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Graphical Analysis of the Growth Rate of National Economies by Considering the Supply Chain Strategy in 25 Countries over the Period From 2000 to 2016

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ABSTRACT- **The article presents the graphical analysis of economic indicators for 25 countries: GDP growth rate (%) and GDP per person employed (thousand US dollars) for the period from 1990 to 2016 by considering the supply chain strategy (SCS) and transparency. The authors carried out the decomposition of economic growth rates of selected countries according to the following factors: 1) extensive factors – the growth rate of the capital stock and the size of labor force; 2) intensive factors – R&D expenditures; 3) the dynamics of foreign direct investment in the country 4) supply chain strategy. Over the past 16 years, only a few countries from the sample have shown growth of the national economy higher than the growth rates of the world economy. These are China, Turkmenistan, India, Malaysia, and Singapore (their economies grew at a rate of more than 5% per year). The most dynamic renewal of fixed assets can be observed in China, the United States and Japan. At the same time, over the past 10 years China has demonstrated an active investment policy, increasing the investment in fixed assets almost five times. China and India were countries that most actively used the size of labor force as a factor of extensive growth. Korea, Japan, Germany, USA, China and Singapore demonstrated the most dynamic growth in R&D expenditures. Despite the non-monotonous dynamics of foreign direct investment in these countries, over the entire period of observation from 1990 to 2017, the United States has been the most attractive country for foreign direct investment. At the same time, the most significant growth in foreign direct investment was recorded in China and, recently, in the United Kingdom.**

Keywords- *graphical analysis, transparency, supply chain strategy, growth rate of national economies, extensive and intensive factors of economic growth, R&D expenditures, investment, labor force.*

1. Introduction

Growth rate can be also boosted global commerce by, for instance, improving supply chain efficiency and reducing complexities associated with global contracts, classification, and trade compliance.

Montreal-based 3CE addresses one major source of supply chain friction by deploying natural language processing to automatical-ly identify and correctly classify traded goods according to customs' commodity taxonomies (for example, identifying that manually labeled "baby food" is the taxonomically correct "homogenized composite food preparation").36 Improvements in transparency and supply chain efficiency can help companies secure better trade financing, reducing banks' concerns about compliance risks. Banks can also use AI technologies to review trade documents, sort and label properly, and analyze risks in a much less labor-intensive way.

The overwhelming majority of the instruments of state regulation facilitating the economic growth are aimed at increasing the accumulation of private capital in physical and intangible forms. Traditionally, pursuing this goal, the government focuses on stimulating private savings and investments and uses such tools as reducing the tax burden and increasing current budget spending to boost effective demand [1]. Investments stimulate economic growth, activating demand in the short term, and in the long run – increasing production capabilities. Therefore, the level of investment directly reflects the economic situation of a country. However, in Russia, the share of budget investments against GDP has been constantly decreasing since 1993. Do such trends promote the growth of the Russian economy? To answer this question, it is necessary to analyze the practices of financing capital expenditures in developed countries. On the one hand, considering, for example, European countries, one can see that over the past 40 years, government investment in the largest countries of the European Union and on average in the European Union are declining against GDP. On the other hand, such a decrease occurs only in the most developed European

