Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/01/jls.htm
2015 Vol.5 (S1), pp. 309-318/Elham and Sedaghat
Research Article

THE IMPACT OF HUMAN CAPITAL AND PRIVATE INVESTMENT ON ECONOMIC GROWTH

[*]Elham Khajehzadeh and Shahbaz Sedaghat
Department of Accounting, Payame Noor University (Pnu), Iran
**Author for Correspondence*

ABSTRACT
The objective of the current study is to investigate the factors =constituting the physical capital, human capital, and economic growth, and also, to analyze the relationships among them using conventional econometric methods and EVIEWS software. The study was conducted in Iran and the research data were used on an annual basis in order to estimate the model. The information and statistics were gathered from Journal of Iran's Central Bank and documental and library references. According to the assumptions stated in the research, the findings demonstrate that investment development in the private sector and human capital development index both have positive and significant effects on the growth rate of actual Gross Domestic Product (GDP) per capita. Increase in actual GDP per capita growth rate and human capital development index both positively and significantly affect investment development index of private sector. An increase in actual GDP per capita growth rate also leads to augmentation of human capital development index.

Keywords: *Human Capital, Private Investment, Economic Growth*

INTRODUCTION
Human capital is one of the most substantial factors in economic and social growth, and, the economic/social growth in turn enables further promotion of human capital. Economic/social growth and development have been among the important goals of all countries, especially during the last 50 years.
In the developing countries, this concept signifies alleviation or elimination of poverty, and alternatively, it means making efforts to enhance Gross Domestic Product (GDP), promotion of people's living standards to the level of well-developed nations. Investment is regarded as the leading factor of economic progress, and in the general concept, represents all expenditures which result in preservation of production dimensions besides enhancement of production capacity as well as generation of revenue (Salehi, 2009) Investment on human resource and the process of human capital formation and its exceeding influence on growth of economic variables have been the matter of discussion among economic development theorists.
Human capital contributes to promotion and improvement of production capacity of the society's individuals. And, the process of human capital formation positively influences the increase of added value in different sectors of economy.
On the other hand, continual and consistent expansion of exports is achieved on the grounds of economic growth and development, and, it is only possible via a process in which the scientific and technical fundamentals of production have been completely transformed.
The economists and sociologists unanimously agree on the fact that the only factor which will ultimately determine the orientation, path and rate of economic/social growth and development of a society is the human resources of that society, and not its physical capitals or natural and material resources. Therefore, the essential prerequisite of blossoming and prosperity in any society is reliant on development of its human capital and fostering of its human workforce.
Development of human capital provided by instruction or training of young people, will lead to facilitation of technology transfer and industrial progress (Emadzadeh and Hashemian, 1994). The research works carried out by World Bank for 92 industrial and developing countries indicate that the natural capital averagely accounts for 20% of the country's wealth whereas this figure is 16% and 64% for physical and human capitals, respectively (Vikram and Shwar, 1993).

Following different investigations and tests, Shultz (1961) proved the hypothesis that the development key is the human not material resources. He accentuates the crucial fact that the exceeding growth during 1929-1959 in USA has been mainly due to an increase in the human wealth accumulation, in turn a result of the investments made on human force in the fields of hygiene, health and so on, contributing to improvement of manpower's efficiency (Schultz, 1961).

In Iran, excessive reliance on petroleum revenues and negligence about promotion of human workforce quality through education led to doubts concerning sustainable economic growth in the country because continual increase of production and its sustainability is possible through productivity growth and technologic transformation and the only means to attain this goal is perpetual instructions aimed at improvement of efficiency and people's skill level (Amini and Hejazi, 1999). Human capital and surplus of private physical capital can lead to sustainability in economic growth even in absence of technological advancement and population growth. Private sector investment causes enhancement of technology level in the whole economy. Increase in private investment will contribute to improvement of economic growth in sustainable state. In addition, private sector investment enables formation of a linkage between imported technology and economic growth (Abadi, 2009). The objective of the research is to determine the mutual and interactive effects of private investment and human capital and economic growth in Iran.

