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THE IMPACT OF HUMAN CAPITAL AND INNOVATION DETERMINANTS ON ECONOMIC GROWTH: EVIDENCE FROM GEORGIA

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Abstract

The hyper-competitive global economy of the twenty-first century has become an era of innovation, technology, productivity, new knowledge, and skills, focused on sustainable and inclusive growth. Human capital is one of the fundamental factors for ensuring sustainable and inclusive growth. The process of human capital formation is long and is influenced by many factors. Its measurement is one of the actual issues. The negative effects caused by the pandemic were added to the humanitarian, economic, logistical, and other types of problems caused by the Russia-Ukraine war, which took on a global character and affected all countries of the world with more or less severity.

This study aims at providing a theoretical concept of human capital measurement and innovation activity indicators. The paper studies the role of human capital and innovation activity for a country's development based on the experience of Georgia. For this purpose, multiply regression models have been built and evaluate. The empirical results based on models and coefficient's significance suggests causality between human capital, innovation activity and the economic growth of Georgia: Contribution of human capital and innovation activity to economic growth is essential.

Keywords

Human Capital; HCI; Government Expenditure in Education; Innovation Activity; Economic Growth; Econometric Model

JEL Classification: A10, B4, C51, H52

Introduction

Recognizing both economic and non-economic aspects, the OECD proposed a broad definition of human capital as "*The knowledge, skills, competencies, and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being*" (OECD, 2001). This definition has obtained wide acceptance.

Schultz (1961) introduced the term "Human capital" and referred it to as the value of human capabilities. He declared that human capital is not dissimilar to other types of capital, it could be invested in various ways such as education and training. It means that the more education and training, the higher the accumulated human capital stock is. As a result, such investment will generate higher productivity, raising individuals' earnings and consequently in the higher aggregate level of production, and so does the income on a national level.

Human capital was generally defined into five categories: Health facilities and services: On-the-job training; Formally organized education at the elementary, secondary, and higher levels; Study programs for adults; Migration of individuals and families to adjust to changing job opportunities. In other words, the concept of human capital refers to the abilities and skills of human resources of countries, while human capital formation refers to the process of acquiring and increasing the number of people who have the skills, good health, education, and experience that are crucial for economic growth. Thus, investment in education and health are considered as human capital components (Totladze, 2020).

At the same time, the activation of innovative processes can be considered as a concomitant process of human capital transformation. Accordingly, the main cycles of transformation of human capital, related to the accumulation and use of knowledge, determines the activity of innovative processes. Education and knowledge capital is the main factor of the formation of human capital for the innovative development of the national economy. People's ability to create innovations, their further realization, and management depends on factors, among which can be distinguished: features of general, secondary, and higher education (length of education at different levels, educational programs, quality of education in schools and higher education institutions, cognitive indicators of education level assessment), i.e. These are the characteristics that determine the accumulation of human capital in the country. In the other words, indicators like patents-residents, patents-nonresidents, researchers in research and development activities, high-technology exports, scientific and technical journal articles, number of citations, registered new trademarks in the country, high-tech export can be considered as human capital measurement, as well innovation activity determinants on a macro level (Totladze L., Khuskivadze M., 2019).
Human capital affects growth through two mechanisms. Firstly, human capital directly participates in the production process as a productive factor. In this sense, the accumulation of human capital would directly generate the growth of output. Secondly, human capital can contribute to raising technical progress and increase innovation activity. In this way, the level of human capital affects productivity growth. The main objective of this study is to examine the relationship between human capital, innovation activity, and economic growth (Totladze L. 2020).

The Methodological Framework

The contribution of human capital to economic growth has been accepted by theoretical models and empirical studies. The main methodological problems are choosing the indicator used to measure human capital. In the other words how to measure human capital. There are three approaches to human capital measurement.

The Cost-Based Approach

Among direct measurement approaches, the approach measures human capital by looking at the stream of past investments undertaken by individuals, households, employers, and governments. The cost-based approach is relatively easy to apply, because of the ready availability of data on both public and private expenditures in formal education. In terms of a mathematical formula, the cost-based approach can be expressed as the following.

$$C = \sum_{j=1}^{r} c_j = \sum_{j=1}^{r} \left[\sum_{i=t=1}^{m} s_i^e / (1+r)^i \right]_j$$

where C is the discounted total cost; *c* is the expected cost in the year j; *s* is the expected cost in the year i and *r* is the discount rate.

