Sustainable Development and Investment Policy (on the Example of the USA)

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Abstract: It is well known that the overwhelming number of countries with a developed market in the period from the early to mid-1970s to the present is characterized by a tendency towards a reduction in the cumulative average annual growth rate of per capita GDP. However, no earlier than the mid-1980s and no later than the mid-2000s, a specific (special) period of time with a gentle line of cumulative dynamics emerged. As for the United States and only for this period, the article also provides an illustration of the predominant growth of GDP in relation to fixed capital. After the end of the special period, the dynamics everywhere again sharply weakens. The article is devoted to the study of the phenomenon of a special period on the example of the United States. It is shown that the stabilization of the growth rate of labor productivity in the considered period of time is associated with the dynamics of specific capital requirements. In turn, it was revealed that the factor influencing the amount of capital requirements, and, thereby, the dynamics of productivity is the intellectual component of investment. Thus, the nature of the special period, the predominant growth of the product relative to fixed capital in the United States during approximately 1980-1990s, is to a certain extent clarified.

1 INTRODUCTION. STATEMENT OF A QUESTION

As is known, since the late 1960s and early 1970s, practically in all developed countries there has been a clear tendency towards a weakening of economic dynamics. The downtrend is not, however, monotonous. At a certain stage (not earlier than the mid-1980s and not later than the mid-2000s), the indicated trend is interrupted, the cumulative (with a base, for example, 1970), average annual GDP growth rates stabilize or even slightly increase.

This period can be considered "special". This article attempts to investigate its nature using the example of the United States.

2 SPECIAL PERIOD

The period of time with a relatively stable dynamics of per capita GDP between phases with a declining trend, we called a special period. It turned out that the presence of such a period is characteristic of most developed countries (Table 1).

Table 1. Cumulative average annual growth rates of GDP per capita by periods in developed market countries (GDP per capita, constant 2010 US$)*

Austria (1995-2008)			Netherlands (1991-2009)		
1971-1994	1971-2008	1971-2019	1971-1990	1971-2009	1971-2019
2,5	2,4	2,0	1,9	1,9	1,7
Luxembourg (1990-2007)			Norway (1992-2001)		
1971-1989	1971-2007	1971-2019	1971-1991	1971-2001	1971-2019
3,1	**3,2**	2,40	3,1	3,1	2,2
Belgium (1997-2008)			Portugal (1987-2008)		
1971-1996	1971-2008	1971-2019	1971-1986	1971-2008	1971-2019

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2,2	2,2	1,8	**2,6**	**2,6**	2,1
Greece (1988-2010)			Singapore (2003-2010)		
1971-1987	1971-2010	1971-2019	1971-2002	1971-2010	1971-2019
1,8	**1,8**	1,2	5,1	5,0	4,5
Denmark (1985-1997)			United States (1985-2007гг.)		
1971-1984	1971-1997	1971-2019	1971-1984	1971-2007	1971-2019
2,0	2,0	1,6	2,1	2,1	1,8
Israel (1985-2007)			United Kingdom (1988-2007)		
1971-1984	1971-2007	1971-2019	1971-1987	1971-2007	1971-2019
2,1	**2,1**	1,9	**2,3**	2,3	1,8
Spain (1989-2007)			France (1994-2001)		
1971-1988	1971-2007	1971-2019	1971-1993	1971-2001	1971-2019
2,4	**2,4**	1,9	**2,2**	**2,2**	1,6
Italy (1983-1991)			Finland (2000-2008)		
1971-1982	1971-1991	1971-2019	1971-1999	1971-2008	1971-2019
2,8	**2,8**	1,4	2,6	2,7	2,0
Canada (1985-2007)			Sweden (1990-2007)		
1971-1984	1971-2007	1971-2019	1971-1989	1971-2007	1971-2019
2,1	2,1	1,7	1,9	1,9	1,6
Korea, Rep. (1983-2003)			Germany (1995-2001)		
1971-1982	1971-2003	1971-2019	1971-1994	1971-2001	1971-2019
7,2	**7,2**	5,8	2,3	**2,2**	1,8
Switzerland (1989-2008)					
1971-1988	1971-2008	1971-2019			
1,1	1,1	1,0			

* The boundaries of the special period are indicated in brackets.

In a number of developed countries, for example, Australia and Japan, the presence of a special period has not been revealed. In all cases, the cumulative average annual growth rate of GDP per capita during the special period is comparable to the analogous indicator prevailing before it began. In some countries, the average annual growth rate of GDP per capita in a special period is slightly lower than the indicators that existed before it began (Singapore, Germany), in Finland - slightly higher. But the "second wind" is not eternal, and after the end of the special period, the pace has sharply decreased everywhere.