countries, while in less developed one there is growth in or, at least, the same level of government investment against GDP [2]. It is impossible to increase the efficiency of budget regulation if the share of budget investments in GDP is reduced. According to international experts of the World Bank, sustainable economic growth at 7% of GDP per year over the period of 20-25 years can be achieved only at the aggregate investment level of not less than 25% of GDP (more often 30% or higher), whereas in Russia the level of investment is 21 % of GDP [3]. At the same time, the share of budget investment financed from the federal budget does not exceed 2% of GDP. In this paper the authors carry out a consistent analysis of GDP growth rates by considering the supply chain strategy in selected countries, the dynamics of the extensive factors of economic growth – the growth of the capital stock and the size of labor force, the dynamics of intensive factors of economic growth – the level of R&D expenditures, the volume of foreign direct investment and R&D expenditures. In addition to this, the article considers in detail the impact of R&D expenditures on endogenous growth by SCS. Starting from [4], technical progress has been generally seen as an exogenous factor. In reality, while some new technologies may occur spontaneously, others are the result of R&D expenditures. This predetermined a new line of research which included R&D expenditures in the production function, thus taking into account external factors related to technical progress [5]. R&D expenditures can be estimated using the data on the costs of research, education and additional employee training. However, the method of cost estimate of the investments in knowledge and its depreciation rate are still to be developed. At the same time, there are publications attempting to link the growth of cost factors and technical progress [6]. One of the main hypotheses states that technical progress, rising costs for research and development, and increased cost factors may be the results of increased knowledge [7]. The new growth theory and the direction of the neoclassical theory – the theory of capital and investment emphasizes the growth of investment in human capital and knowledge [8]. Let us analyze the structural changes in the economy using the theories of Prebisch, [9] and [10]. According to the results of Prebisch's structuralist development approach and the theories of Kaldor and Thirwall, the goods and sectors of SCS in the national economy have different income elasticity of

demand. That is why to ensure long-term economic growth, it is necessary to create an effective structure of a country's trade specialization, in which the income elasticity of export demand grows at a faster rate than the import demand. This can be done by actively promoting a combination of selective ("vertical") and horizontal instruments of industrial and technological policy. These tools should be aimed at changing the production structure of the developing economy and, thus, the structure of its trade specialization (that is, facilitating "dynamic comparative advantages"), which would enable faster economic development.

2. Methodology

Let us decompose the economic growth rate into intensive and extensive components. The study will be based on the method of time series data graphical analysis. The graphical method of representation and analysis of time series allows for better understanding of concentration and localization of the data and understand the law of its distribution based on the SCS. The need of using the graphical analysis method is the consequence of the fact that the tabular view of the data series and descriptive statistics often do not allowed for understanding of the process's nature. At the same time, a time series graph allows for making quite a lot of conclusions. To analyze the factors of economic growth, the following groups of countries were selected:

1)   countries with a stable market economy and a high level of GDP per capita: the USA, the UK, Japan, Korea, Canada, Germany, France, Norway, Italy, Australia;
2)   Eastern European countries with a high level of GDP per capita that are successfully implementing economic policies aimed at stimulating economic growth through market reforms and industrial policy: the Czech Republic, Hungary, Poland;
3)   Southeast Asian countries with high GDP per capita successfully implementing economic policies aimed at stimulating economic growth: Singapore, Malaysia;
4)   emerging market economies with low GDP per capita: BRICS countries – Brazil, Russia, China, India, South Africa, as well as Argentina and Mexico;
5)   countries of the former Soviet Union with a low level of GDP per capita that are implementing economic policies aimed at

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stimulating economic growth: Turkmenistan, Azerbaijan, Belarus.

The data on the countries were collected and processed using various sources, analytical systems and databases (OECD iLibrary, Bloomberg, Tomas Reuters, ProQuest Research Library, World Bank, ISI Web of Knowledge). The authors graphically analyzed the following indicators of the national economies of the selected countries:

1.   GDP, trillion US dollars;
2.   GDP per capita, thousand US dollars
3.   GDP per person employed, thousand US dollars;

4.   GDP growth rate, %;
5.   investment in fixed assets, billion US dollars;
6.   the dynamics of the size of labor force, the dynamics of the population of the country, the dynamics of the unemployment in the countries;
7.   R&D expenditures, % of GDP;
8.   foreign direct investment by country, billion US dollars;

3. Results and discussion

To simplify the data visualization and further analysis, let us create a legend for all of the following graphs (Figure 1).

