INSTITUTIONAL DETERMINANTS OF THE QUALITY OF NATIONAL EXPORT

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Abstract. In the article we analyze the impact of institutional factors on export of innovation in various countries. The components of the Global Innovation Index are important indicators that predict international competitiveness of export, these are, for example, quality of institutions, state of human capital, level of expenditure on research, infrastructure, etc. In this study we examine the influence of economic policies on technical complexity of export.

Keywords: advanced technology, export, international competitiveness, globalization.

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Introduction

In a globalised world the quality of export determines the actual and perspective competitiveness of economies in world markets due to increasing openness to trade and rising importance of exogenous factors for national economic growth. To enhance competitiveness, countries more often specialize on production and export of advanced goods with high value added and of advanced technology products.

The connection between scientific and technological level and the country's export specialization

In the context of modern geo-economic transformations lowering of the share of trade in primary goods and reorientation towards the exports of advanced goods is often considered an important goal in national economic strategies. It strengthens innovativeness of economic models and their international competitiveness. Only a handful of countries can attain this goal and as a result, the technological gap between the developed countries which constitute the core and the developing countries of periphery is widening. Differentiation of technological development of countries is an objective process driven by unpredictability of the process of innovation. The current state of technological development of the world is characterized by differentiation with most of the developing countries and emerging economies lagging behind the developed.

Many authors contributed to the literature on the quality of foreign trade as a premise of economic growth and the preconditions of changes on the world product market. For example, Gertler (2006) noted that developed countries should produce and export complex goods due to capital abundance, as the Heckscher-Ohlin model predicts. Nevertheless, there are important factors that act against this tendency. Rodrik (2006) examined the reasons behind the location of high-tech production in developing countries and the following changes in their export structure. Over a long period of time international mobility of capital reoriented

production, including high-tech, towards less developed countries with cheap labor. At the same time, the level of participation of a country in global value chains is still important. Traditional export sectors in developed countries are currently under pressure from cheaper exports from developing countries. Those of them characterized by the higher level of value added are more successful in keeping their positions (Giovannetti, G., Sanfilippo, M., Velucchi, M., 2010). The question of perspectives of these tendencies is important today. Which factors determine competitiveness of countries on the global market?

Technological progress ensurescompetitiveness on the world market, economic growth and social progress. The level of technological development of a country is determined by a number of factors. First of all, this is the state of research and development, but also the available production capacities, efficiency of resource use and, to the great extent, institutions. Capability of a country to generate new technologies is a basis for high and steady level of international competitiveness. The Global Innovation Index allows comparing the level of technological development across countries (tab.1).

Table 1

Rankingofcountriesintheglobalinnovationindexin 2015

Economy	Rank	Score	Economy	Rank	Score	Economy	Rank	Score
Switzerland	1	68,3	Hong Kong (China)	11	57,2	France	21	53,6
United Kingdom	2	62,4	Germany	12	57,1	Israel	22	53,5
Sweden	3	62,4	Iceland	13	57	Estonia	23	52,8
Netherlands	4	61,6	Republic of Korea	14	56,3	Czech Republic	24	51,3
United States	5	60,1	New Zealand	15	55,9	Belgium	25	50,9
Finland	6	60	Canada	16	55,7	Malta	26	50,5
Singapore	7	59,4	Australia	17	55,2	Spain	27	49,1
Ireland	8	59,1	Austria	18	54,1	Slovenia	28	48,5
Luxembourg	9	59	Japan	19	54	China	29	47,5
Denmark	10	57,7	Norway	20	53,8	Portugal	30	46,6

* Source: The Global Innovation Index, 2015

Global innovation leaders alsohead the international competitiveness rankings. The level of competitiveness and innovation in developed countries is higher; one of the reasons is greater availability of the necessary financial resources. But the situation on the world market of advanced products is changing as the global importance of some emerging markets grows. For example, in 2014 China left Germany and the US behind in the ranking of world exporters of advanced products (Figure 1).

