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Impact of Economic Shocks on the Russian Reproduction System

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Abstract. The impact of external shocks on the Russian economy, which have intensified significantly in the last decade, has a negative impact not only on the dynamics, but also on the structure of the economy, causing negative shifts in its “core” – the reproduction system. The slowdown in the processes of capital accumulation and the involvement of private savings in this process, the increasing dependence on government spending and technology imports, the reduction in the share of profits and taxes in the business sector in the creation of GDP – all that undermines the basis of long-term economic growth and increases its susceptibility to external shocks. The purpose of the study is to identify “problem” areas in the structure of the economic reproduction system – processes that are most susceptible to the effects of non-cyclical negative phenomena – shocks, and through this determine the resistance of the entire system to them, in order to identify adequate directions for structural policy. The article confirms the decisive role of gross capital formation, the involvement of private savings in investment, the formation of entrepreneurial profits, and the investment of national advanced production technologies in protecting the reproduction system and, through it, the entire economy from increasing external shocks and sanctions. The article proposes the main directions of an integrated structural policy – comprehensive stimulation of private investment, increasing the efficiency of production factors by accelerating the creation of the transfer of new technologies and renewal of fixed capital, promoting the export of technologies for the “markets of the future.”

Keywords: reproduction system, economic shocks, investment, innovation, advanced production technologies, structural policy.

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Воздействие экономических шоков на российскую воспроизводственную систему

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Аннотация. Воздействие на российскую экономику внешних шоков, значительно усилившихся в последнее десятилетие, оказывает негативное влияние не только на динамику, но и структуру экономики, вызывая отрицательные сдвиги в ее «ядре» – воспроизводственной системе. Замедление процессов накопления капитала и вовлечение в этот процесс частных сбережений, нарастание зависимости от государственных расходов и импорта технологий, сокращение доли прибыли и налогов в предпринимательском секторе в создании ВВП – все это подрывает основу долгосрочного роста экономики и усиливает ее подверженность внешним шокам. Цель исследования заключается в выявлении «проблемных» зон в структуре воспроизводственной системы экономики – процессов, в наибольшей степени подверженных воздействию нециклических негативных явлений – шоков, и через это определяющих устойчивость к ним всей системы, для определения адекватных направлений структурной политики. В статье подтверждается определяющая роль валового накопления капитала, вовлечения частных сбережений в инвестиции, образования предпринимательской прибыли, инвестирования национальных передовых производственных технологий в защите воспроизводственной системы и через нее всей экономики от усиливающихся внешних шоков и санкций. В статье предложены основные направления интегрированной структурной политики – комплексное стимулирование частных инвестиций, повышение эффективности факторов производства за счет ускорения создания трансфера новых технологий и обновления основного капитала, содействие экспорту технологий для «рынков будущего».

Ключевые слова: воспроизводственная система, экономические шоки, инвестиции, инновации, передовые производственные технологии, структурная политика.

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Introduction

The impact of economic shocks as non-cyclical negative poorly predictable events – endogenous (purely economic – investment, labor, price, inflation, etc.) and exogenous (non-economic – political, technological, pandemic, natural), external and internal – on the Russian economy penetrates deep into the reproduction processes, changing the structure of capital accumulation and consumption, savings and innovative modernization. Ultimately, such structural changes, both negative and positive, as well as the resistance of the national economy to them, determines the prospects of economic growth in the conditions of external constraints, market and technological shocks.

It is reasonable to analyze the impact of shocks on the reproduction system within the framework of the following periodization:

1992–1996 – internal exogenous shock of privatization and denationalization;

1998–1999 – internal endogenous shock of the sovereign debt default, which caused a crisis in the foreign exchange market and the banking system, coinciding with the external shock of falling prices on the world oil market and stock crisis in Latin America, and then in South-East Asia;

2008–2009 – endogenous external shock of the global financial crisis, which caused a fall in investment and oil prices;

2014–2015 – exogenous external shock caused by anti-Russian sanctions of the “first wave”;

2020 – external exogenous shock of the global pandemic COVID-19;

2022 – external exogenous shock caused by the “second wave” of external sanctions.

The impact of external and internal shocks on the reproduction system of the Russian economy during these periods is so great that we can speak of a certain “new reality”, in which changes in the reproduction and then in the sectoral structure of GDP cause restrictions on economic growth (Lyman, et al., 2022). In particular, the decline in foreign investment (technologically related – almost to zero), export-import embargo, external currency restrictions, difficulties in using the positive trade balance to increase investment in the civ-

il sector, etc. not only worsen the reproductive structural proportions as a basis for a long-term GDP growth, but also reduce the national economy’s resistance to the external shocks.

