JEL Classification: E17, O47, C01 https://doi.org/10.35945/gb.2019.07.001

THE ROLE OF INNOVATIONS IN DRIVING ECONOMIC GROWTH: CASE OF ADVANCED ECONOMIES

OKSANA ZHYLINSKA

D. Sc., Professor,
Taras Shevchenko National University of Kyiv, Ukraine
zhylinska@ukr.net

OLEKSANDR CHERNYAK

D. Sc., Professor,
Taras Shevchenko National University of Kyiv, Ukraine
chernyak@univ.kiev.ua

OLENA BAZHENOVA

D. Sc., Associate Professor,
Taras Shevchenko National University of Kyiv, Ukraine
olenabazhenova@univ.net.ua

KEYWORDS: ECONOMIC GROWTH, INNOVATION, ECONOMETRIC MODELLING, PANEL DATA MODELS.

For citation: Zhylinska O., Chernyak O., Bazhenova O. (2019), The Role Of Innovations In Driving Economic Growth: Case Of Advanced Economies, *Globalization And Business, №7*, pp. 11-15. https://doi.org/10.35945/gb.2019.07.001

INTRODUCTION

Issues of economic growth have been paid attention even in ancient times. For instance, Mesopotamian brick plates contained inscriptions devoted to the calculation of the barley surplus product as the difference between the total output (gross collection of barley) per year in the condition of "normal harvest" and expenditures related to the provision of seed fund, consumption of labor and other costs measured in barley units, It has been considered as a primitive system of social accounting (Kurz, Salvadori).

During last two millennia the world's GDP has increased 497 times, GDP per capita - 17 times, which corresponded to 29 times population growth according to Angus Maddison (Maddison, 2001). Thus, income gap between the poorest and richest regions of the world, which at the beginning of the second millennium was 1.1: 1, at the beginning of the third millennium comprised 18: 1 (Maddison, 2005).

Throughout the history of world economic development, the periods of rapid economic growth have been replaced by periods of recession. Thus, the countries that demonstrated high growth rates over the long term, in the future had worsened welfare due to wars, natural disasters etc.

Although it should be noted that in developed countries, the growth rate is characterized by greater stability over the long term than in the poorer ones, which are characterized by sudden unexpected changes in economic growth, mainly due to political instability or military action (Lucas, 1988).

Due to up-to-date economic growth models, it is mainly determined by scientific and technological factors.

Thus, this paper is devoted to the research of innovations influence on economic growth in advanced economies. The level of innovations is likely to be determined by quantity of researchers in R&D (per million people) and research and development expenditure (% of GDP).

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

Nowadays economic growth is considered to be determined mainly by the scientific and technological factors, among which there are innovations, accumulation of physical and human capital, external effects etc.

For instance, in Grossman and Helpman's model (Grossman, Helpman, 1991, 1994) the rate of economic growth is determined by the rate of innovation and the index of specialization in intermediate consumption goods sector (Guarini, 2009).

Agion and Howitt included uncertainty into the endogenous growth model (Aghion, Howitt, 1992). The main factor of economic growth in model is considered to be technological progress, which is stimulus for firms engaged in research activities that produce innovations to compete. The model includes vertical innovation when new inventions result in the aging of existing ones. For example, innovations represents inventions of intermediate goods and inventions that promote the productivity of intermediate goods in the production of final goods.

Model of Lukas focuses on the relationship between the rate of growth of the economy and the productivity of training its individuals (Lucas, 1988). On the one hand, higher productivity of teaching contributes to increasing the marginal product of labor and wages and, accordingly, increasing incentives to study. On the other hand, the less individuals will prefer current consumption in comparison with the future, the more time they will be ready to devote to training, which will lead to acceleration of economic growth.

RESEARCH METHOD

For testing the innovations influence on economic growth in advanced economies we constructed panel vector model of autoregression.

In the reduced form the developed panel vector model of autoregression has the following form:

$$Y_{it} = \Gamma_0 + \sum_{j=1}^{k} \Gamma_j Y_{it-j} + \varepsilon_{it}, \qquad (1)$$

where Y_{it} - vector of endogenous variables,

Γ_0 - vector of intercepts, Γ_j - matrix of coefficients $(j = \overline{1,k})$, ε_{it} - disturbances.

Given the shock to system, variables of model deviate from the equilibrium state and should return to it (Chernyak, 2014). The trajectory of returning to equilibrium state is an impulse response.

The analysis of the decomposition of the prediction errors variances of modelled variables allows determining the sources of their volatility.

RESULTS

In the paper we have examined the hypothesis of impact of research and development factors on economic growth of advanced economies.

For this purpose it has been taken such indicators as GDP per capita, PPP (constant 2011 international $), researchers in R&D (per million people) for advanced countries in period 1996-2017. This group of economies due to International Monetary Fund includes such countries as Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Macao SAR, Malta, Netherlands, New Zealand, Norway, Portugal, Puerto Rico, Singapore, Slovak Republic, Slovenia, Spain, Sweden, United States and United Kingdom.