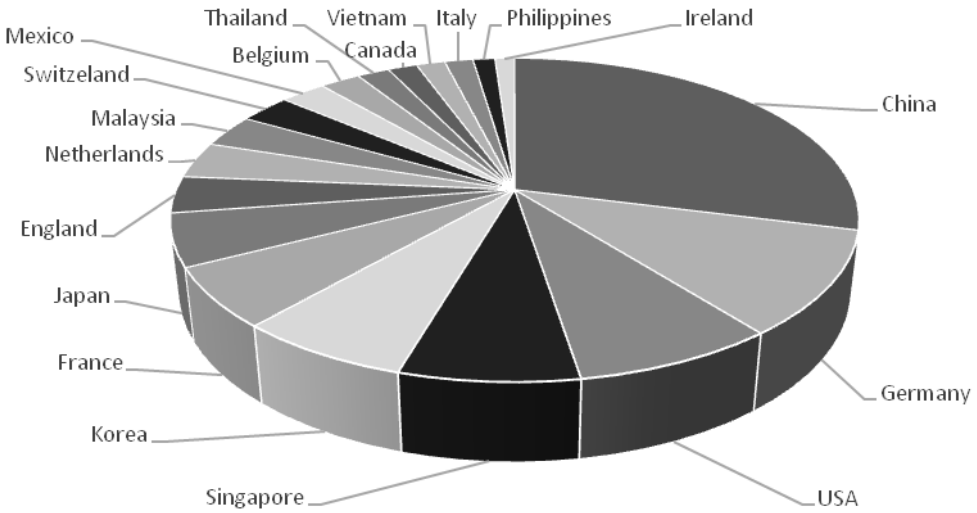

Fig. 1. Share of countries in world exports of high-tech products, 2014, %*
*Calculated according to The World Bank

The group of net exporters of advanced products is heterogeneous (Tab.2).

Table 2

The share of world's high-tech products exports, %

Economy	2007	2008	2009	2010	2011	2012	2013	2014
China	17,12	18,46	19,78	22,81	23,56	25,3	26,59	26,0
Germany	8,68	8,68	8,94	8,9	9,45	9,36	9,2	9,3
USA	12,34	11,99	8,46	8,2	7,51	7,42	7,05	7,25
Singapore	5,82	6,36	6,09	7,13	6,52	6,42	6,44	6,39
Korea	5,71	5,48	5,93	6,82	6,29	6,07	6,19	6,21
France	4,46	4,99	5,27	5,6	5,45	5,43	5,38	5,34
Japan	6,67	6,51	6,08	6,86	6,52	6,17	4,99	4,7
England	3,48	3,28	3,04	3,38	3,59	3,39	3,29	3,29
Netherlands	3,81	3,16	3,24	3,34	3,46	3,21	3,28	3,27
Malaysia	3,69	2,33	3,26	3,33	3,15	3,06	2,87	2,95
Switzeland	2	2,31	2,51	2,4	2,58	2,51	2,53	2,6
Mexico	1,89	1,81	1,99	2,12	2,1	2,2	2,16	2,3
Belgium	1,42	1,54	1,89	1,79	1,79	1,83	1,98	2,03
Thailand	1,71	1,7	1,77	1,92	1,71	1,69	1,61	1,63
Canada	1,49	1,46	1,48	1,35	1,29	1,46	1,38	1,47
Vietnam	0,13	0,09	0,13	0,23	0,47	0,81	1,32	1,44
Italy	1,5	1,56	1,6	1,48	1,61	1,38	1,41	1,43
Philippines	1,67	1,46	1,38	0,9	0,67	1,04	1,04	1,11
Ireland	1,59	1,51	1,55	1,19	1,22	1,13	1,04	0,99

* Source: The World Bank

It comprises not only developed countries, but also developing, first of all the countries of Southeast Asia. During the period of study, some of the countries of interest became less important, whereas others managed to strengthen their positions on the world market. Furthermore, in 2007-2014 the rate of growth of trade in advanced goods was much higher than that of the costs of research and development and employment in this sector. Overall, the share of trade in advanced goods decreased in Great Britain, Japan, Ireland, the USA and the Netherlands.

Developing countries (Indonesia, Malaysia, South Korea and Vietnam) strengthened their positions in development of high technologies and on the world market of advanced goods and now are starting to compete in the export of high technologies. Due to lower factor prices, developing countries could greatly improve their positions as producers of advanced technology products.

There are many factors that determine the ability of a country to bring out a nationally and internationally competitive product, among them the skills necessary to develop such a product, investments in research and advanced development (more detail in Tab. 3), innovation activity of firms and investment in the branch, state support. Together they guarantee the build-up of high-technology export.