Figure 1. The legend for the graphs in Figures 3–8.
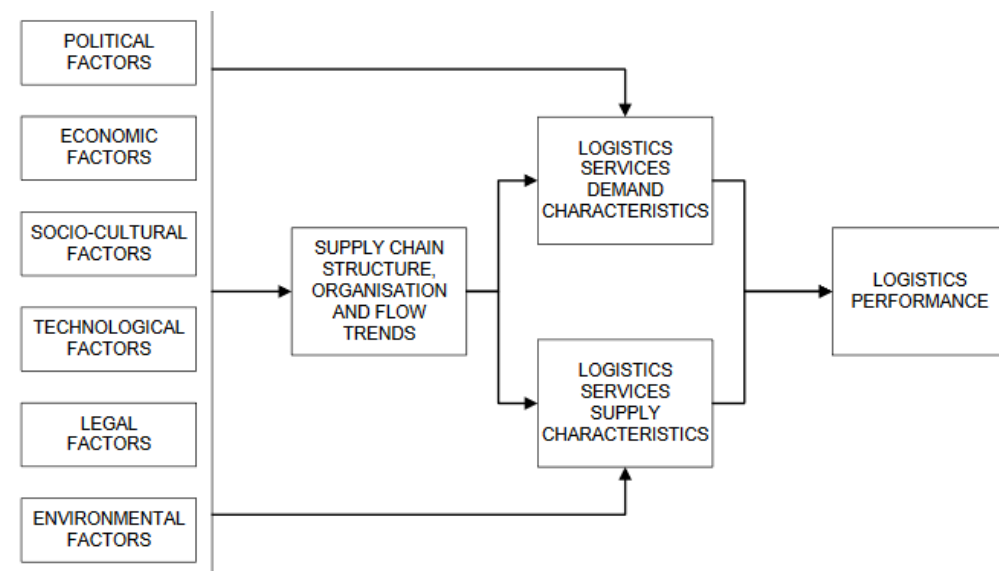

Figure 2: supply chain effects on the economic growth effects

Let us consistently represent the selected indicators on the chart and graphically analyze them.
1) GDP and economic growth.
Figures 3, 4 show the dynamics of economic indicators by countries: GDP growth rates (%) and GDP per person employed (thousand US dollars) for the period from 1990 to 2016.

The analysis of Figure 2 shows that over the past 6 years only a few countries from the sample showed growth rates of the national economy higher than the growth rates of the world economy. These were such countries as China, Turkmenistan, India, Malaysia, and Singapore, where over the past 10 years the growth rate of the national economy has exceeded

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5% per year [10]. As for the most important indicator describing labor productivity in the national economy – GDP per person employed, during the entire period of observation (1990–2016) only a few countries were able to achieve (and maintain for more than 2 years) these indicator at a level higher than the United States: Norway (1990–2016), Australia (2010–2015), Germany (1992–1994), Japan (1991–1998), and Singapore (2010-2014).
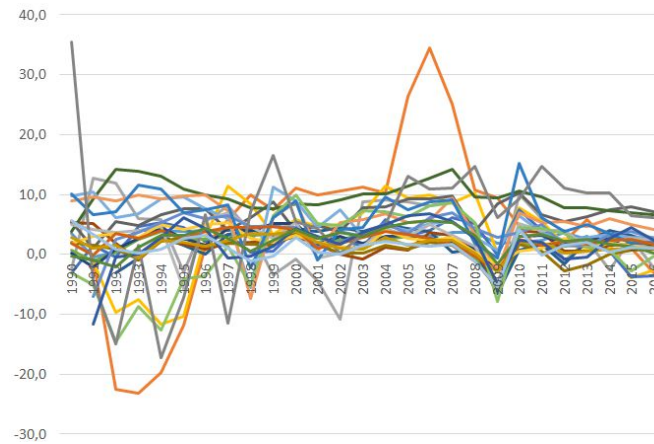
Figure 3. Dynamics of the GDP growth rate by country in 1990-2016, % per year
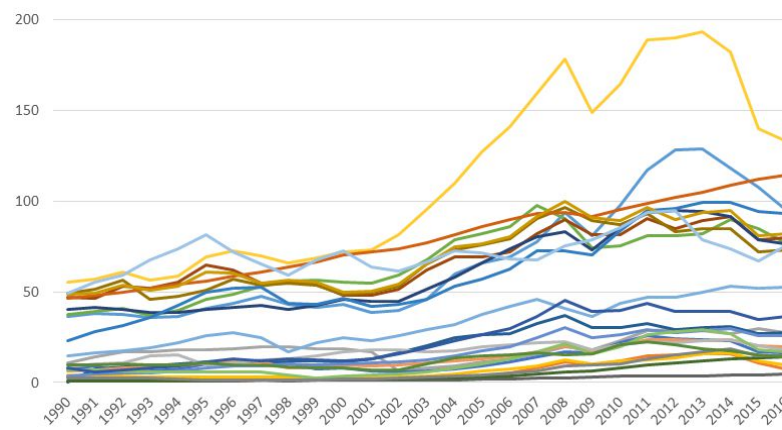

Figure 4. Dynamics of GDP per person employed by country, thousand US dollars, 1990-2016.