MATERIALS AND METHODS

Data Analysis Method

Econometric modeling of time series is based on stationarity assumption of variables. Based on this assumption, variance and covariance of variables remain constant along the time and are actually independent of time. In case of absence of stationarity assumption, i.e. non-stationarity of variables in time series, use of t and F statistics is misleading and it will be highly likely that the acquired result is merely a fake regression and no actual and equilibrium economic relationship exists. Therefore, it is necessary to check the stationarity of variables. In unit root test, stationarity versus non-stationarity of variables is tested. Augmented Dickey-Fuller test is used in the present project to check the stationarity of model variables, and, Akaike and Schwarz-Bayesian criteria are employed for determining the optimal lag. The number of co-integration vectors is also determined based on Maximum Eigen-value Test and Trace test. If I (1) and I (0), self-explanatory model with distributed lags will be applied. In this method, economic analyses can be performed in both short-run and long-run intervals 1. And if I (1), all variables are endogenous and Johansen method will be applied.

Stationarity Test

Augmented Dickey-Fuller test was used to check stationarity of variables. Tables (1) and (2) show test results on model variables in surface approach with y-intercept and in surface state with y-intercept and time trend.

Table 1: Results of Stationarity Test of Variables in Surface Approach with Y-intercept

Result	Prob .	**Computational statistic**	**Variable**	
Non-stationary	0/79	-0/81	Actual GDP per capita growth rate	y-n
Non-stationary	0/8	-0/78	Private sector's investment development index	$\frac{I_K}{Y}$
Non-stationary	0/2	-2/20	Capital investment development index	$\frac{I_H}{Y}$
Non-stationary	0/99	1/12	Population growth rate	N
Non-stationary	0/97	0/38	Workforce growth rate	l

Table 2: Results of Stationarity Test of Variables in surface approach with y-intercept and time trend

Result	Prob .	Computational statistic	Variable	
Non-stationary	1/54	-0/79	Actual GDP per capita growth rate	y-n
Non-stationary	0/4	-2/29	Private sector's investment development index	$\frac{I_K}{Y}$
Non-stationary	0/99	-0/18	Capital investment development index	$\frac{I_H}{Y}$
Non-stationary	0/12	3/09	Population growth rate	N
Non-stationary	0/95	0/76	Workforce growth rate	L

None of model variables are stationary in surface response. Hence, for the variables that are not stationary in surface response, Augmented Dickey-Fuller test is performed on their first-degree difference. For the first-order difference, these variables have a larger absolute value of computational statistic than the absolute value of the table at significance level of 5%. They become stationary and turn into I (1) by differencing once. The results of the respective test are included in Tables (3) and (4).

Table 3: Results of stationarity test of variables in the first-order difference with y-intercept

Result	Prob .	Computational statistic	Variable	
stationary	0/0003	-5/07	Actual GDP per capita growth rate	y-n
stationary	0/08	-3/28	Private sector's investment development index	$\frac{I_K}{Y}$
stationary	0/005	-5/28	Capital investment development index	$\frac{I_H}{Y}$
stationary	0/03	-3/18	Population growth rate	N
stationary	0/000	-5/98	Workforce growth rate	L

Table 4: Results of stationarity test of variables in the first-order difference with y-intercept and trend

Result	Prob	Computational statistic	Variable	
stationary	0/002	-5/19	Actual GDP per capita growth rate	y-n
stationary	0/02/	-3/15	Private sector's investment development index	$\frac{I_K}{Y}$
stationary	0/000	-5/87	Capital investment development index	$\frac{I_H}{Y}$
stationary	0/01	-4/19	Population growth rate	N
stationary	0/000	-8/19	Workforce growth rate	L

Stationarity Test with Structural Break

Perron believes that most of macroeconomic time series lack the unit root characteristic and the reason of unit root and non-stationary behavior of most macroeconomic variables is the researcher's lack of attention to structural break in the trend of respective variables. In the event of structural break, the y-

intercept of trend function might change the slope of trend function as well as the y-intercept and slope of time trend function. Here, Perron's method was used for performing this test.