Table 3

Total gross expenditure on R & D

Indicator	Gross expenditure on R & D (Bln. Dollars. USA)				The share of global gross expenditure on R & D (%)			
Period / Economy	2007	2009	2011	2013	2007	2009	2011	2013
World	1 132,3	1225,5	1340,2	1477,7	100	100	100	100
Countries with highin come	902,4	926,7	972,8	1 024	79,7	75,6	72,6	69,3
Countries with above average income	181,8	243,9	303,9	381,8	16,1	19,9	22,7	25,8
Countries with below average income	46,2	52,5	60,2	68	4,1	4,3	4,5	4,6
Countries with low income	1,9	2,5	3,2	3,9	0,2	0,2	0,2	0,3
EU	251,3	262,8	278	282	22,2	21,4	20,7	19,1
ASEAN	328,8	378,8	455,1	545,8	29	30,9	34	36,9
OECD	860,8	882,2	926,1	975,6	76,0	72,0	69,1	66,0
G20	1 042,6	1 127,0	1231,1	1 358,5	92,1	92,0	91,9	91,9

* Source: UNESCO Institute for Statistics Database

Over the period 2007-2013 financing of scientific and technological progress changed. The share of upper middle income countries in global expense on R&D rose by 10 percentage points, the share of ASEAN – by 7 percentage points. At the same time, there was a decrease in the respective shares of the EU (by 3 percentage points) and of OECD (by 10 percentage points). These transformations were accompanied not only by remarkable changes in volumes of funding of innovation activity, but also in the number of employed in the sector and as a result the number of patents registered by residents of a country. In terms of dynamics of international trade in high-tech products emerging economies left developed countries behind.

It should be mentioned that it is extremely difficult to quantify some of the factors of interest. To estimate the influence of the factors of internal economic environment on the integration of a country into the global innovation space we use the model that employs fuzzy sets:

$$Y = f\left(x_1; x_2; x_3; x_4; x_5; x_6\right),$$

Where x_1 is the index "Institutions", $x_2$stands for the index "Human capital and research", x_3 for index "Marketsophistication", x_4 is index "Businesssophistication", x_5 – "Infrastructure" and x_6 – subindex "Innovation results".Estimation was performed in MATLAB with the help of FuzzyLogicToolbox.

Technological asymmetries become apparent in concentration of high-tech industry in the leading countries. Let's take a look at the main world centers of production and export of high-tech goods China, Germany, USA and Singapore.

In 2015 the factors take the following values for China: index "Institutions" is 54, index "Human capital and research" 43.1, index "Marketsophistication" 49.3, index "Business sophistication" 44.9, "Infrastructure" 50.5 andsubindex "Innovation results" 58. We'll explore the separated impact of these factors on the result.

Out of all analyzed factors, consistently positive influence on integration of China into the global high-tech space had only indices "Institutions", "Business sophistication" and subindex "Innovation results". Changes in the indices "Infrastructure", "Human capital and research", "Market sophistication" can even have negative influence on integration of a country into the global high-tech market (Tab.4, Figure 2).

Thus, to increase the share of high-tech production in exports from China it is important to improve the quality of institutions and promote business. These measures will further foster increase in the number of patent requests, scientific and technical publications, the volumes of export of knowledge-intensive goods and services, the volumes of receipts from the use of intellectual property rights (subindex "Innovation results").

Since some of the independent variables which determine the dynamics of the share of high-tech export from China are statistically significant, ambiguous result of others suggests that the limit of quantitatively-based growth has been reached and qualitative transformations are needed.Exceptionally high level of high-tech exports from China is even more impressive when we consider that in terms of the Global Innovation Index the country was ranked only 29th in 2014.