2) The dynamics of the extensive factors of economic growth – the growth of the capital stock and the size of labor force are presented in Figures 5-7. Figure 5 shows the dynamics of investment in fixed assets by country, in trillion US dollars for the period from 1990 to 2017. As we can see in Figure 4, China, the United States and Japan demonstrate the most dynamic renewal of fixed assets. Moreover, the level of investment in capital in China in 2006 estimated over 1 trillion US dollars, like in Japan, whereas in

the USA this figure exceeded 3.2 trillion US dollars. However, by 2015 the level of capital investment in China amounted to more than 4.8 trillion US dollars, and in the USA it was more than 3.5 trillion US dollars, while in Japan the level of investments in fixed assets remained at the level of 2006 – 1 trillion US dollars. Thus, China has demonstrated an active investment policy over the past 10 years, having increased the flow of investments in fixed assets almost fivefold.
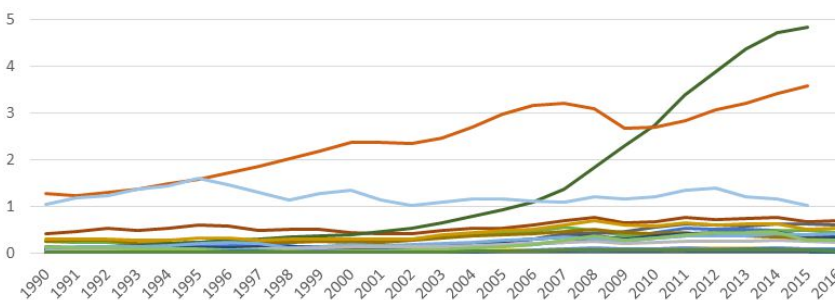

Figure 5. Dynamics of investments in fixed assets, trillion US dollars, 1990-2016.

The dynamics of the size of labor force (in million people) by country is shown in Figure 5. The analysis of these data demonstrates that this factor of extensive growth was most actively used in China and India: in the period from 1990 to 2016, the size of labor force in China grew from 641 million people in 1990 to 803 million people in 2016. In India over the same period this indicator increased from 328 million people in 1990 to 512 million people in 2016. For instance, the size of labor force in the United States over the same period grew from 128 million people in 1990 to 162 million people in 2016; in Brazil – from 65 million people in 1990 to 108 million people in 2016.
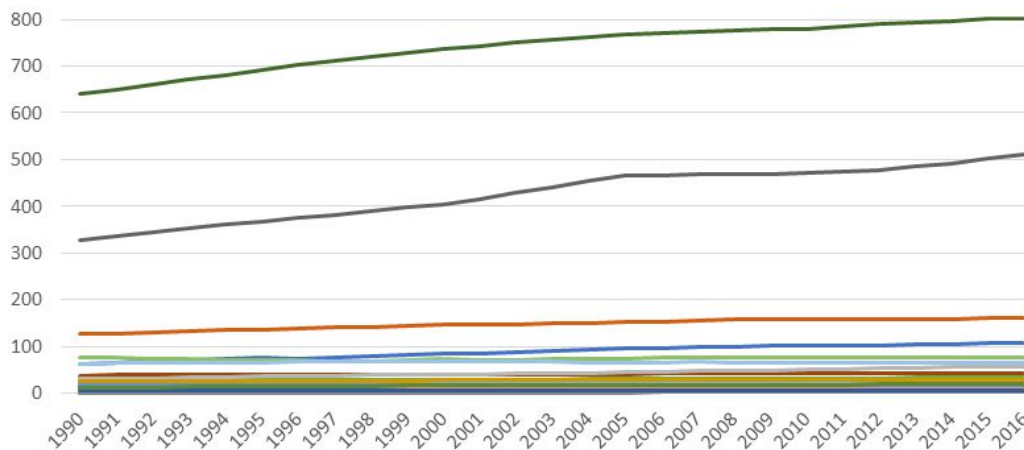

Figure 6. Dynamics of the labor force by country, million people, 1990-2016.

