convergence, and the figure in this section also demonstrates the reduction of cross-sectional deviation of the researched countries and long-term convergence.

Finally, it was discovered that the coefficient of convergence has become positive and significant, with a rate of convergence of 28% in each period when focused on the values of human capital and natural resources. Since the adjustment rate has slowed, it shows convergence in the per capita income of the nations studied in this study, taking into account human capital and natural resources.

The estimation model's findings demonstrate how human capital increases per capita income and indirectly aids in the convergence of per capita income in the studied countries.

Furthermore, in the studied countries, the variable of natural resources has a positive and increasing effect on per capita income and its convergence in such a way that with each increase of one unit in this variable, the amount of per capita income increases by 0.2% and converges towards the long-term per capita income.

The findings of this study are consistent with those of Debrisi and Shahbazi et al. (2014) and support the theory of conditional convergence among ECO member nations. Additionally, compared to estimates from other studies, the pace of conditional convergence in the current study was calculated at 28%, a significant increase. Thus, it can be concluded that taking into account natural resources and human capital accelerates conditional convergence toward balanced growth and has a favorable impact on the regional convergence of ECO nations.

According to the findings of this study, it is advised that the ECO organization's policymakers and member countries create the environment for increased inter-country commerce by taking relevant steps.

As a result, implementing the targeted free trade zone in the ECO trade agreement can be effective, facilitating access to 400 million people's markets and creating beneficial external impacts in member nations.

There are no compelling reasons to support the effectiveness of this regional organization from the rising income disparity among ECO member nations or the frequency of sigma divergence. Therefore, it is suggested to conduct further in-depth research on the structural issues responsible for widening the income difference among ECO members.

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