THE IMPACT OF NEW TECHNOLOGIES ON COUNTRY DEVELOPMENT

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Abstract

Economic growth and competitive advantages on the world market are the most important development indicators of anational economy. In this regard, special attention should be paid to the factors serving as drivers of the current economic growth and how they affect the country's competitiveness and its economic security. Based on the level of new technologies in the country, its economic development forms the patterns establishing its current state and trajectory of economic development, which determine the future direction of its evolvement as a leading, following or lagging behind nation subject on the map of the world community.The article attempts to reveal impact of a number of factors related to the high-tech productions, contributions for the use of intellectual property, cost of the development and development of new technologies on the GDP dynamics. Authors endeavour to identify the most important factors for economic development, to define groups of countries with similar characteristics in terms of the GDP dependence from the abovementioned factors.

Key words: high-tech exports, intellectual property, GDP growth, inequality of countries

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Introduction

Economic growth and the country's position on the world market are the most important indicators of the national economic development. In this regard, special attention should be paid to the factors serving as the sources of the current economic growth and how they affect competitiveness of the country and its economic security.

There are a number of features that radically characterize the modern economy:

1) different proportion of value added in the commodities, "Malthusian" and high "Schumpeterian" products;

2) constantly improving production technologies;

3) focus on the individual features of a particular user;

4) patent protection for most of the technology;

5) development of large multinational companies with production division, when researches are carried out in the head company, and assembly operations — in the branches located in other countries.

Commodities are the goods, which are produced subject to the country-owned resources and which are not subject to substantial processing. The added value of these products is usually determined by their rarity in nature, complexity of extraction and initial processing, so the rent from raw materials is decreasing (in view of resource constraints) and belongs, as a rule, to the country — owner of these territories.

"Malthusian" goods are the homogeneous goods with relatively low added value available for wide production and exchange. Most Malthusian goods are the industrial mass-consumption goods not protected by patents (food, haberdashery). They can also include technically complex goods received for "Screwdriver Assembly". In the presence of only raw materials and Malthusian goods in the economy, the theory of relative advantages could work, but in the modern economy an increasing share in the national wealth is occupied with "Schumpeterian"goods. The added value of these products is often accumulated not so much in the physical media, as in the advanced technical development, know-how and embodied intellectual capital (software products, information).

This disrupts equilibrium exchange in the world market – the countries producing more "Schumpeterian" goods accumulate a larger share of income, and at the same time, countries producing "Malthusian" products are in a relative loss and their economies grow at a slower pace.

1 Literature review

One of the pioneer works on the impact of high technology on the economic growth is the Schumpeterian theory of innovation. Not only he names innovation as a source of economic growth, but argues that innovations tend to cluster, and innovations are not distributed over the whole economic system at random, but tend to concentrate in certain sectors and their surroundings (Schumpeter, 1939). Currently, Reinert is one of the apologists of the difference in the technological potential of countries as a reason for their uneven development within the world community. In his works (Reinert, 2004), he points out that the inequality in development is caused withaccelerated liberalization of foreign trade in the country,when it is implemented before the national industry becomes competitive. If a country liberalizes its trade in the conditions, when its industry is not able to compete successfully with other

participants in the world market, the more developed countries deepen their specialization in the knowledge-intensive industries, while the less developed countries develop the primitive ones (raw materials, agriculture, etc.). As a result, the knowledge-intensive sector in a less developed country keeps declining, as a more advanced "partner" gets a comparative advantage in thehigh technology area. This position is considered to be quite controversial, but the studies conducted at the regional level show the uneven development of Chinese regions in development of the high-tech industry (He, Lin &Hao, 2018). Another research (Harrison, Lin & Xu, 2014) displays conditions of Africa's comparative advantage in the low-tech areas rather than in the high-tech manufacturing one. At the same time (Prisecaru, 2015) recognized that the high-tech industries were the main engine of industrial growth in Europe and a quantum leap in development of the Irish economy was caused with deployment of high-tech foreign enterprises in the country (Medvedkin, Medvedkina, 2017). The developed countries currently produce from 60 to 90% of the GDP on the basis of scientific and technological progress (Golova, Sukhovey, 2017). Migration of innovative forces to the leading countries is also facilitated by migration ofthe innovative human capital. This is confirmed in the work (Topkaya, 2015) according to which a large part of innovation patents are submitted to the middle-income countries, while most of the implemented innovations and the innovators themselves migrate to the US and the most developed countries of the European Union. In this regard, only the OECD countries with larger markets are able to increase their innovation by investing in the R&D (Ulku, 2004),