Figure 7 shows the dynamics of the number of the unemployed as a percentage of the labor force by country for the period from 1990 to 2017. It should be noted that in South Africa the unemployment rate remained consistently high throughout the entire period from 1990 to 2017 estimating almost 25%. In Brazil, for the period from 2014 to 2017, the unemployment rate increased from 7% in 2014 to 12.5% in 2017. In Italy, for the period from 2014, the unemployment rate fell from 12.7 in 2014 to 11.4% in 2017. In France, for the period from 2014, the unemployment rate fell from 10.3% in 2014 to 9.8% in 2017. In Turkmenistan, for the period from 2014, the unemployment rate fell from 9.0% in 2014 to 8.4% in 2017. In Canada the unemployment rate slightly increased: from 6.9% in 2014 to 7.1% in 2017. The lowest rates of unemployment growth for the period from 1990 to 2017 can be found in Singapore – less than 2% in 2017, in Japan – 3.1% in 2017, in the Czech Republic – 3.9% in 2017, the United States – 4.9% in 2017. In Russia, this figure estimated about 5.8% in 2017.
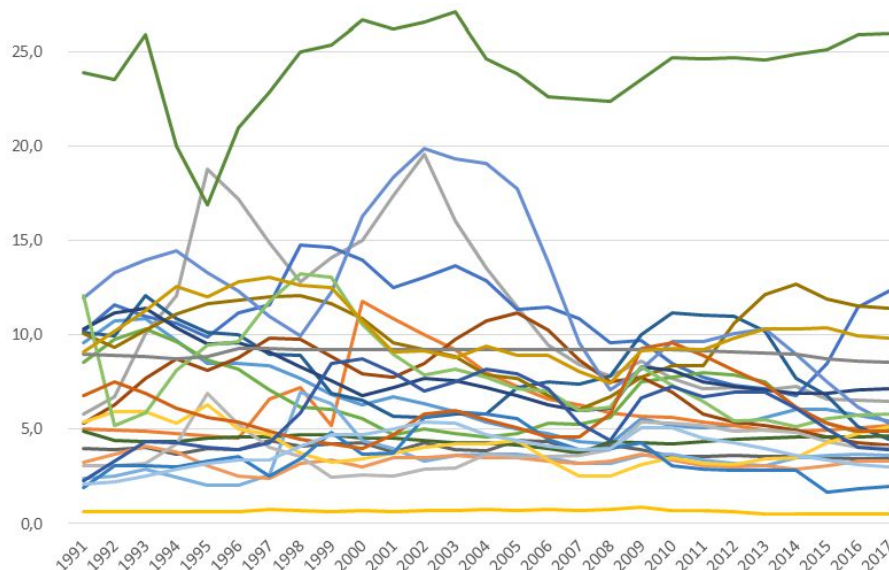

Figure 7. The dynamics of unemployment by country, % of the labor force, 1990-2017.

3) Dynamics of intensive factors of economic growth. In the neoclassical approach, GDP growth, apart from extensive factors, depends on an intensive factor – total factor productivity (TFP) [12]. In the neoclassical theory of economic growth, long-term growth which occurs due to diminishing marginal

productivity of labor and capital does not depend on the accumulation of these factors, but is determined exogenously by technical progress, which partially determines the level of TFP [13]. In this article, the authors considered the level of R&D expenditures to estimate TFP. Figure 7 shows the dynamics of R&D expenditures (% of GDP) by countries for the period from 1996 to 2015. Having analyzed the data presented in Figure 7, one can see that Korea demonstrated the most dynamic growth from 1996 to 2015: the level of R&D expenditures grew almost twofold over the period of observation – from 2.2% of GDP in 1990 to 4.3% in 2015. The level of R&D expenditure remains steadily high in Japan: 2.7% of