The general problem of the impact of external and internal shocks on reproduction in the Russian economy can be highlighted by analyzing the structural dynamics of GDP distribution – the basis for considering the structure of reproduction – against the background of the above-mentioned periods of shock impact (Fig. 1).

The diagram shown in Fig. 1 allows clearly identify two trends in the development of reproduction processes in the structure of the Russian economy, formed under the influence of non-cyclical shock forces.

Trend number one reveals a stronger impact of external and internal shocks at all stages on gross accumulation than on final consumption. It is capital accumulation that falls much deeper under the impact of shocks that cause a reduction in GDP growth as well. Thus, in 1998 the reduction in gross accumulation amounted to 52.2 % and in final consumption – 2.1 %, in 2009–41.0 % and 3.9 % respectively, in 2022–4.2 and 0,4 %.

At the same time, in the reproduction structure of the Russian economy at all stages of the action of external and internal shocks (1995–2022), the sign of the balance of payments did not change – net exports remained positive and at a high level – 18.8 % of GDP in 1999, and 12.5 % of GDP in 2022.

Trend number two is a constant reduction in gross savings against the background of consumption growth in the structure of GDP distribution. Thus, in 1998–1999, the rate of accumulation decreased two-fold (by 13.5 %) relative to 1995 (the share of final consumption has grown by 4.5 %), in 2009 the share of accumulation decreased by 2.9 % from the level of 2004 (the share of consumption has grown by 4.8 %). Further, in 2015 the rate of accumulation decreased by 2.7 % from the level of 2012 (final consumption has grown by 1 %), and in 2022 – by 1.5 % from the value of 2021.

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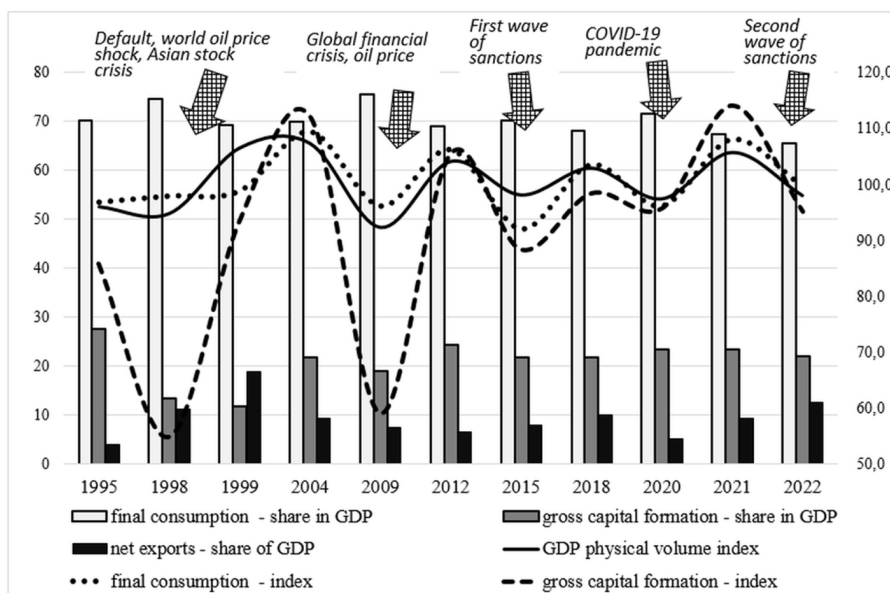


Fig. 1. Dynamics of GDP distribution structure in Russia, % (shares in GDP – left scale, indices – right scale), associated with periodization of shocks (drawn by the Authors based on data: (ROSSTAT, 2024))

a high level – in 1999 18.8 % of GDP, and in 2022–12.5 % of GDP.

Based on this general description of the shocks impact on the Russian production system, the hypothesis of the study can be formulated as the following. Non-cyclical forces cause, first of all, a reduction in investment, which undermines the basis for future economic growth and its resistance to shocks, while the stabilization of GDP dynamics in the short term (during the shocks) is ensured, most particularly, by consumer spending and a positive balance of payments, with a low level of public debt, which is typical for the Russian economy. All this may provoke a long-term recession in case of strengthening the external shocks and restrictions and reduction of public expenditures, which should be taken into account when adjusting the state structural polmade icy, initially, in the regulation of reproduction processes (investment, consumption, savings) and technological modernization.