Table 5: Results of Perron's structural break test for the variable "y-n"

Test result	**Critical value**	**Computational** τ	**Results of Perron's Structural Break Test for variable y-n** **Year of Structural Break: 1989** $\lambda = .37$	
Non-stationary	-3/56	-3/27	y-n =2/47-/50DU-/03DT+/06T+ 0 /38 y-n (-1)	Trend
Non-stationary	-3/43	-3/21	y-n =4/51-/17DU-/79DTB+/082T+ +/25 y-n (-1)	y-intercept
Non-stationary	-4/04	-3/52	y-n =7/09-/62DU-/51DT-/87DTB+ /14T + /20 y-n (-1)	y-intercept and trend

Table 6: Results of Perron's structural break test for the variable "$\frac{I_K}{Y}$"

Test result	**Critical value**	**Computational** τ	**Results of Perron's Structural Break Test for variable** $\frac{I_K}{Y}$ **Year of Structural Break: 1989** $\lambda = .37$	
Non-stationary	-3/56	-2/28	$\frac{I_K}{Y}$=5/34-/33DU+/75DT-/21T+/34$\frac{I_K}{Y}$ (-1)	Trend
Non-stationary	-3/43	-2/57	$\frac{I_K}{Y}$=1/42-/64DU-/13DTB+/74T+/88$\frac{I_K}{Y}$ (-1)	y-intercept
Non-stationary	-4/04	-2/42	$\frac{I_K}{Y}$=1/76-/17DU-/92DT-/58DTB+/32T+/43$\frac{I_K}{Y}$ (-1)	y-intercept and trend

Table 7: Results of Perron's structural break test for the variable "$\frac{I_H}{Y}$"

Test result	**Critical value**	**Computational** τ	**Results of Perron's Structural Break Test for variable** $\frac{I_H}{Y}$ **Year of Structural Break: 1989** $\lambda = .37$	
Non-stationary	-3/56	-1/62	$\frac{I_H}{Y}$=1/23-1/5DU +/21DT+/01T+/87$\frac{I_H}{Y}$ (-1)	Trend
Non-stationary	-3/43	-1/64	$\frac{I_H}{Y}$=2/08-/42DU-/73DTB+/36T+1/77$\frac{I_H}{Y}$ (-1)	y-intercept
Non-stationary	-4/04	-1/55	$\frac{I_H}{Y}$=1/20-/74DU+1/7DT-/3DTB+/3T+4/86$\frac{I_H}{Y}$ (-1) 5	y- y-intercept and trend

Table 8: Results of Perron's structural break test for the variable "n"

Test result	Critical value	Computational τ	Results of Perron's Structural Break Test for variable n Year of Structural Break: 1988 $\lambda = .31$	
Non-stationary	-3/87	-2/46	n=1/40-/05DU-/08DT+/14T+/68n (-1)	Trend
Non-stationary	-3/76	-/90	n=/71-/03DU+ /24DTB+/01T+/90n (-1)	y-intercept
Non-stationary	-4/17	-2/69	n=1/58+/02DU-/06DT+/18DTB+/13T+/65n (-1)	y-intercept and trend

Table 9: Results of Perron's structural break test for the variable "l"

Test result	Critical value	Computational τ	Results of Perron's Structural Break Test for variable l Year of Structural Break: 1978 $\lambda = .21$	
Non-stationary	-3/80	-3/24	l=6/17-/40DU-/43DT+/63T+ /21l (-1)	Trend
Non-stationary	-3/77	-3/16	l=4/78-/63DU-/75DTB+/32T+ +/55l (-1)	y-intercept
Non-stationary	-3/99	-3/64	l=6/53-/36DU-/76DT-/83DTB+/13T+/40l (-1)	y-intercept and trend

As observed absolute value of τ computational statistic is greater than absolute value of critical value of Perron's test statistic at significance level of 5%. Thus, null hypothesis cannot be rejected in any of these cases and it is accordingly concluded that our data are not stationary. In addition, it is illustrated by the results that the structural break didn't occur in the data and results of Dickey-Fuller test are still applicable.
Finally, the results of stationarity test of variables are summarized in Table (4-6) which indicates all variables are I (1).

