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INVESTIGATION OF THE NONLINEAR EFFECT OF HUMAN CAPITAL ON ECONOMIC GROWTH

*Seyyed Abolhasan Shahidi Yasaghi
University of Payamnoor Qucan, Iran
*Author for Correspondence

ABSTRACT

In this research, we attempt to obtain the nonlinear effect of human capital on economic growth in Iran, the amount and type of this effect. Economic Development and growth has been always one of the important goals of developing countries. considering that the human capital is on of the important and irrefutable ingredient in order to the acceleration in economic development and growth. considering the estimated model, existence of the nonlinear effect of human capital on economic growth, has confirmed. This nonlinear effect is due to existence the overflow of knowledge. Hence we can say that the effect of human capital on economic growth in Iran for the various years is different. Therefore. The importance of human capital is not less than the physical capital. In this article, the research method is analysis- causal and estimation of model using the time series data relevant to Iran has been done. Considering the difference in the effects of human capital on economic growth in Iran for the various years, so it should be regarded in economic planning.

Keyword: Human Capital, *Economic Growth, Iran, Nonlinear Effect, Time Series*

INTRODUCTION

Speeding up in the economic growth process is tendency that there is in the developing countries. In this relationship, the determination of economic growth sources as one of the important economic indexes has been regarded always and many national activities and aims is regulated with this index.

Today increase the quality of human resources is one of the most important issues in the country, because the more production and higher quality is depends on an efficient work force. The investment in the human resource and the process of human capital formation enumerate the economic growth pivot.

The Problem Exposition

The concept of human capital and investment in human ability components, not utilize just for education and training, rather in general predicate to every activity that increase the quantity and productivity of the labor and then has caused increase in net income levels. In the subject of the constitutive components of the human capital, will be dealt to variation disjoints of investment in this type of capital.

The investment is the main element of the economic development and generally is all of the costs that have cause the saving, survival and increase in production capacity and also creating income. These costs are not only including the material investment in equipment, stocks and Natural Resources, rather are consist of human investment, research and development of education and training, research and development education and training, service, health and labor force mobility.

The most of economists are believed that in fact the lack of investment in human capitals is the main cause in descending economic growth level in the developing countries and until that countries can't promoted the education and training, using of the sciences and knowledge and professional skills, the labor revenue and efficiency and capital remain in low level and the economic growth accomplished slowly and with the heavy costs. In fact can express that the physical capitals will be more productive only when the country has a necessary quantities of human capital.

The economic growth is one of the goals that all country put it part of the main economic programs and use the various methods to reach it. Although economic growth is not only goal of communities in order to achieve the economic development, but obtained to the other desirable goals of development without a proper and constant growth rate is not possible. The one of the important factors and prerequisite in the economic growth of developing countries is provide the human capitals. The most of economists and

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hypothesis's in human force, have considered the enhancement of educational investment, is one of the determining factors in the economic growth of industrial countries.

Importance of the Issue

Many economists believe that costs which are spending to training the human force have an important role in economic growth of country. The opinion of these group of economists the high level of life, increase the efficiency of the labor force, control population growth, help to more fair the income distribution, is as results of the increase of investment in human capital. so in planning for economic development and forecasting the economic variables, the investment index play a great role.

With regard to the fact that Iran is one of the developing countries and with young population of the country, for having stable, continuous and long time economic growth, the investment and a different perspective to human capital is requires.

Some of the theorists in the human force, are believed that the purpose of the investment in human capital is achieve to human development as it means that with the increase in health, employment, safety and similar cases, the promotion and improvement of people efficiency takes form in order to the goals of comprehensive economic-social development in the society.

The Literature and a Review of the Studies Conducted

Human capital idea emanate the opinion of Adam Smith in the 1776 that he introduce the improvement in labour skills (for example with education) as a main source of individual incomes. In assertion of Smith the Promotion of skill to apply is one of the main factors that explain the difference between the payment and productivity. though the opinion of Adam Smith discussed more than two centuries ago, but only from decade 1930 , was began experimental studies in this field, as the first he was Schumpeter by definition the concept of entrepreneurship, introduce the human capital as a human capital as an important factor in the growth and development process of countries in decade 1920. In fact he introduced the human capital as a Supplement of material capital in the development of countries and he expressed this classic economics thought that the material capital storage is only actuating motor of growth and development in countries, is wrong.