Literature Review

Previous Studies on Economic Shocks

Primarily, studies of economic shocks were conducted separately from the scientific

analysis of economic cycles, placing shocks in a series of random, unpredictable events that affect various processes in the national and world economy. E. E. Slutsky (Lola, 2014) was one of the first to study the reaction of the economy to shocks as weakly predictable impulses in an attempt to derive from this reaction certain regularities used to predict modifications of economic cycles that arise when the economy unexpectedly leaves the state of equilibrium. This is what the “Frisch-Slutsky paradigm” is about – the idea of changing phases of the economic cycle caused not by the known laws of economic dynamics, which consider the action of endogenous forces (overproduction and overaccumulation, investors’ striving for risk, etc.), but by not fully predictable exogenous forces – epidemics, political instability, trade wars and sanctions, etc. (Minakir, 2009).

Then, the studies of economic shocks were closely linked to the analysis of the nature and periodicity of the change of phases in economic cycles. Thus, J. Hicks in the neo-Keynesian theory singled out the exit of the economy from the general equilibrium as a transmission link between shocks and cyclical recession (Hicks, 1946). Later these ideas were transformed into

the “concept of TFP-shocks” – upswings in factor productivity associated with uneven innovation development in different industries – the result of knowledge overaccumulation in them (Mishra, et al., 2011).

N.D. Kondratyev mentioned the shock character of the impact on the economy of such exogenous forces as inventions and scientific discoveries, as well as endogenous ones – fluctuations in commodity prices and interest rates – in his study of “long waves” of dynamics (the emergence of shocks at the beginning and end of “waves”, which serves as a phase transition between them) (Kon-dratyev, 1989). F. Canova, D. Lopez-Salido, C. Michelacci, continuing the research of economic cycles in the theory of “creative destruction” of J. Schumpeter, speak about technological cycles, which cause an unexpected increase in unemployment for the state and markets, which is then fixed at a lower level due to productivity growth (positive effect of technological shocks) (Canova, et al., 2006). Also, C. Perez sees in technological shocks the acceleration of innovative development of the economy as the reason for the previously unpredicted movement of capital and labor between industries, which has a shock effect on the dynamics of GDP and employment (Perez, 2002).

***Previous Studies on the changes
in the reproductive structure of the economy***

Shifts in reproduction proportions in the economy are considered mainly in the context of inter-sectoral redistribution of capital – between industry and the financial market, between high-tech, processing and extractive sectors, as well as in connection with the acceleration of innovative development of industry. The studies of changes in the reproductive structure in the post-industrial era conducted in the second half of the 20th century (Bell, 1973; Clark, 1991; Reich, 1992) are of interest, which consider such transformations in the economy and society as “tertiarization” and “servicization”, which accelerate the accumulation of capital outside the industrial sector, change the structure of consumption and exports. Further post-industrial expectations of changes in the reproduction system structure by the example

of Russian national economy are associated with the problems and prospects of expansion of new Industry 4.0 markets on the institutional basis of the National Technology Initiative (AeroNet, Au-toNet, NeuroNet, EnergyNet, TechNet, etc. – a total of 9 markets) (Magomadov, et al., 2021).

Changes in the institutional basis of structural changes in the reproduction system were considered as a purposeful “cultivation” of new investment institutions and industrial policy made by the state (Yasin, 2005), as a change in the coordination strategies between the state and business as investors (Emar-Duverney, 1997), as a result of the impact of internal factors on entrepreneurial behavior and the inclination of investors and savers to risk (North, 1990).

***Research on changes
in the reproductive structure
under the influence of technological shocks***

Structural shifts in the reproduction system are analyzed in connection with the impact of radical technological innovations of recent decades. They are so rapid that it is difficult to predict their long-term effects on the economy (the emergence of highly productive new industries – Mining 4.0, Energy 4.0, Transport 4.0, Medicine 4.0, etc. as a result of the diffusion of Industry 4.0 technologies) (Schwab, 2018).

The authors, who divide the structural effects into modernization and neo-industrial ones induced by Industry 4.0, emphasize the dual impact of shocks on the reproduction system structure. Modernization structural shifts in the reproduction system reflect the neutral impact of technological shocks, associated with a decrease in the share of the raw materials sector and growth of the manufacturing sector in investment, exports, and employment. Neo-industrial shifts reflect the positive nature of technological shocks, the indicators of which are the decrease in the share of manufacturing sector with the growth of the high-tech sector in the process of transition to the digital economy (Ipatova, 2019).