Table 10: Results of Stationarity Test of Variables

Result of stationarity test	Variable
I(1)	Actual GDP per capita growth rate
I(1)	Private sector's investment development index
I(1)	Capital investment development index
I(1)	Population growth rate
I(1)	Workforce growth rate

Analyzing the Long-Run Relationships between Model Variables using Johansen's Test
All the variables in this time series are I (1). Therefore, Johansen's method shall be used as it is designed for I (1) variables. In fact, the respective method is suitable for determination and testing of co-integrating

relationships between time series variables and demonstrates the relationships between the variables. Using this test, the presence of co-integrating relationship between model variables can be examined.

Determining Degree of Vector Auto-Regression Model

To carry out Johansen's test, above all it is significant to determine the degree of vector auto-regression model. For this purpose, Schwarz Bayesian and Akaike measures are used and the point where the lowest value of this test occurs is accepted as the optimal lag.

Table 11: Result of Optimal Lag Determination Test of Vector Auto-regression (Model 1)

HQ	SC	AIC	Lag
2/04	2/27	1/94	0
-4/71	-2/90	-5/45	1
-7/01	-3/60	-8/55	2
-6/83	-2/27	-6/33	3

Table 12: Result of optimal lag determination of vector auto-regression (Model 2)

HQ	SC	AIC	Lag
-2/46	-3/36	-2/51	0
-3/57	-3/96	-3/32	1
-5/01	-4/86	-5/31	2
-4/69	-3/15	-4/95	3

Table 13: Result of optimal lag determination of vector auto-regression (Model 3)

HQ	SC	AIC	وقفه
-5/64	-4/77	-3/56	0
-6/21	-5/69	-5/31	1
-7/23	-6/51	-6/15	2
-9/06	-7/63	-7/57	3
-7/76	-6/25	-5/33	4

The optimal degree of VAR model in the present research is 2 for the first and second models and 3 for the third model based on three information criteria namely: Schwarz-Bayesian, Akaike, and Hannan-Quinn.

Co-Integration

Co-integration test 2 deals with analysis of long-run relationship of variables and enables the researchers to verify the likelihood of long-run relationships between non-stationary variables, which is asserted by economic theories. Different tests are used to test co-integration; one method is to apply Johansen-Juselius test. This method provides two validation tests for recognition of convergence vectors, including: statistics of Trace Test 3 and Maximum Eigenvalue Test 4.

Estimation of Long-Run Relationship and Extraction of Co-Integrating Vectors using Johansen-Juselius Method:

To obtain the long-run relationship of variable in this method, presence of co-integration and number of co-integrating relationships are initially determined using two statistics of Maximum Eigenvalue and Trace tests. In Maximum Eigenvalue test, the null hypothesis "absence of co-integrating relationship" is tested versus "presence of a co-integrating relationship" whereas "presence of one or less co-integrating relationship" is tested versus "presence of two co-integrating relationships". The Trace test also respectively tests "absence of co-integrating relationship" versus "presence of one or more co-integrating relationships" and ""presence of one or less co-integrating relationship" versus "presence of two or more

co-integrating relationships". The corresponding hypothesis will be accepted if the statistic obtained from the test of these variables exceeds the critical values at significance level of 5 % and number of co-integrating vectors is inferred in this way. In the next step, the vectors are normalized based on one of arbitrary variables.