2 Methodology

We have divided the total number of countries studied into 5 groups according to the graduation of the GDP per capita (inthe current us dollars) as of 2016:

Countries with super high income: from 20,000 $ US and above;

Countries with high income: 12,000 – 19,999$ US

Upper-middle-income countries: 4,000 – 11,999$ US

Lower-middle-income countries: 1,000 – 3,999 $ US

Countries with low income: 999 $ US and below

The panel data for the first four groups were analysedsubject to theFixed Effects Model in the econometric Gretl package. The low-income group was not analyzeddue to the lack of sufficient data for the analysis. The following country groups were used for modelling (see Tab.1):

Tab. 1: Groups of countries included in the study onthe GDP per capita level

	Super high income	High income	Upper-middle-income	Lower-middle-income
1	Australia	Argentina	Bulgaria	Bolivia
2	Austria	Barbados	Bosnia and Herzegovina	Indonesia
3	Belgium	Chile	Jamaica	Cameroon
4	Cyprus	Croatia	Brazil	Guatemala
5	Denmark	Czech Republic	Ecuador	Egypt, Arab Rep.
6	Finland	Estonia	Jordan	Bangladesh
7	France	Greece	Colombia	Cote d'Ivoire
8	Germany	Hungary	Belarus	India
9	Iceland	Latvia	China	Georgia
10	Ireland	Lithuania	Costa Rica	Cambodia
11	Israel	Panama	Botswana	Moldova
12	Italy	Portugal	Lebanon	Myanmar
13	Japan	Slovak Republic	Malaysia	Nicaragua
14	Korea, Rep.	Uruguay	Montenegro	Nigeria
15	Netherlands		Peru	Pakistan
16	New Zealand		Romania	Philippines
17	Norway		Russian Federation	Swaziland
18	Puerto Rico		Serbia	Tunisia
19	Singapore		Thailand	Ukraine
20	Spain		Turkey	Vietnam
21	Sweden			
22	Switzerland			
23	United Kingdom			
24	United States			

Source: ranged by authors based on http://databank.worldbank.org/ statistics

3 Results

Our hypothesis lies in the heterogeneity of the impact of the high-tech exports and intellectual property charges on a country's GDP for the countries with different levels of income. We used the World Bank datafor selected countries for 1990-2016. The logarithm ofthe GDP per capita (l_GDPpercapita) was taken for the explained variable, exports of high-tech products and charges for intellectual property on the balance of payments were used as regressors. High-tech exports are products with high R&D share in value added, including such products as aerospace, computers, pharmaceuticals, scientific instruments and electrical equipment.Charges for the use of intellectual property (calculated by balance of payments) are the payments between residents and non-residents for permission to use intellectual property rights (such as patents, trademarks, copyrights, industrial processes and designs including

trade secrets, and franchises) and for the use, through licensing agreements, of produced originals and prototypes (such as copyrights on books and manuscripts, computer programs, cinematographic works and sound recordings) and related rights (such as, for live performances and television, cable or satellite broadcasting (quoted from worldbank.org metadata) All values were taken in the current $ US.

Tab. 2: Panel Data analysis for super high income group

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	− 0.550922	0.322961	− 1.7058	0.0888	*
l_Hightech	0.310724	0.0384902	8.0728	<0.0001	***
l_Hightech_1	− 0.222844	0.038023	− 5.8608	<0.0001	***
l_Chargesforintell	0.109078	0.0297492	3.6666	0.0003	***
l_Chargesforintell_1	− 0.0768219	0.0292755	− 2.6241	0.0090	***
l_GDPpercapita_1	1.08226	0.0465924	23.2282	<0.0001	***
l_GDPpercapita_2	− 0.244823	0.0661037	− 3.7036	0.0002	***
l_GDPpercapita_3	0.149673	0.0669758	2.2347	0.0260	**
l_GDPpercapita_4	− 0.165773	0.0438967	− 3.7764	0.0002	***

Mean dependent var	12.02321	S.D. dependent var	4.026758
Sum squared resid	4.579759	S.E. of regression	0.106868
LSDV R-squared	0.999346	Within R-squared	0.904873
LSDV F(31, 401)	19772.01	P-value(F)	0.000000
Log-likelihood	370.4779	Akaike criterion	− 676.9557
Schwarz criterion	− 546.6921	Hannan-Quinn	− 625.5330
rho	0.064064	Durbin-Watson	1.791973