We tend to associate the nature of the special period with the computer information boom that began approximately in the mid-1980s. The positive impact of computer technology has manifested itself in almost every developed country. The new local trend usually lasted for about 10-20 years and ended most often by the middle - end of the 2000s. Earlier than all other countries, opposition to the global trend towards weakening economic dynamics manifested itself in the USA, Denmark, Israel, Italy, Canada, Rep. Korea. This phenomenon has manifested itself en masse since the late 1980s, early-mid 1990s (second wave).

The first bell, indicating the end of a special period, rang in 2000 and was connected, apparently, with the global financial crisis, when the shares of, first of all, high-tech companies literally collapsed. The inertia associated with the influence of computer technology, however, continued until 2008. World financial and economic crisis 2008-2009 put the last points over the i.

With regard to countries with emerging markets, there is no need to talk about a certain special period. However, in most of these countries, over the past two to three decades, economic development has ceased to be chaotic. It has become more orderly, characterized by an increasing rate of growth in GDP per capita. In different countries, growth began in different years, but, as a rule, not earlier than the beginning, the mid-1990s. And it continued until the end of the period under review. It is possible that these two to three decades were necessary to provide susceptibility to the results of the computer revolution.

3 STAGES OF ECONOMIC GROWTH IN THE USA

The ratio of indicators of the dynamics of GDP and fixed production capital, its change over time can give a certain idea of the characteristic features of

economic growth, extensive or intensive type of development. Data for the USA are presented in Fig. 1.

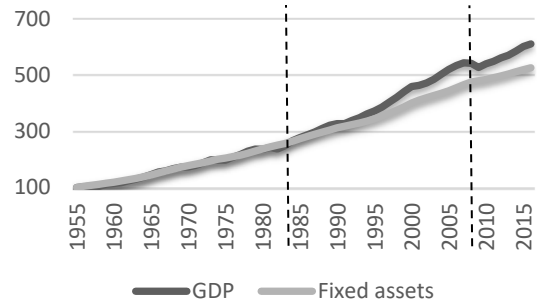

Figure 1: Growth index of GDP and fixed assets (constant 2009 US$),%, 1955-100.

Until the mid-1980s, the production base and product release developed almost synchronously, indicating an extensive type of development. In the next 20 years or so, there has been a predominant dynamics of GDP relative to fixed capital, which is a sign of intensive growth. Since about the middle of the 2000s, the growth rates of both indicators have practically equalized again.

The phenomenon of predominant product growth is the subject of further analysis.

4 DECOMPOSITION OF PRODUCTIVITY DYNAMICS INTO EXTENSIVE AND INTENSIVE COMPONENTS

Qualitative characteristics of the production apparatus (PA) measured by numerous technical and economic indicators reflecting its specific aspects and properties. We associate the consolidated generalized assessment of the quality of PA at the macroeconomic level with the indicator of labor productivity. The higher this indicator, the higher the level of technological perfection of the PA.

The restructuring of the PA, the replacement of obsolete fixed assets can be carried out on the basis of two types of technologies, each of which ensures productivity growth. The difference between the types consists in the ratio of the productivity of the equipment supplied for replacement and its cost, more precisely, the value of the specific investment. In one case, these are breakthrough technologies with specific investments that are fundamentally better than those being replaced; in the other, they are modern ordinary technologies with a ratio of cost and productivity similar to replaceable methods of production.

If the worker's labor productivity increases less or approximately to the extent of the increase in the cost of his workplace (capital-labor ratio), then it is natural to attribute this growth to ordinary technologies. These technologies are based on routine R&D, knowledge mainly of yesterday. Replacing obsolete assets with conventional technologies increases productivity, but at best maintains the same capital intensity (capital productivity). Higher growth rates of productivity in relation to capital-labor ratio are due to the phenomenon of breakthrough technologies that have fundamentally better technical and economic parameters. This type of technology provides an increase in both productivity and capital productivity; generated by fundamental R&D, new knowledge.

The idea of measuring the measure of innovativeness of the PA modernization project is to try to decompose the increase in labor productivity into extensive and intensive (innovative) factors that generate it. On the one hand, this is an increase in fixed capital (capital-labor ratio), on the other, a change in its qualitative components, that is, the volume of product per unit of fixed capital (capital productivity).

At the operational level, the measurement of the innovation component within the framework of the considered approach is associated with the dynamics of capital productivity. An assessment of the intensity of innovative activity is considered to be the part of the increase in productivity due to the dynamics of capital productivity. The more productivity growth exceeds growth of the capital-labor ratio, the higher the level (scale) of innovation, the role and importance of the innovation factor.