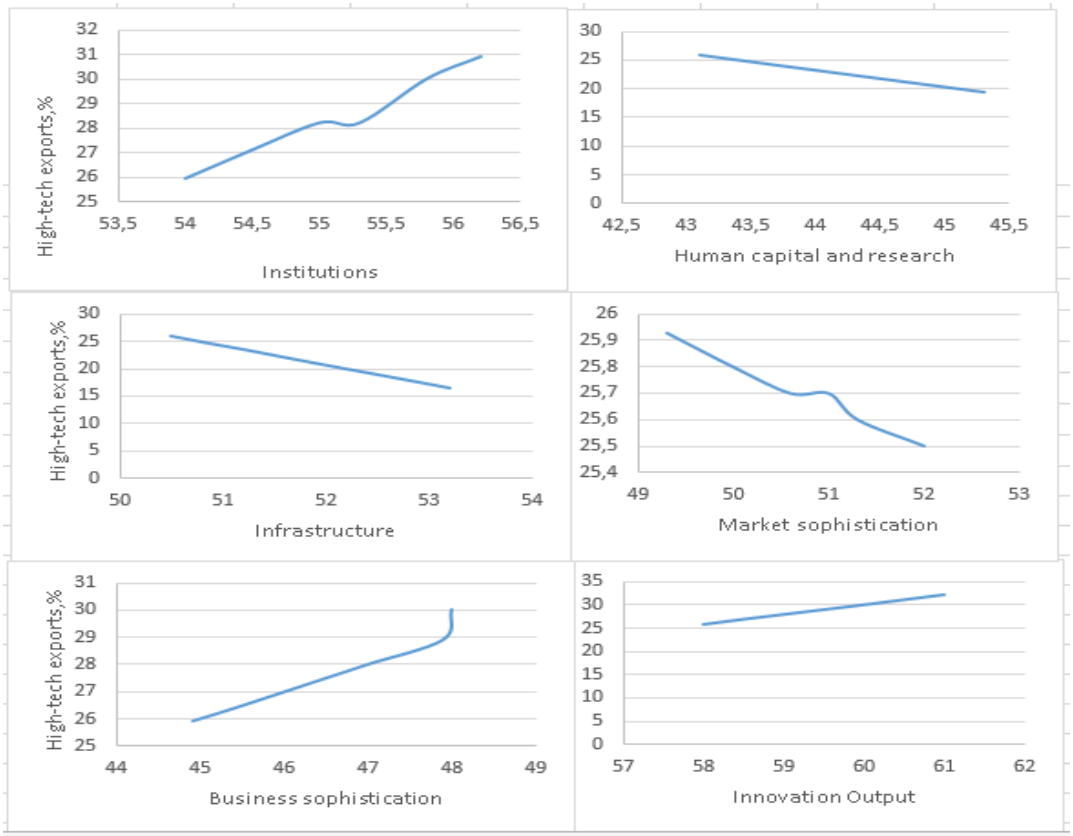

Fig. 2. Projected changesof China's high-tech export*

*Authors' calculations using data The Global Innovation Index, 2015; OECD Stat

Table 4

Projected changes in the value share of hi-tech export of China in the succession of the value factors of domestic economic environment

Institutions	High-techexports,%	Humancapitalandresearch	High-techexports,%	Infrastructure	High-techexports,%	Marketsophistication	High-techexports,%	Businesssophistication	High-techexports,%	InnovationOutput	High-techexports,%
54	25,93	43,1	25,93	50,5	25,93	49,3	25,93	44,9	25,93	58,0	25,93
54,5	27,1	43,7	24,1	50,9	24,5	50,0	25,8	45,4	26,4	58,5	27
55	28,2	44	23,2	51,2	23,5	50,6	25,7	46,3	27,3	58,9	27,8
55,3	28,2	44,6	21,4	51,7	21,7	51	25,7	47	28	59,4	28,8
55,8	30,0	45,0	20,2	52,1	20,3	51,3	25,6	47,9	28,9	59,9	29,8
56,2	30,9	45,3	19,3	52,8	17,9	52,0	25,5	48,0	30,0	61,0	32,1

*Athors' calculations using data The Global Innovation Index, 2015; OECD Stat

According to the Global Innovation Index ranking, Germany has the second biggest share of high-tech export in the world (9.3%) after China (26.0%). The actual values of independent variables for Germany in 2015 were: 83.2 for index "Institutions", index "Human capital and research" 56.6, index "Market sophistication" 59.2, index "Business sophistication" 49.2, "Infrastructure" 56.7andsubindex "Innovation results" 53.4. We'll explore the separated impact of these factors on the result as other independent factors stay constant (Tab. 5, Figure 3).