The regulation of structural shifts in the reproduction system under the conditions of shocks by the state is studied through the prism of strategic planning and target programming instruments, capital redistribution within the

framework of innovative industrial development projects, launching development institutions and public-private partnerships (transition from “passive” to “active” industrial policy) (Lanskaya, et al., 2015). It is also proposed to level the impact of shocks on reproduction through the transition from poorly coordinated programs of sectoral development to a single state investment and modernization program, which allows fully realize the comparative advantages of the national economy (Chernenko, et al., 2015). It also can be realized in the system of transition from regulating “... the seller’s market to the buyer’s market in the context of a series of global crises (Andreeva, 2016)”, including the transition from the support of state holding companies – monopolies to stimulating competition in processing industry (Andreeva, 2016).

Research Methodology

This study used the method of comparing the dynamics of data series on the state of indicators of the processes, the proportions of which form the reproductive structure (investment and capital accumulation, consumption and savings, exports and import, as well as indicators of innovation activity and technological modernization).

The source of data was the official statistical releases of the Federal State Statistics Service of the Russian Federation – ROSSTAT (official website of ROSSTAT) for 1995–2022 in such sections as National Accounts, Investments in Non-Financial Assets, Fixed Assets and Other Non-Financial Assets, Efficiency of the Russian Economy, Science, Innovation and Technology (ROSSTAT, 2024).

Interpretation of the results of data analysis is presented in graphical form – in the form of charts that allow combining the dynamics of some macroeconomic indicators (GDP, investment, creation of new technologies) with the shares of indicators of GDP distribution (reproductive).

Results

Structural dynamics of GDP distribution in the Russian economy

In order to determine the nature and depth of external and internal shocks impact on the

structure of reproduction system in the Russian economy, we have analyzed this process in detail by a number of indicators.

In particular, the structural dynamics of gross savings in the Russian economy is shown in Fig. 2.

The diagram (Fig. 2) reflects the higher resistance phenomenon of fixed capital accumulation to the impact of both external and internal shocks, while the movement of inventories – working capital – showed deeper decline. At the same time, the very rate of accumulation in the Russian economy throughout the market reforms (20 % on average), is significantly lower than the level of industrialized countries (in 2019, China – 43.8 %, India – 33.6 %, South Korea – 35.2 %, Belarus – 28.5 % (Trading Economics, 2024)). This indicates that the benefits of increasing private investment in innovation and the transition to the export of processed products instead of raw materials have not been properly utilized in Russia.

The structural dynamics of final consumption expenditures in the Russian economy is shown in Fig. 3.

The diagram (Fig. 3) allows us to conclude that the segment of consumption represented by the state is more resistant to various shocks (especially since 2015), while the final consumption of households is less shock-resistant (the difference is 2–4 times). In the structure of consumption expenditures, the share of the state increases by 2–3 % under the impact of shocks, but in the long-term it does not increase, fluctuating below the level of 20 %.

The data on changes in private savings (share in GDP – savings rate) in the Russian economy under shocks are shown in Fig. 4.

The diagram (Fig. 4) shows the obvious phenomenon of savings rate stability in Russia to all exogenous and endogenous, external and internal shocks, even under the influence of which it did not fall below the level of 20 % (25 % on average). On the contrary, in 2022 the savings rate in Russia reached 31.7 %, despite a GDP decline of 2.1 %, which is three times lower than in the US, five times higher than in the UK in the last decade, coinciding with China, which has much higher savings rate (Trad-