The Income-Based Approach

The approach measures human capital by looking at the stream of future earnings that human capital investment generates over the lifetime of a person. Hence, in contrast with the cost-based approach, which focuses on the input side, the income-based approach measures the stock of human capital by looking at the output side. This approach measures human capital by summing the discounted values of all future income streams that all individuals expect to earn throughout their working life or lifetime. Mathematically,

$$Y = \sum_{j=1}^{T} y_j = \sum_{j=1}^{T} \left[\sum_{i=1}^{m} w_i^e / (1+r)^i \right]_j$$

where Y is the discounted total expected income; y is the expected income in the year j; *ei w* is the expected income in the year i, and *r* is the discount rate.

The approach elaborated by Jacob Mincer is empirically implemented by explaining the logarithm of the wage of a worker from her/his educational attainment and labor market experience (which is another source of human capital formation) while controlling for a set of background characteristics such as gender, type of labor contract (e.g. full-time or part-time, fixed term or tenure), and sector of economic activity:

$$\text{Log}\,(wi,\,) = \alpha + \beta Si + \gamma Xi,t + \varepsilon i,t$$

where w is the gross hourly wage of worker I in year t, X includes background characteristics, γ is the regression coefficient of these background characteristics, α is a constant term, and ε is an error term. The term S indicates the schooling level of the individual, and regression coefficient β measures the private return to investment.

The schooling level S is often measured as the number of years of education. In that case, the quasi-elasticity β has a straightforward interpretation: it measures the % increase in the person's wage when (s)he would take an additional year of schooling. existing estimates of β are in the range of 5 to 15%.

The starting point is the idea that schooling is an investment in human capital, and this investment would generate a future return in the form of a higher wage for the individual.

The Output-Based Approach

This approach measures human capital by its output. In other words, several indicators that can sufficiently represent the stock of human capital as a whole or at least as a group might be employed as the proxy. It is important to note that this approach does not directly view human capital as accumulated. Rather, it tends to find a suitable indicator or index that reflects the amount of human capital of an economy or a group of people. They might be average years of schooling, literacy rate, enrolment rate, net enrolment, gross enrolment, or some other educational attainment indexes. The formula can be expressed below.

$$\overline{H} = \sum_i L_i H_i ,$$

Where *H* is human capital, *I L* is the proportion of the labor force with the ith level of education and *I H* is the number of years of schooling associated with the level of education.

The Indicators-based Approach

Recently several indicators are widely used for the measurement of human capital. 1. The UN Human Development Index (HDI), which combines measures of average achievements in a country in three basic dimensions of human development, i.e. health, education and knowledge, and standards of living. The structure of the index is constituted of health, knowledge, and standard living with many sub-variables such as adult literacy rate, life expectancy at birth, gross enrollment ratio, GDP per capita, etc. The Human Development Index (HDI) provides a single index measure that aims to capture three key dimensions of human development: access to knowledge, long and healthy life, and a sufficient standard of living; 2. World Bank Human Capital Index (HCI); 3. The PISA tests 15-16-year-old students for their cognitive skills in terms of reading, mathematics, science, and problem-solving; 4. The PIAAC, which tests adults for their competencies in terms of literacy, numeracy, and ability to solve problems in technology-rich environments. The PISA and the PIAAC are new measures and express the cognitive skills and abilities of students. The new approaches to human capital measurement clarifies what indicators can be considered to precisely measure more accurate human capital.

Many studies in economic literature show the channels through which human capital accumulation and education may lead to economic growth. One of the main methodological difficulties is choosing the proxy indicator used to measure human capital. Human capital is considered a fundamental factor for the research sector, where current research has a positive spillover for the productivity of future research. As is argued, R&D is intensive in human capital relative to other sectors that produce consumables and intermediate goods (Tiruneh M., Radvansky M. 2011).