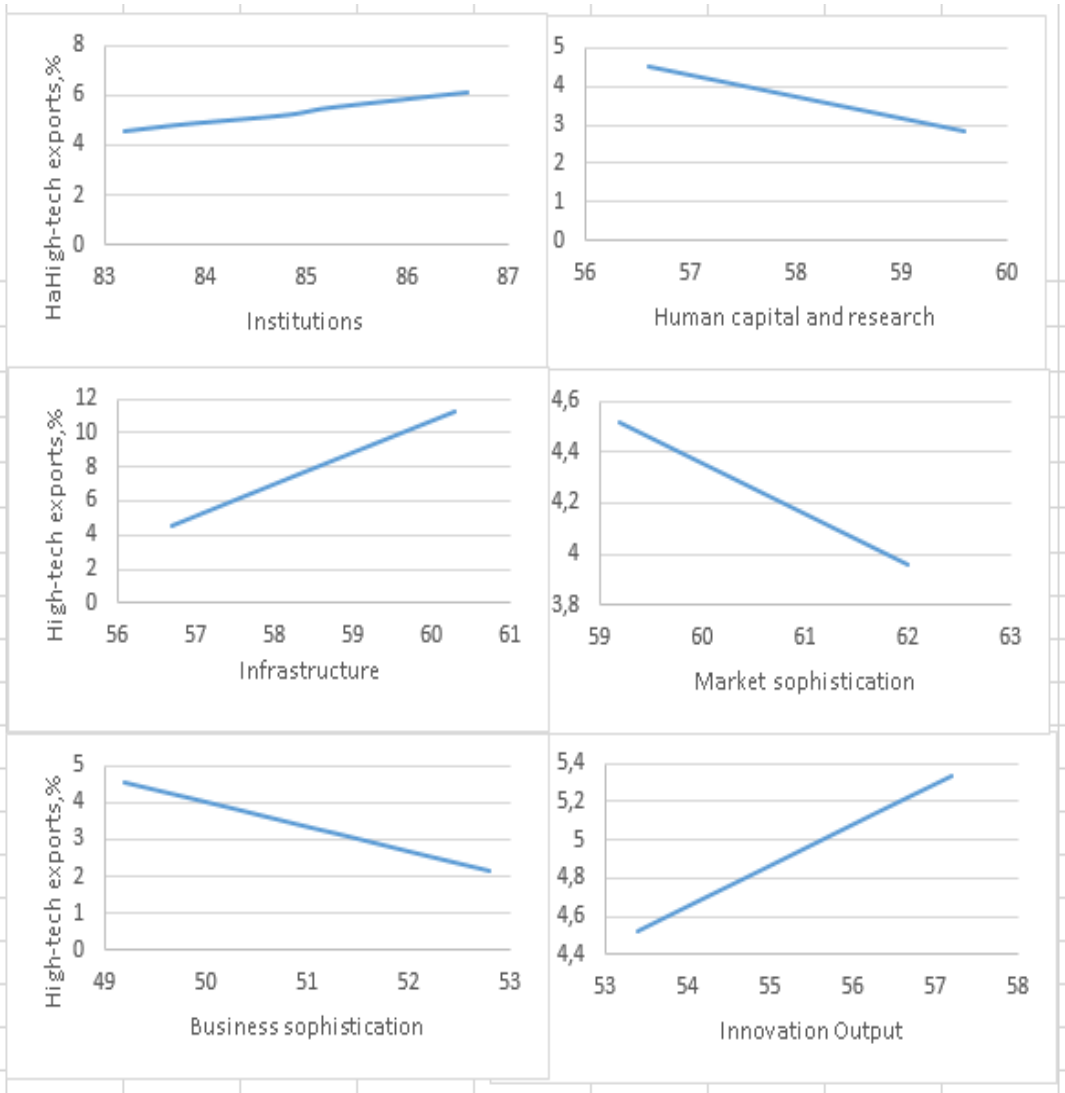

Fig. 3. Projected changesof Germany's high-tech export*

*Authors' calculations using data The Global Innovation Index, 2015; OECD Stat

There is positive correlation between the values of indices "Institutions", "Infrastructure" and subindex "Innovation results" and the level of Germany's integration into the global innovation market.