But Walsh (1935) was the first person in the year 1935, who was investigated this question that "whether expenditures that the persons suffered for the professional jobs are a kinds of investment? ".

In fact with this question, he wanted to study that the mentioned expenditures carry out in the framework of the profit willing and market system with the motivation similar the investment in the conventional concept, or not. Final, he using the analysis of the cost-profit, achieve to this result that the investment in the professional educations carry out with an motivation similar the physical investment. With all these descriptions, from the decade 1960, when Schultz (1960) in own inauguration speech in the economic society of America (1961), analyze and interpret the educational expenses as a kind of investment.

The concept of human capital was entered in the economic literature and in this framework; Becker (1964) in his book under the title "human capital" developed the theory of the human capital formation and represented the method of efficiency analysis obtained due to the investment in human capital. He knows the main concept of human capital theory in increasing the generator and efficient capacity of individuals and believes that the increase in capacity, has Enhanced in the individual, on the other hand, the difference in incomes of people are mainly due to the difference in the quality of their work force. Also Ackrost Norwegian economist, in an article published in the 1959, the investment as an important and effective variable on economic growth and development of the countries, has entered in his analysis for the first time. He this assumed that the primary increase in national output is commensurate with the increase in physical capital, to be doubt and find that the quality of human factor is effective in production power of every production unit. In fact the missing link of Ackrost for explain the economic growth of the countries was the human capital variable. Hence for more justify of economic growth of the countries a third factor as the human capital in addition to the labor and physical capital, has entered into the production function.

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Research Objectives

The aim of this article is using the results and proposals related to the nonlinear effects of human capital on the economic growth in the economic decisions. One of the application aims of this research is using the results and proposals of this study in the allocation of costs and long-term investment in the education.

The Hypothesis of the Research

Human capital in the form of nonlinear relationship is effective on the economic growth.

The Research Method

Research method in this article is analysis- causal that at first with the library study on concept of human capital and its role in the economy and with regard to the different economic viewpoints and with the economic experimental study and perusing of the growth models we Investigate the nonlinear relationship of the human capital and economic growth by collecting the necessary information and data and then model will be estimated.

Collecting the information carry out from the collection of Central Bank accounts, statistics yearbooks of statistics center of Iran, Office of research and research supervision and deputy Presidential Strategic, and the economic reports in studied years. The information of non-oil gross production of the human capital and Employed force for Iran are related to years 53-85. Investigation and assess the finding and estimated model has been done by using the method of ordinary Least Squares.

The Validity of each econometric analysis depends on the amount of the ability to access the right data. Therefore it is necessary that in this debate to pay the nature of the sources and used data constraints.

Gross Domestic Production (GDP): Considering that the oil incomes are not mainly under the influence of the economic planning, to show the share of production factors and the economic growth are used the Gross domestic production minus the oil incomes. Information related to the gross domestic production without oil is extraction from the national accounts in relevant years. (The table number 1).

Physical Capital (K): The pure capital storeage to fixed prices of year 1997, that indicates the physical capital are extraction from the national accounts in relevant years. (The table number 1).

The Total Population Working (L): The information of this time series for years 1353-1375has been used from the article under the title" Alireza Amini "statistics estimated time seriesin Iran's economy, state's development programs and budget magazine, July 1379, fifth year No. 3" and for the reminder years extracted from the statistics yearbooks of statistics center.(The table number 1).

Human capital: it is the index related to human capital HDI or the human development index, that extracted from the from the international money files.(The table number 1).

To indicate the economic growth (AGDP) have been used from the growth of Gross domestic production to fixed price of years 1376physical capital (K), the pure capital storeage to the fixed price 76 years, The total population working (L) and the human capital or the human development index.

By applies the unit root test in order to stability of the average and variance of variables in model during the time, we can said that all model variables are static with the I(0).(tables number 4,5,6,7)

For checking the stability of data using the unit root test and Dicky Fuller, can be said that the economic growth (or growth of GNP, that is calculated with the difference of the GNP), the human capital growth (that is calculated with the difference of the human development index), physical capital growth (by using the difference of the capital stock logarithms is calculated) working growth (by using the difference of the working logarithms is calculated) will be stable and static. FindingsWith regard to the amount of 0/86 for R^2, it can be said that the non-linear effect of human capital on the economic growth has been confirmed (appendix3).

Considering the amount of 481 for independent variable D (LOG (HDI)), the effect of human capital on the economic growth for the years 1978-1990, that indicates the existence of positive effects.