The analyzed indicators are presented in Table 1.

Table 1.

Main characteristics of GDP per capita, PPP (constant 2011 international $) and researchers in R&D (per million people) for advanced countries

	GDP per capita, PPP (constant 2011 international $)		Researchers in R&D (per million people)	
	Mean	St. Dev.	Mean	St. Dev.
Australia	39148,56	4165.669	3889.61	471.22
Austria	39532.86	3337.00	4049.44	828.86
Belgium	37587.70	2788.83	3444.99	682.01
Canada	37822.47	3287.65	4050.43	608.60
Cyprus	29988.62	2673.71	842.97	262.67
Czech Republic	24303.53	4130.70	2293.32	867.88
Denmark	41771.84	2376.00	5648.53	1516.54
Estonia	21377.14	5428.78	2736.36	545.32
Finland	35317.69	3821.42	7377.34	383.78
France	34781.53	2035.02	3416.62	565.22
Germany	38007.48	3475.26	3663.02	3475.26
Greece	25258.18	3177.62	1972.14	638.37
Hong Kong SAR, China	40198.96	8521.25	2420.11	792.12
Iceland	38446.10	4857.55	6572.40	987.83
Ireland	40295.16	9569.33	3019.13	1042.42
Israel	26958.92	2790.17	7770.74	678.44
Italy	35102.25	1536.67	1527.42	345.74
Japan	34653.09	1768.17	5125.77	132.13
Korea, Rep.	23993.42	5941.84	4280.84	1793.77

Source: World Development Indicators and authors' calculations

Latvia	16819.27	5218.50	1582.86	301.47
Lithuania	18903.10	6191.45	2471.76	332.23
Luxembourg	81523.17	9020.67	4610.90	386.75
Macao SAR, China	70280.47	31926.85	733.53	584.25
Malta	25350.42	4238.74	1425.42	445.96
Netherlands	41408.54	3371.27	3271.16	816.96
New Zealand	29472.67	3233.41	3223.25	668.29
Norway	57851.16	3595.61	5085.82	650.26
Portugal	25062.92	1313.04	2666.92	1082.30
Puerto Rico	31248.74	2770.57	290.45	42.71
Singapore	58926.28	13354.97	5005.43	1389.40
Slovak Republic	20307.19	5354.11	2228.88	419.07
Slovenia	26019.72	3675.19	3026.83	883.25
Spain	29848.00	2437.98	2306.93	538.02
Sweden	38383.43	4538.05	5615.74	864.86
Switzerland	51991.71	3631.58	3871.80	821.60
United States	46251.26	3703.33	3776.60	327.01
United Kingdom	33980.52	2925.96	3667.30	647.58

According to World Development Indicators data and authors' calculations, the mean of researchers in R&D (per million people) is more than 5000 in such countries as Denmark, Finland, Iceland, Israel, Japan, Norway, Singapore and Sweden. Moreover, for example, in Finland this indicator is maximal (7377.34). Although the number of researches in Finland now is declining. Puerto Rico, Macao, Cyprus have minimal values of mean of researchers in R&D despite high values of their GDP per capita. For instance, Puerto Rico has the lowest level of this indicator (290.45) with not so small mean of GDP per capita (31248.74).

In Denmark, Germany, Ireland, Korea, Portugal and Singapore the number of researches engaged in R&D sector is more volatile (more than 1000). For instance, in Denmark this indicator has increased by more than 236%, in Germany - by 73%.

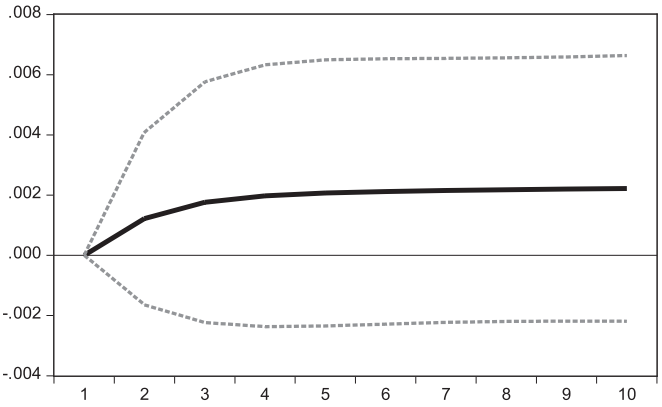
The variables have been tested for a unit root using tests for panel data models such as Lewin, Lina, and Chu and Breitung criteria for common process of a unit root and Ima, Pesaran, and Tina criteria, criteria based on the use of ADF and PP statistics that include individual processes of unit root.