Table 5

Projected changes in the value share of hi-tech export of Germany in the succession of the value factors of domestic economic environment

Institutions	High-tech exports, %	Human capital and research	High-tech exports, %	Infrastructure	High-tech exports,%	Market sophistication	High-tech exports, %	Business sophistication	High-tech exports, %	Innovation Output	High-tech exports, %
83,2	4,52	56,6	4,52	56,7	4,52	59,2	4,52	49,2	4,52	53,4	4,52
83,8	4,8	57,2	4,18	57,1	5,27	59,8	4,4	50,1	3,94	54,1	4,67
84,8	5,17	57,8	3,84	57,9	6,76	60,4	4,28	50,9	3,41	54,9	4,84
85,2	5,45	58,4	3,5	58,4	7,69	60,9	4,18	51,4	3,09	55,6	4,99
86	5,82	59	3,16	59	8,8	61,4	4,08	52	2,69	56,3	5,14
86,6	6,09	59,6	2,82	60,3	11,2	62	3,96	52,8	2,17	57,2	5,33

*Athors' calculations using data The Global Innovation Index, 2015; OECD Stat

These results show that the necessary actions of the potential strategy with the aim of increasing the share of high-tech production in Germany's export could be: improving the quality of institutions, infrastructure development and other actions that result in increase of sub index "Innovation results". At the same time, our sample doesn't provide evidence that gains in the values of indices "Human capital and research", "Business sophistication" and "Market sophistication" will guarantee positive changes of the dependent variables.

Now we are going to analyze the data for the USA. The actual values of the factors for the USA are the following: index "Institutions" is 86.8, index "Human capital and research" 54, index "Market sophistication" 81.5,index "Business sophistication" 55.4, "Infrastructure" 58.8 and sub index "Innovation results" 58 in 2015. Again, we'll look at the impact these factors separately have on the result.

Out of all factors considered, only the impact of "Institutions" and "Business sophistication" on the level of integration of the US into the global high-tech market is always positive.