Mankiw, Romer, and Weil (1992) have built a model to explain the growth endogenously by extending the Solow growth model to enlist human capital as a separate input from labor (known as MRW models). The variables in their model can be expressed in terms of efficiency unit of labor. Based on the similar production function and assuming that the country-specific shock is not correlated with the saving rate and population growth, the OLS estimation can be employed. They use an average percentage of working people in secondary school to proxy for human capital investment rate and other traditional variables as well as the baseline coefficients and establish relations among the variables through the so-called Augmented Solow model. The results show this model can explain over 67% of the cross-country difference in income per capita. Another interesting result is that poor countries tend to converge to a steady state faster than rich countries.

There are a lot of research papers that estimate the relationship between public funding of education and economic growth both in developed and transition countries.

Some results of Barro (1999) showed a positive link between education quality and economic growth. Gregorious and Ghosh (2007) made use of the heterogeneous panel data to study the impact of government expenditure on economic growth. Their results suggest that countries with large government expenditures tend to experience higher economic growth. Nonnemen and Vanhoudt (1996) use as a proxy in the MRW model, the share of education expenditure in GDP and they conclude that the relationship between human capital and economic growth is insignificant. Murthy and Chien (1997) as a proxy of human capital use a weighted average of the population registered in tertiary education, secondary and primary and they conclude that there is a significant positive and direct link with economic growth. Barro and Lee (1993), and Islam (1995) used as a proxy for human capital the average number of years of schooling of the population over 25 years. María Serena (2001) used as a proxy for human capital both individual income (assuming these increase as the accumulation of human capital increases) and the educational attainment of the population aged 25 years and over, as an average year of education (Pelinescu E. (2015). The positive impact of education quality more than quantity is highlighted by Hanushek and Woessmann (2007) and Hanushek and Kimbo (2000), who use as indicators of human capital the results of PISA and TIMS tests. Hanushek and Schultz (2012) for example showed that a deviation of 100 points in PISA test results may lead to a difference of 2 percentage points in the growth rate of GDP per capita (Izushi H., Huggins R., 2004). In many papers, because the average number of years of schooling is difficult to determine, this indicator was replaced by gross enrolment rate in primary, secondary, and tertiary school or by enrolment rate (literacy rate) (Pelinescu E. 2015).

The Model and Empirical Results

After analyzing above mentioned methods and indicators we applied a multiply regression model for evaluating human capital and innovation activity impact on economic growth in Georgia. We built econometric models and have used four different proxies for human capital accumulation and innovation activity: government expenditure on education, government expenditure on research and development, number of patents applied by residents, and number of trademarks. We considered government expenditure on education, government expenditure on research and development, as human capital proxies and the number of patents applied by residents, and the number of trademarks as innovation activity proxies. We have applied annual statistical data during the period 2000-2019 for Georgia. The data retrieved from databases of World Bank (https://ourworldindata.org/government-spending); the United Nations (https://unctad.org;) UNESCO (http://data.uis.unesco.org,) National Statistics Office of Georgia (http://Geostat.ge)and National Intellectual Property Center of Georgia (https://www.sakpatenti.gov.ge/ka /publications/).

At first, we test the dependence of GDP per capita on human capital accumulation by building a simple regression model. The y is used as the dependent variable while HC is used as the independent. Running the regression yields the results as follows:

$$Y = -44292,3082 + 36363,0064\ HDI, \qquad (1)$$

Where,
Y - is *GDP Per Capita Atlas Method (Current $)* in the country (GDP/capita is the real level of GDP per capita);
HDI – Human Capital Index.

The model is statistically significant with $R^2 = 0{,}91$. Regression coefficients also have statistical significance. A linear relationship at a 5 % level of statistical significance because the p-value of HC/beta is less than 0.10. This means that the growth rate of GDP causes human capital. To find which indicators of human capital contribute to economic growth we formulate a theoretical model as follows:

$$Y = bo + b1\ GOVE + b2\ GERD + b3\ NoP + b4\ NoTrM + U, \qquad (2)$$

Where,

Y - is *GDP Per Capita Atlas Method (Current $)* in the country (GDP/capita is the real level of GDP per capita);
GOVE - Expenditure on education as a percentage of total government expenditure %;
GERD - Government expenditure on R&D as a percentage of GDP;
NoP - Patents applications by residents;
NoTrM – Registered number of trademarks by residents.