GDP in 1990 and 3.3% of GDP in 2015. In Germany, the level of R&D expenditures increased from 2.2% of GDP in 1990 to 2.9% of GDP in 2015. In the United States, the growth rate of R&D expenditures is less significant, with the growth from 2.4% of GDP in 1990 to 2.9% of GDP in 2015. There is an even less significant increase in R&D expenditures in France: 2.2% of GDP in 1990 and 2.23% of GDP in 2015. In China, from 1990 to 2015, R&D expenditures increased from 0.6% of GDP in 1990 to 2.1% of GDP in 2015. Singapore is another country that spent at least 2% of GDP on R&D from 2001 to 2015.
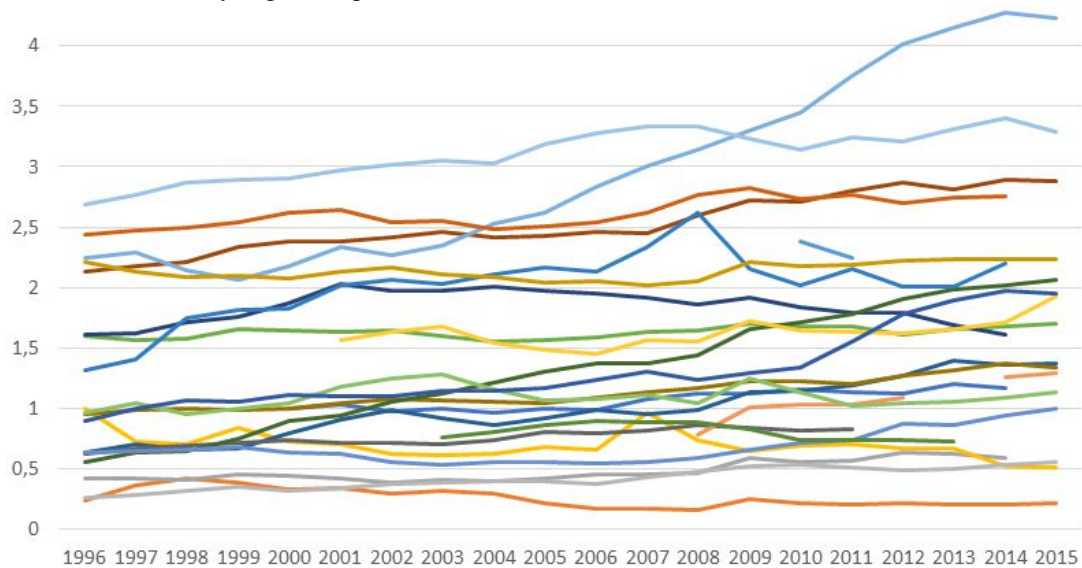

Figure 8. Dynamics of R&D expenditures by countries, % of GDP, 1990-2015.

4) Dynamics of foreign direct investment in the country.

The flow of foreign direct investment (FDI) is an important factor in the country's investment attractiveness [14]. Figure 9 shows the dynamics of the flow of foreign direct investment by country, in billions of US dollars for the period from 1990 to 2016. Despite the non-monotonous dynamics of foreign direct investment by country, the United States has been the most attractive country for foreign direct investment over the entire observation period