With regard to the amount of 481 for independent variable D(LOG (HDI)) for the years of 1978-1990 and the amount of 209 for independent variable D(LOG (HDI)) DUM* for the years of 1991-2007, the non-linear effect of human capital on the economic growth can be conclude.

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The human capital compared to the physical capital has advantage because that theamortisement of human capital compared to physical capital is low, even by using more of the human capital, it can be improved, while decrease the amount and quality of physical capital, by using more of it.

In fact can said that the physical capitals only when more productive that the country have a necessary quantities of the human capital.

Tables, Figures and Graphs

Table 1: Used data in model

Year	K	HDI	L	GDP
1978	721424	0.44	9616906	219191
1979	752375	0.442	9891113	209919
1980	778031	0.45	9952539	178149
1981	796843	0.459	9993547	170281
1982	802396	0.464	10125616	191667
1983	832643	0.47	10330184	212877
1984	869026	0.478	10582891	208516
1985	872903	0.493	10795229	212686
1986	839373	0.498	11056033	193235
1987	834288	0.509	11358156	191312
1988	819473	0.519	11587768	180823
1989	827723	0.527	11947394	191503
1990	819894	0.536	12432854	218539
1991	860746	0.543	13096615	245036
1992	897888	0.552	13368340	254822
1993	926128	0.562	13507469	258601
1994	944143	0.569	13771563	259876
1995	959928	0.576	14087429	267534
1996	990738	0.584	14571572	283807
1997	1030557	0.591	15083200	291769
1998	1071840	0.598	15479030	300140
1378	1116355	0.601	16005643	304941
1999	1162139	0.619	16444490	320069
2000	1219032	0.627	16884018	330565
2001	1288511	0.634	17596223	357671
2002	1369087	0.641	18287178	385630
2003	1456503	0.652	18913317	410429
2004	1551748	0.66	19765000	438900
2005	1645973	0.674	20476343	467930
2006	1745489	0.684	20983200	499071

Table 2: The Estimated model
Estimation Command:
========================
LS (DERIV=AA)
GDP D(LOG(HDI)) D(LOG(K)) D(LOG(L)) DUM*D(LOG(HDI)) C MA(1) MA(2) MA(3) AR(2)
Estimation Equation:
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GDP = C(1)*D(LOG(HDI)) + C(2)*D(LOG(K)) + C(3)*D(LOG(L)) + C(4)*DUM*D(LOG(HDI)) + C(5) + [AR(2)=C(6),MA(1)=C(7),MA(2)=C(8),MA(3)=C(9),BACKCAST=1981,ESTSMPL="1981 2007"]

Substituted Coefficients:
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GDP = 481.43172481*D(LOG(HDI)) + 108.729895232*D(LOG(K)) + 163.52329594*D(LOG(L)) - 272.318811491*DUM*D(LOG(HDI)) - 8.99734890889 + [AR(2)=-0.437311857884,MA(1)=1.0265436487,MA(2)=1.24142866157,MA(3)=0.565465340523,BACKCAST= 1981,ESTSMPL="1981 2007"]

Dependent Variable: AGDP
Method: Least Squares
Date: 09/16/11   Time: 01:16
Sample (adjusted): 1981 2007
Included observations: 27 after adjustments
Convergence achieved after 36 iterations
MA Backcast: 1978 1980

	Coefficient	Std. Error	t-Statistic	Prob.
D(LOG(HDI))	481.4317	82.12363	5.862280	0.0000
D(LOG(K))	108.7299	36.00190	3.020116	0.0074
D(LOG(L))	163.5233	75.58392	2.163467	0.0442
DUM*D(LOG(HDI))	-272.3188	96.73660	-2.815054	0.0115
C	-8.997349	2.626798	-3.425215	0.0030
AR(2)	-0.437312	0.116088	-3.767082	0.0014
MA(1)	1.026544	0.176208	5.825751	0.0000
MA(2)	1.241429	0.082849	14.98426	0.0000
MA(3)	0.565465	0.161832	3.494143	0.0026
R-squared	0.858225	Mean dependent var		4.037037
Adjusted R-squared	0.795215	S.D. dependent var		5.502807
S.E. of regression	2.490198	Akaike info criterion		4.923803
Sum squared resid	111.6195	Schwarz criterion		5.355748
Log likelihood	-57.47134	Hannan-Quinn criter.		5.052243
F-statistic	13.62027	Durbin-Watson stat		1.677022
Prob(F-statistic)	0.000003			
Inverted MA Roots	-.23+.96i	-.23-.96i	-.58	