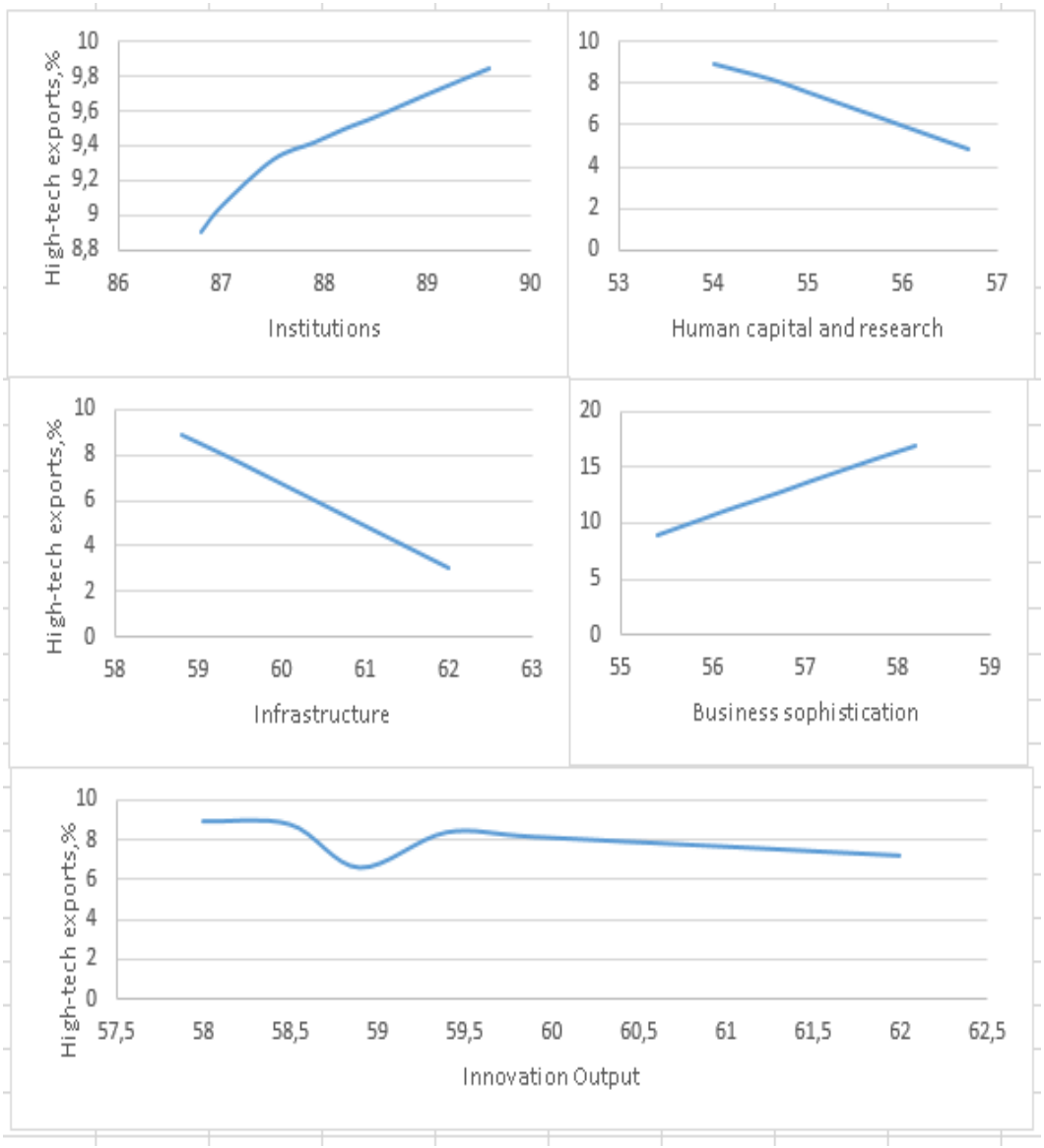

Figure4.Projected changes of high-tech export of the USA*
*Authors' calculations using data The Global Innovation Index, 2015; OECD Stat

Indices "Infrastructure", "Human capital and research" and sub index "Innovation results" always exert negative influence on the integration of the country into the global high-tech market (Tab. 6, Figure 4). Negative correlation of these factors with the dependent variable confirms the necessity of change in the mode of participation in the global value chains even for the USA, the leader of economic development. It is important to secure the direct dependency of investment into human capital and innovation activity with advantages from foreign trade in high-tech products.

Table 6

Projected change sin the value share of high-tech export of USA in the succession of the value factors of domestic economic environment

Institutions	High-teche xports, %	Human capital and research	High-tech exports, %	Infrastructure	High-tech exports, %	Business sophistication	High-tech exports, %	Innovation Output	High-tech exports, %
86,8	8,9	54	8,9	58,8	8,9	55,4	8,9	58	8,9
87	9,05	54,6	8,17	59,3	8,04	55,9	10,4	58,5	8,74
87,5	9,32	55	7,53	59,9	6,94	56,2	11,3	58,9	6,56
87,9	9,42	55,3	7,05	60,4	6,02	56,7	12,7	59,4	8,34
88,2	9,5	55,8	6,25	60,8	5,28	57,1	13,9	59,9	8,11
88,5	9,57	56,2	5,6	61,3	4,36	57,8	15,9	61	7,62
89	9,7	56,7	4,8	62	3,07	58,2	17	62	7,17

*Authors' calculations using data The Global Innovation Index, 2015; OECD Stat

In the next part we review he details of the foreign trade of Singapore, one of the countries developing very fast economically. The independent variables took the following values in 2015: index "Institutions" wass 95.5, index "Human capital and research" 60.9, index "Market sophistication" 71.6,index "Business sophistication" 63.1, "Infrastructure" 69.5 and sub index "Innovation results" 51.5.

According to the estimation results, positive correlation with the dependent variable is observed for the values of indices "Institutions" and "Market sophistication". It should also be noted that Singapore is world's leader in the rankings "Infrastructure" and "Business sophistication" (Tab.7, Figure 5).The findings show that the share of export of high-tech products can be increased by improvement of the quality of the market.