from 1990 to 2017 [15]: from 1990 to 2000 the United States showed an increase in FDI from 49 billion US dollars in 1990 to 350 billion US dollars in 2000. This was followed by a decline to the level of 110 billion of US dollars in 2002-2003. Next, there was an increase to the level of 340 billion US dollars in 2007, followed by a decline to 150 billion US dollars in 2009, and then again growth to 500 billion US dollars in 2015, and in 2016, again, there was a decrease to the level of 479 billion US dollars [16, 17].
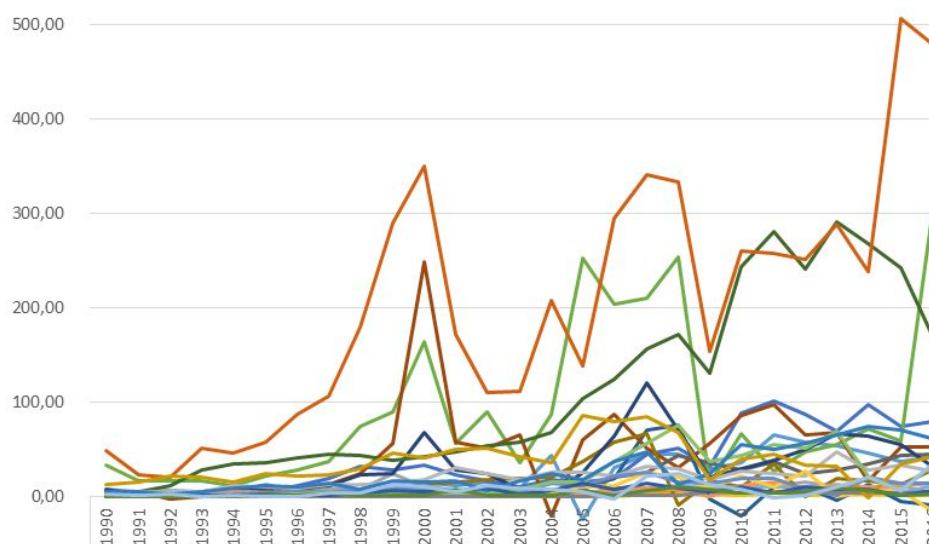
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Figure 9. Dynamics of foreign direct investment by country, billions of US dollars, 1990-2016.

The most significant growth in foreign direct investment in China began in 2004 estimating 68 billion US dollars. This was followed by the growth in foreign direct investment to 172 billion of US dollars in 2008, and a decrease to 154 billion US dollars in 2009. Later, foreign direct investment grew to 288 billion US dollars in 2013, with a sharp decline to 170 billion US dollars in 2016. It should be noted that recently, from 2015, there has been a rapid growth in foreign direct investment in the UK: in 2015 foreign direct investment grew to the level of 80 billion US dollars, and in 2016 this figure increased to 300 billion.

In particular, innovations in cargo handling, storage systems and packaging, and innovative business models within the supply chain, are daily business for the logistic industry; The Commission has been and is supporting innovative solutions along the supply chain through specific programmers.

4. Conclusion

Global supply chains and the trade of intermediary products, which are inevitably based on the global division of work, are expected to increase accordingly. Nevertheless, given the above discussed developments, it is mostly presumed that this growth will slow down in the future. Most mechanisms of state regulation that facilitate the economic development are aimed at accelerating the accumulation of private capital in physical and intangible form. Traditionally, the fiscal policy connected with this process was focused on stimulating private savings and investments with such instruments as reducing the tax burden and increasing current budget spending to expand effective demand. However, theoretical and empirical studies conducted in the 1990s revealed a high efficiency of direct financial impact on innovation processes and economic growth exerted through national and targeted programs and projects. Therefore, to ensure the required level of economic growth in the period of post-crisis development, in addition to such measures as active social policies, promoting diversification of the economy, consumer demand, mortgages, housing, improving the investment climate, governments should focus on improving the targeted programs of planning and financing budget expenditures. The budget optimization is achieved both by reducing the tax burden and by increasing the expenditures on implementing targeted programs, since the latter create the necessary conditions for increasing private investment, reducing unemployment, improving the quality of human capital, and provide conditions for the development of particular regions and industries. Analysis of the best international practices related to the development and successful implementation of various types of state economic policies showed that the following countries have successfully applied the following mechanisms:

−   Structural policies aimed at increasing productivity and per capita income: Norway, USA, Australia, Singapore, Canada, Germany;

−   industrial policy focused on the creation of a developed (according to Kaldor) production structure of the economy, for such indicator as the share of high-tech exports in total industrial exports: Singapore, Malaysia, Korea, China, Germany, France, the United States;

−   innovation policy focused on the growth of TFP, with the expenditures on research and development of at least 2.0% of GDP: Korea, Japan, Germany, USA, France, Singapore, China;

–   investment policy, in terms of the investment in fixed assets: China, USA, Japan, Germany;

–   investment policy, in terms of foreign direct investment in the country: China, USA, UK.