Chart 3: Table and Graph of the estimated model

Obs	Actual	Fitted	Residual
1981	-4.40000	-1.89679	-2.50321
1982	12.6000	14.1165	-1.51649
1983	11.1000	11.7487	-0.64869
1984	-2.00000	-2.12814	0.12814
1985	2.00000	5.18530	-3.18530
1986	-9.10000	-3.71681	-5.38319
1987	-1.00000	-0.81092	-0.18908

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1988	-5.50000	-4.97015	-0.52985
1989	5.90000	3.37267	2.52733
1990	14.1000	9.61046	4.48954
1991	12.1000	14.3221	-2.22211
1992	4.00000	2.97381	1.02619
1993	1.50000	-1.35753	2.85753
1994	0.50000	1.09961	-0.59961
1995	2.90000	1.84679	1.05321
1996	6.10000	4.07941	2.02059
1997	2.80000	4.78972	-1.98972
1998	2.90000	1.61058	1.28942
1378	1.60000	2.21225	-0.61225
1999	5.00000	5.40811	-0.40811
2000	3.30000	2.90426	0.39574
2001	8.20000	6.19487	2.00513
2002	7.80000	8.35219	-0.55219
2003	6.40000	8.07533	-1.67533
2004	6.90000	5.61718	1.28282
2005	6.60000	6.68087	-0.08087
2006	6.70000	5.35101	1.34899
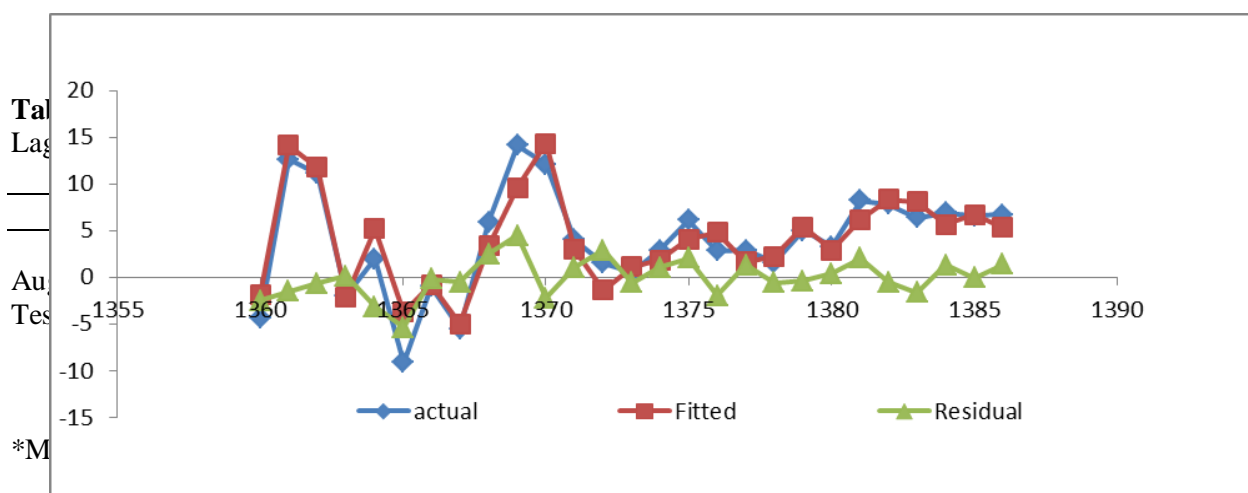
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AGDP)
Method: Least Squares
Date: 09/16/11 Time: 23:43
Sample (adjusted): 1981 2007
Included observations: 27 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
AGDP(-1)	-0.928503	0.192992	-4.811091	0.0001
D(AGDP(-1))	0.370073	0.172077	2.150626	0.0422
D(AGDP(-2))	0.204161	0.157847	1.293411	0.2087
C	3.549968	1.079247	3.289302	0.0032

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R-squared	0.524635	Mean dependent var	0.807407
Adjusted R-squared	0.462631	S.D. dependent var	6.587863
S.E. of regression	4.829265	Akaike info criterion	6.123219
Sum squared resid	536.4014	Schwarz criterion	6.315195
Log likelihood	-78.66346	Hannan-Quinn criter.	6.180304
F-statistic	8.461285	Durbin-Watson stat	2.219621
Prob(F-statistic)	0.000572		