Table 14: Test of determining number of co-integrating relationships (Model 1)

Rank		**Trace test**		**Maximum Eigenvalue Test**	
Null hypothesis H_0	Opposite hypothesis H_1	Computational statistic	Critical value at 95% level	Statistic	Critical value at 95% level
=0 r	r=1	425	379	342	286
r<1	r=2	386	351	289	275
r<2	r=3	328	336	245	249

Table 15: Test of determining number of co-integrating relationships (Model 2)

Rank		**Trace test**		**Maximum Eigenvalue Test**	
Null hypothesis H_0	Opposite hypothesis H_1	Computational statistic	Critical value at 95% level	Statistic	Critical value at 95% level
=0 r	r=1	336	328	245	229
r<1	r=2	315	304	227	215
r<2	r=3	284	391	206	209

Table 16: Test of determining number of co-integrating relationships (Model 3)

Rank		**Trace test**		**(Maximum Eigenvalue Test)**	
Null hypothesis H_0	Opposite hypothesis H_1	Computational statistic	Critical value at 95% level	Statistic	Critical value at 95% level
=0 r	r=1	679	652	224	206
r<1	r=2	645	638	165	157
r<2	r=3	609	318	128	136

Maximum Eigenvalue Test (λmax) and Trace Test (λtrace) suggest presence of 2 co-integrating vectors for all three models. In another statement, there are two linear combinations of the endogenous variables of actual GDP per capita growth rate, private sector's investment development index, human capital development index, population growth rate, and workforce growth rate, which are all stationary. The results of co-integrating vectors are presented in the tables below.

Table 17: Co-integrating vectors estimation results (Model 1)

Second Vector Normalized	First Vector Normalized	Variable
1	1	Actual GDP per capita growth rate
1. 10	0. 33-	Private sector's investment development index
.820	.650	Capital investment development index
-0. 2	0. 049	Population growth rate
1. 42	3. 75-	Workforce growth rate
0380/	540/	$\sum e^2$

Table 18: Co-integrating vectors estimation results (Model 2)

Second Vector Normalized	First Vector Normalized	Variable
1	1	Actual GDP per capita growth rate
-2/24	0/36	Private sector's investment development index
1/35	1/21	Capital investment development index
-2/87	0/25	Population growth rate
3/46	-1/6	Workforce growth rate
0/76	0/07	$\sum e^2$

Table 19: Co-integrating vectors estimation results (Model 1)

Second Vector Normalized	First Vector Normalized	Variable
1	1	Actual GDP per capita growth rate
0/23	2/41	Private sector's investment development index
0/65	-1/87	Capital investment development index
-1/64	2/76	Population growth rate
-0/91	0/33	Workforce growth rate
0/05	0/46	$\sum e^2$

Since two co-integrating vectors and two normalized vectors were acquired, it means that two long-run equilibrium relationships exist between the variables. With regard to earlier discussions, the second vector has the expected signs in the first and third model whereas the first vector has the expected signs in the second model because positive relationships are clearly observed between the endogenous variables i.e. actual GDP per capita growth rate, private sector's investment development index, and human capital development index. The results obtained from the table are completely in alignment with theory. Based on the results presented in the first model, one can conclude that one percent of increase in the value of private sector's investment development index is followed by an increase of 1.1% in actual GDP per capita growth rate. Also, one percent of increase in human capital development index leads to an increase of 0.82% in actual GDP per capita growth rate.

Granger's Causality Test

This test was proposed by Granger with respect to causality of variables and is based on the important assumption that significant information for prediction of any variable is exclusively embodied in its own time series data. Granger states that since future cannot be the cause of the past or present, if the current

values of At are predicted by the past values of Bt, it can be asserted that Bt is the Granger cause of At and the converse statement is true as well. In another words, it can be stated that the variable BT is the cause of variation in at if it can predict at with its past values and vice versa.
The performed tests include estimation of the following regressions:

$$A_t = \sum_{i=1}^{n} \alpha_i B_{t-i} + \sum_{j=1}^{n} \beta_j A_{t-j} + u_{1t}$$

$$B_t = \sum_{i=1}^{\mu} \lambda_t B_{\tau-t} + \sum_{j=1}^{n} \delta_j A_{T-j} + u_{2t}$$