The sufficient volume of investment in the economy is a crucial prerequisite for economic growth. In the conditions of limited external investment sources, it is necessary to maximize the internal potential. However, attracting investment sources is only one of the ways of stimulating the investments as an integral factor of economic growth. Another equally important aspect is developing the choice procedure of these investment projects.

References

[1]   Slepov, V.A., Burlachkov, V.K., Danko, T.P., Kosov, M.E., Volkov, I.I., Grishina, O.A., Sekerin, V.D. *The country's economic growth models and the potential for budgetary, monetary and private financing of gross domestic product growth*. European Research Studies Journal, 20(4), 488-500, 2017.

[2]   Valila, T. *Trends in infrastructure investments in the EU*. EIB Conference in Economic and Finance. Luxembourg, p. 18, 2010.

[3]   Aleksashenko, S.V. *Scenarios and alternatives of macroeconomic policy. In The 12th International Scientific Conference on the Problems Economic and Social Development.* In 4 books. (Ed.) E.G. Yasin. Book 1. Moscow: HSE Publishing House, 2012.

[4]   Solow, R.M. *Technical Change and the Aggregate Production Function*. The Review of Economics and Statistics, 39(3), 312-320, 1957.

[5]   Schankerman, M. *The Effect of Double-Counting and Expensing on the Measured Returns to R&D*. The Review of Economics and Statistics, 63, 454-458, 1981.

[6]   Bashkirova, N.N., Lessovaia, S.N. *State and business co-operation in settling socio-economic issues: Forward to sustainable development of ecologically unfavorable regions*. IOP Conference Series: Earth and Environmental Science, 107(1), 012128, 2018.

[7]   Schultz, T.W. *Reflections on Investment in Man. Journal of Political Economy*. 70(5), 1-8, 1962.

[8]   Fellner, W. *Specific Interpretations of Learning by Doing. Journal of Economic Theory*, 1, 119-140, 1969.

[9]   Kaldor, N. *The case for regional policies. Scottish Journal of Political Economy*, 17(3), 337-48, 1970.

[10]   Ali Akbar, Ahmadi, Abolghasem, Bagheri Sirayi, Mohammad Hossein Moghadasan. *Information technology; a facilitator for improving dynamic capabilities through knowledge management utilization*, UCT Journal of Management and Accounting Studies, Issue 2, pp. 27-36, 2014.

[11]   Muhammad K. *The Effects of Electronic Human Resource Management on Financial Institutes*. Journal of Humanities Insights. 02(01): 01-5, 2018.

[12]   Thirlwall, A.P. *The balance of payments constraint as an explanation of international growth rates differences*. Banca Nazionale del Lavoro Quarterly Review, 32(128), 45-53, 1979.

[13]   Bykanova, O.A., Akhmadeev, R.G., Kosov, M.E., Ponkratov, V.V., Osipov, V.S., Ragulina, Y.V. *Assessment of the economic potential of sovereign wealth funds*. Journal of Applied Economic Sciences, 12(1), 70-84, 2017.

[14]   Bessonov, V.A. *Analysis problems of the Russian macroeconomic dynamics of the transition period*. Moscow: Gaidar Institute for Economic Policy, 2005.

[15]   Bessonov, V.A., Voskoboynikov, I.B. *Changes in aggregate factor productivity in the Russian industry*. In Structural changes in the Russian industry. Moscow: Publishing House of the State University Higher School of Economics, Ch. 2, pp. 55-90, 2004.

[16]   Akhmadeev, R.G., Kosov, M.E., Bykanova, O.A., Frumina, S.V., Philippova, N.V. *Impact of the tax burden on the country's investments.* Journal of Applied Economic Sciences, 11(5), 992-1002, 2016.

[17]   Silvestrov, S.N., Kuznetsov, N.V., Ponkratov, V.V., Smirnov, D.A., Kotova, N.E. *Investment development of Russian regions backed up by natural monopolies*. European Research Studies Journal, 21(3), 90-103, 2018.