Table 5: Unit root test for the physical capital logarithm
Null Hypothesis: DK has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.708596	0.0006
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DK)
Method: Least Squares
Date: 09/16/11 Time: 23:30
Sample (adjusted): 1364 1386
Included observations: 23 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
DK(-1)	-1.452807	0.254495	-5.708596	0.0000
D(DK(-1))	0.582618	0.205139	2.840112	0.0124
D(DK(-2))	0.669733	0.210264	3.185204	0.0061
D(DK(-3))	0.230826	0.172110	1.341152	0.1998
D(DK(-4))	0.365720	0.151519	2.413694	0.0290
D(DK(-5))	0.176630	0.147554	1.197052	0.2499
C	-0.036678	0.008971	-4.088322	0.0010
@TREND(1357)	0.004295	0.000745	5.766232	0.0000

R-squared	0.770740	Mean dependent var	0.000693
Adjusted R-squared	0.663752	S.D. dependent var	0.021216
S.E. of regression	0.012302	Akaike info criterion	-5.689827
Sum squared resid	0.002270	Schwarz criterion	-5.294873
Log likelihood	73.43302	Hannan-Quinn criter.	-5.590497
F-statistic	7.203975	Durbin-Watson stat	2.662640
Prob(F-statistic)	0.000706		

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Table 6: Unit root test for the working logarithm
Null Hypothesis: DL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.092564	0.0173
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DL)
Method: Least Squares
Date: 09/16/11 Time: 23:33
Sample (adjusted): 1981 2007
Included observations: 27 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
DL(-1)	-0.890486	0.217586	-4.092564	0.0004
D(DL(-1))	0.405067	0.179282	2.259392	0.0336
C	0.015162	0.004485	3.380461	0.0026
@TREND(1357)	0.000588	0.000276	2.132084	0.0439
R-squared	0.435633	Mean dependent var		0.000676
Adjusted R-squared	0.362020	S.D. dependent var		0.010030
S.E. of regression	0.008011	Akaike info criterion		-6.679993
Sum squared resid	0.001476	Schwarz criterion		-6.488017
Log likelihood	94.17991	Hannan-Quinn criter.		-6.622909
F-statistic	5.917880	Durbin-Watson stat		2.087448
Prob(F-statistic)	0.003803			

Table 7: Unit root test for the human capital logarithm
Null Hypothesis: D (LHDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.770729	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

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Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHDI,2)
Method: Least Squares
Date: 09/14/11 Time: 16:15
Sample (adjusted): 1980 2007
Included observations: 28 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
D(LHDI(-1))	-1.258762	0.185912	-6.770729	0.0000
C	0.010898	0.001720	6.336374	0.0000
R-squared	0.638099	Mean dependent var		-7.14E-05
Adjusted R-squared	0.624179	S.D. dependent var		0.004983
S.E. of regression	0.003055	Akaike info criterion		-8.675467
Sum squared resid	0.000243	Schwarz criterion		-8.580310
Log likelihood	123.4565	Hannan-Quinn criter.		-8.646376
F-statistic	45.84277	Durbin-Watson stat		2.024064
Prob(F-statistic)	0.000000			

Discussion and Conclusion
Considering the difference of the human capital effect on economic growth for the different years in Iran, therefore this subject in the economic programming must be regarded.

With regard to the increase in human capital index in Iran, why this increase is not due to the economic growth? This can be interpreted, that with the increase in education level of the society, they didn't accepted the jobs lower than their education due to the increase in the expectations of the university graduates.

Because of the direct role of the human capital in the production process and the human capital influence on the other production factors, regard to the human capital and the methods for promotion its quantity and quality that education and apprentice are enumerate the most important of its branches will be necessary that can provide the conditions for achieving a higher and stable economic growth.

The high level of life, increase the labor efficiency, the control of population growth and the help to more equitable distribution of income are results of the increase of investment in the human capital.

So in planning for the economic development and forecasting the economic variables, the investment index plays a great role.

The human capital compared to the physical capital has advantage because that the amortisement of human capital compared to physical capital is low, even by using more of the human capital, it can be improved, while decrease the amount and quality of physical capital, by using more of it.

In fact can said that the physical capitals only when more productive that the country have a necessary quantities of the human capital.

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