The variables are generated as logarithmic values of the sum of GDP Real and expenditures on education and the number of patents. According to this method, we look for a line that minimizes the sum of squares of residues. For the estimated model we employ four explanatory variables, such as government expenditure on education, R&D expenditure, number of patents, and number of trademarks. The model estimates that:

$$Ln(Y) = bo + b1\ Ln(GOVE) + b2\ Ln(GERD) + b3\ Ln(NoP) + b4\ Ln(NoTrM) + U, \qquad (3)$$

The data used in this study is aggregate annual time series during the period of 2000-2019. The statistical methods utilized are the Ordinary Least Squares Method (OLS) and the Granger causality test. Before applying the Granger causality, standard tests such as unit root and co-integration were performed as well. We performed the regression by including all the variables in the model. Using Statistics dates, we obtain the following regression output represents in table #1

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Ln C	5,629388177	1,81050866	3,10928542	0,00829713	1,71802202	9,5407543
Ln (GOVE)	0,953458695	0,724460169	1,3160954	0,21087705	0,6116423	2,5185597
Ln (GERD)	-0,385547594	0,102127033	-3,7751767	0,00231396	-0,6061796	-0,164916
Ln (NoP)	-0,712554161	0,169310803	-4,208557	0,00102312	-1,0783279	-0,34678
Ln (NoTrM)	0,681211125	0,27538288	2,47368727	0,02794013	0,08628258	1,2761397

Table #1 - Source: The processing of the authors

The model is statistically significant with $R^2 = 0{,}91$. For cointegration testing we use the Engle-Granger test – variables are cointegrated. In the chosen logarithmic model, we find significant results for two of the explanatory variables - public expenditure on education and the number of trademarks by residents. The model revealed a negative relationship, statistically significant between GDP per capita and the innovative capacity of human capital (evidenced by the number of patents). Unexpected is the negative relationship between expenditure in R&D and GDP per capita. Therefore, our results should be interpreted in this context: The expenditure in R&D is not effective (An important factor is also migration). The regression outcomes could be improved with longer time series for human capital as human capital affects economic growth with an essential time lag.

Conclusions

In the presented paper, we have empirically investigated the extent to which investments in human capital accumulation and innovation activity have contributed to the growth dynamics in Georgia over the last decades. We have applied statistical data with random effects during the period 2000-2019. We have used four different proxies for human capital accumulation: government expenditure on research and development government expenditure on education and number of patents application by residents and the registered number of trademarks by residents.

The regression results found that the government expenditure on education in Georgia has a significant effect on Real Gross Domestic Product (RGDP). In this case, public financing of education is a true parameter of measuring economic growth. This paper suggests that education is not the only, or the major contributing factor to per capita GDP, there are other contributing factors.

To conclude, the relationship between R & D expenditure and economic growth needs to be built in the long run to have a positive correlation. Survey results have shown that increasing the amount spent on R & D does not necessarily lead to economic growth. Our main results support the argument that expansion of education expenditure has a positive effect on per capita GDP. Therefore, policymakers must pay more attention to the quality of education.

The regression outcomes could be improved with longer time series for human capital as human capital affects economic growth with an essential time lag. Accordingly, our results should be interpreted in this context. In the future, we will use the model as alternative variables for human capital.

An effective educational system obviously contributes to the scientific and technological achievements of the country. The high level of education of the population is a prerequisite for the development of demand for high-tech products and stimulates the creation of innovative products and processes.

Therefore, it is important to match the knowledge obtained in educational institutions and the demand for skills and qualifications of specialists in the labor market. In order to create the innovative sector of Georgia, it is necessary to commercialize existing scientific treatments and inventions, search for current innovations and stimulate demand for them. It is necessary for the revival of science and the improvement of the education system; the activation of innovative activities and their effective management should become a subject of systematic care of the state. A constant connection between science, business, and the state is necessary. The low ratings of Georgia's innovation potential and ability to absorb technologies, as well as the relatively low degree of involvement of enterprises in innovative activities, are due to the fact that the economy of Georgia is still developing in a non-innovative way.