Table 20: Results of Granger Test

Dependent variable	Independent variable	Chi-sq	Prob.	Causality
y-n	$\frac{I_K}{Y}$	8/57	0/01	$\frac{I_H}{Y}\longrightarrow$ y-n
y-n	$\frac{I_H}{Y}$	18/66	0/000	$\frac{I_H}{Y}\longrightarrow$ y-n
$\frac{I_K}{Y}$	y-n	10/15	0/000	y-n $\longrightarrow\frac{I_K}{Y}$
$\frac{I_K}{Y}$	$\frac{I_H}{Y}$	12/33	0/000	$\frac{I_H}{Y}\longrightarrow\frac{I_K}{Y}$
$\frac{I_H}{Y}$	y-n	8/21	0/01	y-n $\longrightarrow\frac{I_H}{Y}$
$\frac{I_H}{Y}$	$\frac{I_K}{Y}$	`16/48	0/0000	$\frac{I_K}{Y}\longrightarrow\frac{I_H}{Y}$

The acquired results demonstrate that there are mutual causal relationships between the endogenous variables i.e. actual GDP per capita growth rate, private sector's investment development index, and human capital development index. In other words, all three variables have significant and positive effects on each other.

Error Correction Model

The major error correction models (ECM) are those which link the long-run fluctuations of variables to their long-run equilibrium values. When two variables are co-integrating, there exists a long-run equilibrium relationship between them. There might be some disequilibrium in the short run however. Such models are in fact some sort of partial equilibrium models in which the effective forces in short run and the rate of approach to the long-run equilibrium values are measured via inserting stationary residue from a long-run relationship.
The estimation results are observed in the table below:

Table 21: Results of Error Correction Model

Prob .	آمارهt	ضریب	Variable
0/03	-3/847	-0/080	Actual GDP per capita growth rate
0/01	-4/126	0/120	Private sector's investment development index
0/05	-3/253	0/050	Capital investment development index
0/02	-3/67	0/001	Population growth rate
0/04	-3/43	0/006	Workforce growth rate
0/05	-3/283	0/127	ECM

0/72 R-squared:	08.14 F-statistic:
Adj. R-squared:0/73	

If the error correction coefficient appears with a negative sign, it represents rate of error correction and tendency toward long-run equilibrium. The respective coefficient shows what percentage of disequilibrium of the dependent variable in each interval is equilibrated and approached to the long-run relationship.

In the second vector, the coefficient ECM (-1) equals -0.12 and according to t-tests statistic, it is significant with a high degree of confidence. Therefore, there is a short-run relationship between model variables. The coefficient represents the error correction part. Economic growth is shifted 12% annually toward the equilibrium. Consequently, the coefficient of equilibration term reflects a low rate of convergence toward long-run equilibrium.

Conclusion

Private sector's investment development index and human capital development index both positively and significantly affect actual GDP per capita growth rate. Increase in both of actual GDP per capita growth rate and human capital development index leaves positive and significant impacts on private sector's investment development index. Also, an increase in actual GDP per capita growth rate causes improvement of human capital development index.

REFERENCES

Amini Alireza, Zohreh Hejazi Azadeh (1999). The role of human capital and R & D in raising total factor productivity and output growth in the economy. *A Business Research* (10) 143-130.

Emadzadeh Mostafa and Hashemian Masood (1994). *Journal of Management* 24 34.

Salehi Malek (2009). The impact of human capital on economic growth in Iran. Thesis (Master of Economics) Islamic Azad University of Shiraz.

Schultz TW (1961). Investment in Human Capital. *American Economic Review* **51**(1) 1-17.

Shah Abadi Abolfazl (2009). Section of private capital and endogenous growth (Case of Iran), a scholarly quarterly helpful (31) 13- 32.

Vikram N and Shwar AD (1993). *A New Database on Physical Capital Stock: Sources, Methodology and Results* **8**136-167.