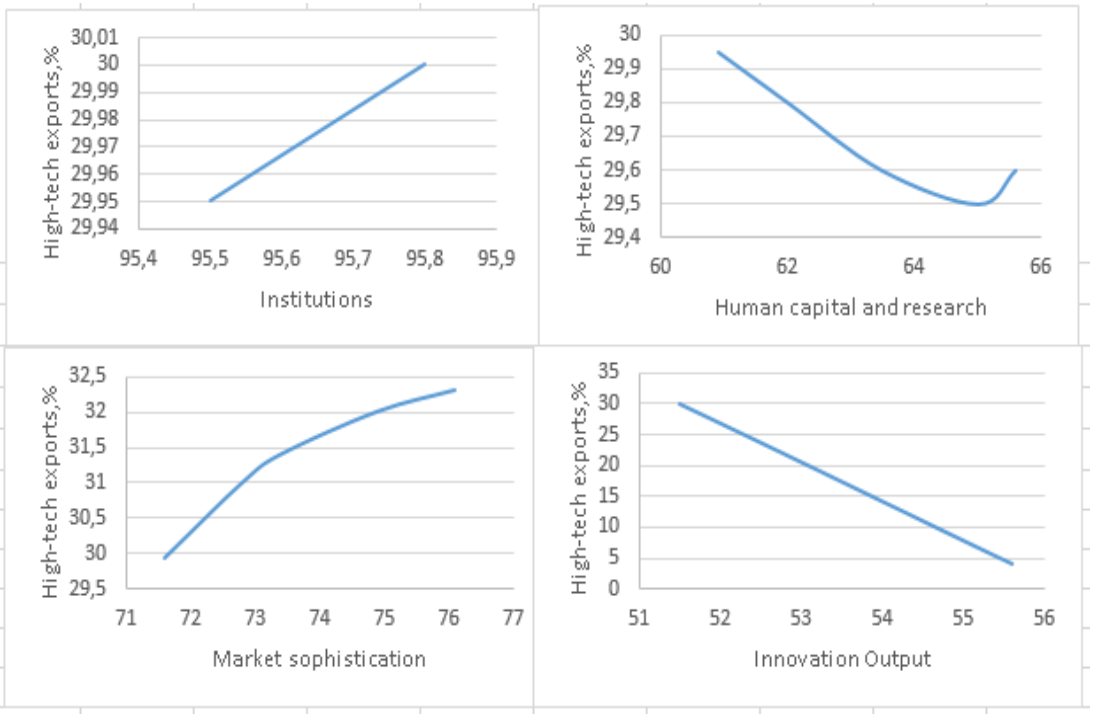

Fig. 5. Projected changes of Singapore's high-tech export*
*Authors' calculations using data The Global Innovation Index, 2015; OECD Stat

Table 7

Projected changes in the value share of high-tech export of Singapore in the succession of the value factors of domestic economic environment

Institutions	High-tech exports, %	Human capital and research	High-tech exports, %	Market sophistication	High-tech exports, %	Innovation Output	High-tech exports, %
95,5	29,95	60,9	29,95	71,6	29,95	51,5	29,95
95,6	29,97	62	29,8	72,8	31	52,1	26,2
95,7	29,98	63,48	29,6	73,4	31,4	53,1	19,9
95,8	30	65	29,5	74,9	32	55	7,83
-	-	65,59	29,6	76,1	32,3	55,6	4,08

*Athors' calculations using data The Global Innovation Index, 2015; OECD Stat

The countries considered in our study make up sort of a "high-tech pole" of the global economy in its current state. The positive influence of "Institutions" is common for all 4 countries, it comprises the complex of basic political, social, legal and economic rule sthat

determine the frame work of business-conductand form the basis for production and export of innovative products.

Thus, leadership in innovation is the precondition for increases in competitiveness of both companies and countries. An important indicator of active integration into the global innovation market is the share in the world's exports of high-tech products. Among the global leaders on this market are not only developed countries, but also emerging economies. The success of the latter depends on the focused state policies.

In this article we tried to identify to which extent the factors of internal economic development of countries influence their ability to integrate into the world market of high-tech products. Using the data from 4 countries we found out the following: first, a major role in their actual leader ship play the constantly high value sand improvement sin the indicator "Institutions" – Political, Regulatory and Business environment. It is also important to pay attention to it if the countries want to keep their positions in perspective. Regardless of political models in the above-mentioned countries and the peculiarities of government control over economic activities, political and economic stability, rule of law, transparent business operations directly affect the success nationally and internationally. Second, the influence of other independent variables on the share of a country in the world high-tech exports is individual and depends on labor and intellectual intensity of export, level of integration into the global value chains. Third, countries that aim for global leadership in export of high-tech products should form competitive advantages by means of innovation and investment.

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