Works Citation

Acemoglu, D., Johnson, S., Robinson, J. A., & Yared, P. (2005). From education to democracy? *The American Economic Review, 95*(2), 44-99. https://doi.org/10.1257/000282805774669916

Appiah E. N. (2017) The Effect of Education Expenditure on Per Capita GDP in Developing Countries. International Journal of Economics and Finance; Vol. 9, No. 10; https://doi.org/10.5539/ijef.v9n10p136

Hanushek, E. A., & Wößmann, L. (2010). Education and Economic Growth. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (Vol. 2, pp. 245-252). https://doi.org/10.1016/B978-0-08-044894-7.01227-6

Harpan I., Draghici A. (2014) DEBATE ON THE MULTILEVEL MODEL OF THE HUMAN CAPITAL MEASUREMENT Procedia - Social and Behavioral Sciences, #124;

Hanushek, E., & Kimko, D. (2000). Schooling, Labor Force Quality, and the Growth of Nations. *American Economic Review, 90*(5), 1184-1208. https://doi.org/10.1257/aer.90.5.1184

Izushi H., Huggins R., (2004) Empirical analysis of human capital development and economic growth in European regions, Cedefop Reference series, 54, Office for Official Publications of the European Communities.

Mankiw, G. N. (2007). *Principles of microeconomics* (4th ed.). Mason, USA: Thomson South-Western Publisher.

Mankiw N. G; Romer D, Weil D.N, (1992) Contribution to the Empirics of Economic Growth, The Quarterly Journal of Economics, Vol. 107, No. 2 (May 1992), pp. 407-437;

Mincer, J. (1974). *Schooling, Experience, and Earnings*. Nat. Bur. of Economic Research, New York.

Nonneman, V, Vandhoult P, (1996) A further augmentation of the Solow model and the empirics of economic growth for OECD countries, Quarterly Journal of Economics, 111 (3), pp.943-953.

Pelinescu E. (2015) The impact of human capital on economic growth. Procedia Economics and Finance 22 (2015) 184 – 190 Available online at www.sciencedirect.com;

Romer, P. M. (1990). Endogenous technological change. *The Journal of Political Economy, 98*(5), S71-S102. https://doi.org/10.1086/261725

Serena María J. Freire, (2001). Human capital accumulation and economic growth, Investigaciones Económicas, vol.XXV (3), pp.585-602;

Schultz, T. P. (1999). Health and schooling investment in Africa. *The Journal of Economics Perspectives, 13*(3), 67-88. https://doi.org/10.1257/jep.13.3.67

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

Tiruneh M., Radvansky M. (2011) The Contribution of Human capital to European Economic Growth: An empirical exploration from a panel data. Institute of Economic Research, Slovak Academic of Sciences.

Totladze L, Veshapeli G. (2021) CONCERNING THE ISSUES OF THE INFLUENCE OF THE DIGITAL TRANSFORMATION ON THE LABOUR AND LABOUR MARKET Proceedings of Materials of International Scientific Conference. Paata Gugushvili Institute of Economics, TSU, V. XIV, Tbilisi, 2021. p. 169-173 http://conferenceconomics.tsu.ge/doc/2021%20konf.pdf

Totladze L. (2020) Government Expenditure on Education and R&D as a Factor of Homan Capital and its Impact on Economic Growth. International Scientific Reviewed Journal “Ekonomisti”,#2,2020.ISSN1987 https://doi.org/10.36172/EKONOMISTI.2020.XVI.02.TOTLADZE

Totladze L., Khuskivadze M. (2020) The Effect of Foreign Direct Investments on Innovation and Technology Transfer. International Scientific-Practical Conference, Tbilisi, 2020; http://conferenceconomics.tsu.ge/doc/2020konfint.pdf;

Totladze L., Khuskivadze M. (2019). Human Capital and its Measurement Approaches. TSU IV International Scientific Conference “Challenges of Globalization in Economics and Business”. Tbilisi, 2019. https://tsu.ge/assets/media/files/7/konf%20IV19.pdf;

http://data.uis.unesco.org;

https://unctad.org;

https://ourworldindata.org/government-spending;

https://www.wipo.int/ipstats/en/statistics.

https://www.sakpatenti.gov.ge/ka/publications/

http://Geostat.ge