Testing for the presence of a unit root has indicated that almost all variables are first order integrated. Thus, in the panel VAR model the first differences of variables have been considered (there is no cointegration between modelled variables).

The number of lags in panel VAR model has been chosen based on values of information criteria such as Akaike, Schwarz, Hannan-Quinn information criteria (chosen number of lags is 3).

Commenting the results of estimation, it should be noted that increasing in number of researches in R&D sector causes the rising gross domestic product per capita beginning in the first period (figure 1).

Fig. 1. Impulse response function for gross domestic product per capita



Source: authors' calculations

Moreover, obtained results have shown the significant impact of researchers in R&D sector on GDP per capita in advanced economies.

CONCLUSIONS

Summing up the results of the research, we should note that innovations production really has significant impact on GDP per capita in advanced economies. Moreover, innovations really determines the economic growth in advanced economies. Besides that, investments in human capital create a reliable basis for economic development in the future. Ignoring these facts may lead to the loss of economy's potential in the aspect of its economic development.

Constructed panel data model for estimating the effect of number of researchers in R&D sector on GDP per capita in advanced economies has shown that increasing in number of researches in R&D sector causes the rising gross domestic product per capita beginning in the first period.

Future direction of research is considered to be the examining of analyzed relationship for developing countries, comparing the results with advanced ones and paving the way for converging of their economies.

REFERENCES:

1. Aghion, P., Howitt, P. A (1992). Model of Growth through Creative Destruction. Econometrica. №60. P. 323-351.
2. Chernyak, O., Stavytskyy, A., Bazhenova, O., Shebanina, (2014). O. Econometrics. Mykolayiv: MNAU, (In Ukrainian).
3. Grossman, G.M. Helpman, E. (1994). Endogenous Innovations in the Theory of Growth. The Journal of Economic Perspectives. Vol.8, No.1. pp. 23-44.
4. Grossman, G.M. Helpman, E. (1991). Innovation and Growth in the Global Economy. Cambridge, MA: MIT Press.
5. Grossman, G.M. Helpman, E., Oberfield, E., Sampson, T. (2017). Balanced Growth Despite Uzawa. https://www.princeton.edu/~grossman/Uzawa.pdf.
6. Guarini, G. (2009). Innovation and growth in the Grossman-Helpman's model with increasing returns: a note. Munich Personal RePEc Archive. URL: http://mpra.ub.uni-muenchen.de/19612
7. International Monetary Fund. World Economic Outlook Database. April (2019). URL: https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx
8. Kurz, H.D., Salvadori, N. (2003). Theories of Economic Growth - Old and New URL: https://www.researchgate.net/publication/252313772_theories_of_ economic _growth_-_old_and_new
9. Lucas, R. (1988). On the Mechanics of Economic Development. Journal of Monetary Economics. № 22. P. 3–42.
10. Maddison, A. (2001). The World Economy: a Millennial Perspective. Organization for Economic Cooperation and Development. 383 p.
11. Maddison, A. (2005). Growth and Interaction in the World Economy. URL: http://www.ggdc.net/maddison/other_books/growth_and_interaction_in_the_world_economy.pdf
12. World Development Indicators. The World Bank. http://data-bank.worldbank.org/data/reports.aspx?source=wdi-database-archives-%28beta%29#

JEL Classification: E17, O47, C01 https://doi.org/10.35945/gb.2019.07.001

THE ROLE OF INNOVATIONS IN DRIVING ECONOMIC GROWTH: CASE OF ADVANCED ECONOMIES

OKSANA ZHYLINSKA

D. Sc., Professor,
Taras Shevchenko National University of Kyiv, Ukraine
zhylinska@ukr.net

OLEKSANDR CHERNYAK

D. Sc., Professor,
Taras Shevchenko National University of Kyiv, Ukraine
chernyak@univ.kiev.ua

OLENA BAZHENOVA

D. Sc., Associate Professor,
Taras Shevchenko National University of Kyiv, Ukraine
olenabazhenova@univ.net.ua

KEYWORDS: ECONOMIC GROWTH, INNOVATION, ECONOMETRIC MODELLING, PANEL DATA MODELS.

For citation: Zhylinska O., Chernyak O., Bazhenova O. (2019), The Role Of Innovations In Driving Economic Growth: Case Of Advanced Economies, *Globalization And Business, №7*, pp 11-15. https://doi.org/10.35945/gb.2019.07.001

SUMMARY

The paper explores the impact of innovations on the cross-country income differences among advanced economies based on the economic and mathematical models construction. As indicator that defines level of innovations production in the country, we have used number of researchers in R&D sector (per million people). Therefore, it has been constructed panel data model to estimate the effect of number of researchers in R&D sector on GDP per capita in advanced economies. Results of estimation have shown the significant impact of researchers in R&D sector on GDP per capita for the group of advanced economies testifying that innovation really matters in driving economic growth.