*, **, *** Significant at the 10%, 5%, 1% level
Source: Calculated by authors

In the group of countries with super high income (Tab. 2), a panel model of the relationship between the logarithm of GDP per capita (l_GDPpercapita) to the logarithms of high-tech exports (l_Hightech) and charges for the use of intellectual property (l_Chargesforintell), expressed in the same currency was tested. The significance of the coefficients at 1% over the studied variables is noted, the indicators of determination show the existence of stable relationship between the GDP logarithm and the logarithms of the studied variables. There is a strong autocorrelation of the explained variable, while both regressors are significantly correlated only on the first lag. The inverse relationship between the explained variable and the first lag of both variables shows the development cyclicity of the processes studied.

It is also necessary to note the extremely uneven dependence of the GDP on the studied variables within the group. Countries such as the USA, Japan, and UK show in the individual regressions extremely low connection with import of high technology as a

dependent variable, however, the relationship with charges for intellectual property is extremely high. This is due to the fact that these countries tend to widely export the technology abroad and organize the assembly production in other countries, while the main R&D units remain in the parent companies. The second factor determining this peculiarity of the above mentioned countries is the widely developed structure of import of software, intellectual and cultural values protected by copyright, which is ahead of the high technologies import. In other countries that are less import-oriented than their own production, the high-tech exportsshare has a much more stable connection with the country's income.

Tab. 3: Panel Data analysis for the high income group

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	2.29176	0.289929	7.9046	<0.0001	***
Hightech	3.51947e-11	1.65624e-11	2.1250	0.0345	**
Hightech_1	– 3.21462e-11	1.63331e-11	– 1.9682	0.0501	*
Chargesforintell	8.33912e-11	3.27751e-11	2.5443	0.0115	**
Chargesforintell_1	– 4.8274e-12	3.43883e-11	– 0.1404	0.8885	
l_ GDPpercapita_1	0.836474	0.0575363	14.5382	<0.0001	***
l_ GDPpercapita_2	– 0.0094059	0.0504705	– 0.1864	0.8523	

Mean dependent var	13.27842	S.D. dependent var	4.591281
Sum squared resid	13.56456	S.E. of regression	0.223315
LSDV R-squared	0.997789	Within R-squared	0.896104
LSDV F(19, 272)	6459.650	P-value(F)	0.000000
Log-likelihood	33.78679	Akaike criterion	– 27.57358
Schwarz criterion	45.96150	Hannan-Quinn	1.881604
rho	– 0.044898	Durbin-Watson	1.994255

*, **, *** Significant at the 10%, 5%, 1% level
Source: Calculated by authors

A group of countries with high per capita income (Tab.3) showed no significance of logarithms of the studied variables on the GDP per capita, but showed the relevance of the variables themselves both the high-technology exports (Hightech) and charges for the use of intellectual property (Chargesforintell) at the 5 % level in the study of their influence on the logarithm of the GDP per capita. This shows that there is a relationship between the studied variables, but theirvaluesaremuch smaller than in the first group of the studied countries. As a rule, countries of this group do not have a considerable level of own high-tech business. This group production is typicallyfocused in the mining, agricultural and tourism sector activities, and in some cases there are a number of assembly plants of the transnational corporations. This weaker dependence is illustrated with smaller significance of the coefficients of the lagged variables.

Tab. 4: Panel Data analysis for the upper-middle income group

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	0.327104	0.269899	1.2119	0.2265	
l_ Hightech	0.0991085	0.0341093	2.9056	0.0039	***
l_ Hightech _1	– 0.0591895	0.0318567	– 1.8580	0.0641	*
l_ Chargesforintell	0.114758	0.0321918	3.5648	0.0004	***
l_ Chargesforintell _1	– 0.0617048	0.0299161	– 2.0626	0.0400	**
l_GDPpercapita_1	1.17327	0.0444638	26.3871	<0.0001	***
l_GDPpercapita_2	– 0.570588	0.0599658	– 9.5152	<0.0001	***
l_GDPpercapita_3	0.289712	0.0511356	5.6656	<0.0001	***
l_GDPpercapita_4	– 0.0395208	0.0353911	– 1.1167	0.2650	

Mean dependent var	12.96541	S.D. dependent var	5.721321
Sum squared resid	11.80020	S.E. of regression	0.195418
LSDV R-squared	0.998927	Within R-squared	0.944019
LSDV F(27, 309)	10655.44	P-value(F)	0.000000
Log-likelihood	86.62412	Akaike criterion	– 117.2482
Schwarz criterion	– 10.28591	Hannan-Quinn	– 74.61462
rho	– 0.295982	Durbin-Watson	2.339571