As is known, labor productivity index can be expressed as multiplication of the capital-labor ratio and the capital productivity indices:

$$I_{pr} = I_{cl} \cdot I_{cpr}, \quad (1)$$

where is the labor productivity index, is the capital-labor ratio and is the capital productivity index.

For the case of continuous time, taking the logarithm of equation (1), we obtain:

$$\ln I_{pr} = \ln I_{cl} + \ln I_{cpr}, \quad (2)$$

Thus, the productivity index is presented as the sum of the capital-labor and capital-productivity indices. On the basis of relation (2), it is possible to single out a part of the rate of productivity growth due to a change in capital productivity:

$$\alpha_{in} = \frac{\ln I_{cpr}}{\ln I_{pr}}, \quad (3)$$

Within the framework of this approach, the parameter will be considered an estimate of the intensity of innovative activity.

So, the positive growth rates of capital productivity and capital-labor ratio make it possible to "naturally" decompose the increase in labor productivity into factors that explain it, without any remainder. Negative growth rates of capital productivity, testifying to the predominant growth rates of capital-labor ratio relative to the dynamics of labor productivity, lead to a parameter value less than zero.

An important note is as follows. A negative value does not necessarily mean that there is essentially no innovation activity. Apparently, the following statement will be true: a positive value of the parameter is sufficient, but not a necessary condition for the presence of innovative activity.

Using this technique, we present data that give some idea of the nature of the reproduction process in the United States, the role of the innovation factor (formula 3) already in certain quantitative estimates (table 2).

Table 2. Share in total productivity growth due to increased capital productivity (assessment of the intensity of innovative activity) by periods (2009 US$),%

Base year	1955			1985		2005
Period	1956-1985	1956-2005	1956-2016	1986-2005	1986-2016	2006-2016
Value α_{in}	2,6	17,8	15,0	41,2	29,5	-7,6

It turned out that in general for the period 1956-2016. approximately 85% of the productivity gain is due to investments based on routine, 15% - on fundamental research and development. It is also possible to assert with certainty about the presence of a special twenty-year period of time, which had a decisive influence on the picture of the reproductive process over the entire more than half a century. In 1986-2005. more than 40% increase in productivity is achieved due to advanced technologies; of providing a significant advantage in the growth of labor productivity over the ratio of capital and labor.

5 THE NATURE OF INNOVATION. THE ROLE OF THE INTELLECTUAL PRODUCT

Consider an approach to studying the nature of the growth of capital productivity. As you know, in the fundamental Harrod-Domar equation, economic dynamics is functionally linked to the rate of accumulation and the marginal capital intensity (capital ratio):

$$G = \frac{I}{Y} : \frac{I}{\Delta Y}, \quad (4)$$

where G - GDP growth rate, I - investments , Y - GDP, ΔY - GDP increase.

By analogy with this equation, we represent the increase in labor productivity $\Delta \mathrm{Pr}$ as a function of the volume of specific investments (for the creation of one job) $\bar{I}^{1,\tau}$ for the period [1, τ] and the indicator $E^{1,\tau}$, which we call normalized investments for the period [1, τ]:

$$\Delta \mathrm{Pr} = \bar{I}^{1,\tau} : E^{1,\tau}, \quad (5)$$

where $\Delta \mathrm{Pr} = \mathrm{Pr}^{\tau} - \mathrm{Pr}^{0}$;

$$\bar{I}^{1,\tau} = \frac{\sum_{i=1}^{\tau} I^{i}}{\sum_{i=1}^{\tau} L^{i} \Big/ \tau};$$

$$E^{1,\tau} = \frac{\sum_{i=1}^{\tau} \bar{I}^{i}}{\sum_{i=1}^{\tau} L^{i} \Big/ \tau} : (\mathrm{Pr}^{\tau} - \mathrm{Pr}^{0}) \quad \tau = 1, \ldots, \mathrm{T},$$

Designations: Pr^{τ} - labor productivity in year; Pr^{0} - labor productivity in the base year 0; $\bar{I}^{i}$ - gross production investment in year i; L^{i} - the number of people employed in year i.

The parameter $E^{1,\tau}$ is interpreted as the need for capital for the growth of labor productivity of the unit intensity; answers the question of how many dollars of production investment is required over a certain period to equip one workplace in order to increase the worker's productivity per unit during the period. In what follows, for brevity, the dimensionless parameter will be called "normalized investment" or "capital requirement".

Data on the dynamics of labor productivity and normalized investment are presented in Fig. 2.

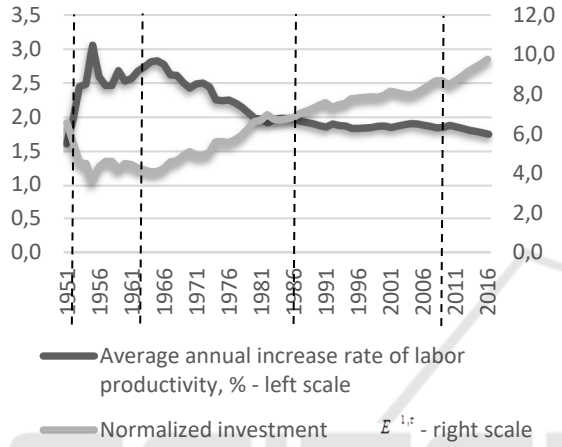

Figure 2: Dynamics of labor productivity and normalized investment (2009 US$),%, base 1950

In fig. 2, the relationship between the cumulative indicators of normalized investments and the cumulative dynamics of labor productivity is clearly visible. In particular, the decrease in the cumulative capital requirement in 1951-1955. accompanied by an increase in cumulative productivity growth; to the period of significant growth in the cumulative indicators of normalized investment from the mid-1960s to the early 1980s corresponds to a noticeable decrease in the cumulative rates of productivity growth, etc. Thus, it is likely that the relationship between changes in capital requirements and productivity growth rates is reversed.

In turn, it is appropriate to assume that the factor influencing the amount of capital demand, and, thereby, the dynamics of productivity, is the intellectual component of investment (table 3).

Table 3: Dynamics of labor productivity and parameters that generate it by periods

Indicators	Fixed base				Variable base			
	1951-1965	1951-1982	1951-2003	1951-2016	1951-1965	1966-1982	1983-2003	2004-2016
Average annual increase rate of labor productivity,%	2,8	1,9	1,9	1,7	2,8	1,1	1,8	1,2
Parameter value $E^{1,\tau}$	4,1	7,0	8,0	9,8	4,1	11,2	8,0	14,1
Increase in the share of an intellectual product in production investments in average annual terms, p.p.	0,74	0,35	0,43	0,37	0,74	0,03	0,48	0,19

During 1966-1982. the share of the intellectual product in production investments remained practically unchanged. The consequence was a sharp increase in the value of the parameter $E^{1,\tau}$ - from 4,1 in 1951-1965. up to 11,2 in 1966-1982 and, thus, a reduction in the average annual increase rate of labor productivity (2,8% and 1,1%, respectively). A significant increase in the share of an intellectual product in production investments in 1983-2003. (0.48 pp on average per year) created the conditions for reducing the parameter $E^{1,\tau}$ to 8,0 and raising the average annual increase rate of labor productivity to 1,8%. Modest and unstable growth of the intellectual product in 2004-2016. proved insufficient to withstand a significant increase in capital requirements. The performance momentum has weakened again.

Thus, the nature of the special period, the predominant growth of the product relative to fixed

capital in the United States during approximately 1980-1990s, is to a certain extent clarified.

6 THE DISCUSSION OF THE RESULTS

It is believed that overcoming the long-term negative trend in the development of the US economy is associated with the neoconservative policy of President Reagan (Reaganomics). It cannot be denied at the same time that this policy was carried out during the years of the computer revolution. Its economic consequences in terms of innovative development manifested themselves in a more favorable dynamics of specific investments than before. With the accumulation rate practically unchanged, it became possible to accelerate labor productivity and macroeconomic growth.

A little later than in the United States, the positive fruits of computer technology manifested in most of the developed countries of the world. After the crisis of 2008-2009. The “computer rent” was exhausted, and the developed countries returned to the trajectory of declining growth.

An important further task is to assess the specific indicators that have given rise to a special period in most developed countries, not just the United States.

7 CONCLUSION

Macroeconomic dynamics in the United States closely correlates with changes in the indicator characterizing the need for capital. In turn, the value of this need is apparently determined by the share of the intellectual product in production investments. We tend to associate the nature of the special period in the United States and other developed countries with the computer-information boom of the 1980s and 1990s. The positive impact of computer technology has manifested itself in almost all of them, although to varying degrees.

The first bell, indicating the end of a special period, rang in 2000 and was connected, apparently, with the global financial crisis, when the shares of, first of all, high-tech companies literally collapsed. The inertia associated with the influence of computer technology, however, continued until 2008. World financial and economic crisis of 2008-2009 placed the last points over the i.

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