*, **, *** Significant at the 10%, 5%, 1% level
Source: Calculated by authors

Countries with the upper-middle income (Tab.4) again show a tighter link with exports of high-tech products and charges on intellectual property than countries of the second group. The model shows that the relationship betweenlogarithms of per capita GDP and the charges for the use of intellectual property assignments is slightly higher than in the first group of countries, butthe autocorrelation dependence is weaker. This is due to the fact that these countries are just beginning to form a culture of intellectual property, which increases the possibility of obtaining income from this variable. On the other hand, the link between per capita GDP and exports of high-tech products is much smaller than in the first group, and the logarithm of high-tech export of the previous year (l_ Hightech _1) is significant only at 10% level. This is due to the fact that the share of own R&D in the country is quite poorly developed and these countries are mainly territories of assembly industries in the countries of the first group. In this regard, the high-tech exports are less dependent on their own high-tech development than the state of production and policy of multinational companies located in the countries of the first group.

Tab. 5: Panel Data analysis for the lower-middle income group

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	0.771301	0.178982	4.3094	<0.0001	***
Hightech	– 9.23416e-13	9.85293e-12	– 0.0937	0.9254	
Hightech _1	2.1384e-12	8.73043e-12	0.2449	0.8067	
Chargesforintelc	2.14512e-10	7.88409e-11	2.7208	0.0069	***

Chargesforintel_1	4.02223e-11	1.02421e-10	0.3927	0.6948	
Chargesforintel_2	– 3.01336e-10	8.28979e-11	– 3.6350	0.0003	***
l_GDPpercapita_1	0.920282	0.0523642	17.5747	<0.0001	***
l_GDPpercapita_2	– 0.23917	0.0684149	– 3.4959	0.0005	***
l_GDPpercapita_3	0.178362	0.0655902	2.7193	0.0070	***
l_GDPpercapita_4	0.0959334	0.0620474	1.5461	0.1232	
l_GDPpercapita_5	– 0.0363846	0.0492183	– 0.7392	0.4604	

Mean dependent var	8.445788	S.D. dependent var	3.509427
Sum squared resid	6.954164	S.E. of regression	0.158161
LSDV R-squared	0.998161	Within R-squared	0.896669
LSDV F(29, 278)	5202.514	P-value(F)	0.000000
Log-likelihood	146.7438	Akaike criterion	– 233.4877
Schwarz criterion	– 121.5847	Hannan-Quinn	– 188.7437
rho	– 0.030408	Durbin-Watson	1.894603

*, **, *** Significant at the 10%, 5%, 1% level
Source: Calculated by authors

Countries with the lower-middle-income (Tab.5) showed no significant relationship betweenthe GDP per capita and export of high technology since most of them (with the exception of India, Indonesia, and Philippines) have relatively weakly developed their own production facilities and a relatively small share of foreign high-tech manufacturing plants. At the same time, charges for intellectual property are significant, and they have longer lag than in other studied groups, which shows a slower dynamics of the explained variable development. It should be also noted that the coefficient before the lag variable Chargesforintel_2 is greater than before Chargesforintel, which may illustrate the deterrent effect of this variable on theincome growth for the countries of this group. As a rule, high fees for intellectual property in these countries reduce financial power of its economic agents and limit their ability to develop their own production, which does not provide induce to increase development of the economy in these regions.

Conclusion

Analysing the results of the study, we conclude that the export of high-tech products is a significant GDP growth factor inthe countries with high and very high per capita income, and this trend is self-sustaining, despite fluctuations in this growth dynamics. While the high-tech production recipients, primarily from the group with the upper-middle-income, are dependent on the high-tech exports, this variable is less significant for their economic growth and, in addition, it depends not so much on its own dynamics of economic development as onthe external factors.

Charges for intellectual property are also strongly associated with the growth of the

GDP per capita for all the groups studied, but the impact is not very significant in view of the negative impact of the lag variable. This goes with the results (Evan, Vozárová & Bolotov, 2018) based on the research of the impact of Intellectual Property Protection on the national economies. In the high-income countries with high amounts of the intellectual property sources, increase in this variable leads to the GDP growth, while in the low-income countries growth of this indicator is more inhibitory than stimulatingthe economic growth. It also lays the base for increasing income stratification among countries of different income groups.

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