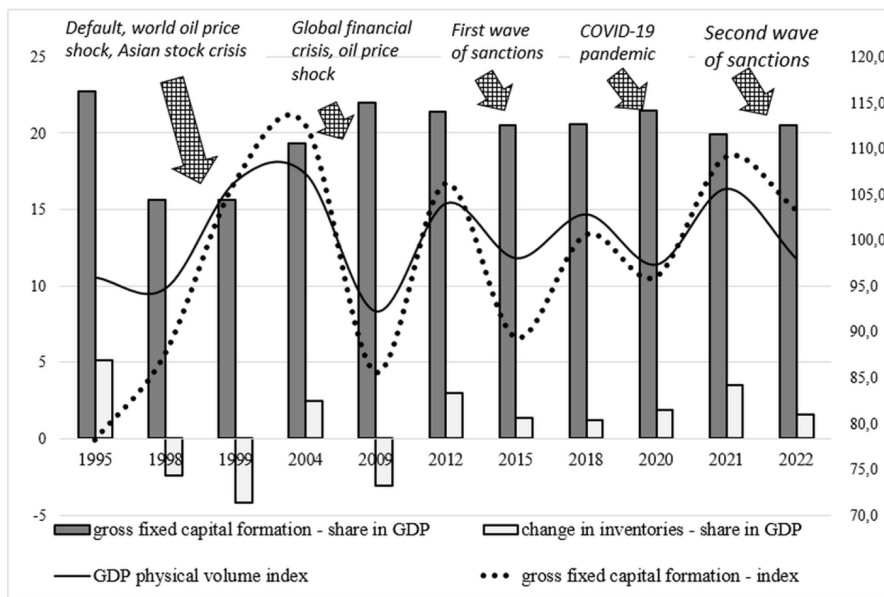


Fig. 2. Structural dynamics of gross capital formation in Russia, % (shares in GDP – left scale, indices – right scale) (drawn by the Authors based on data: (ROSSTAT, 2024))

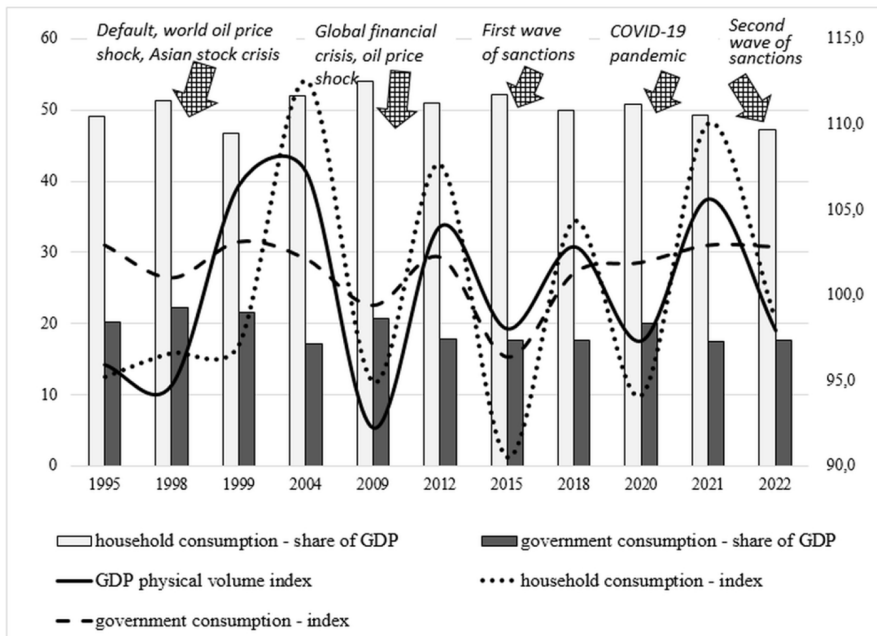


Fig. 3. Structural dynamics of final consumption expenditures, % (shares in GDP – left scale, indices – right scale) (drawn by the Authors based on data: (ROSSTAT, 2024))

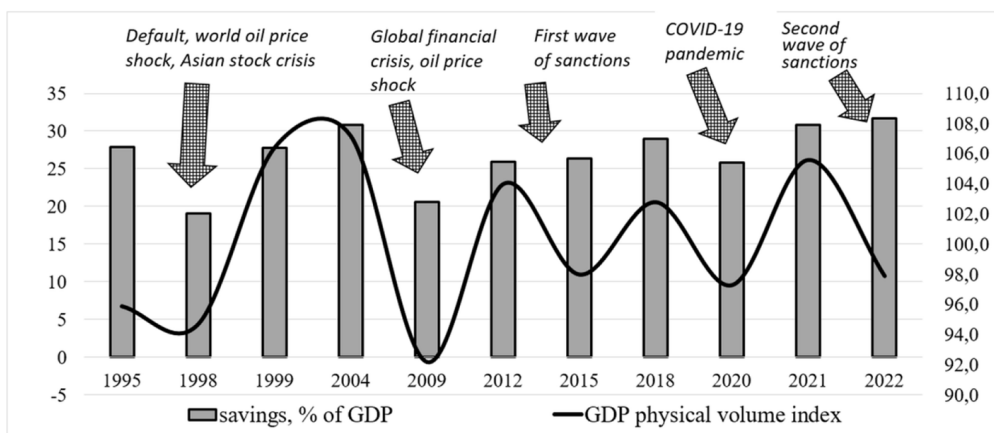


Fig. 4. Structural dynamics of private savings rate (shares in GDP – left scale, indices – right scale) (drawn by the Authors based on data: (ROSSTAT, 2024))

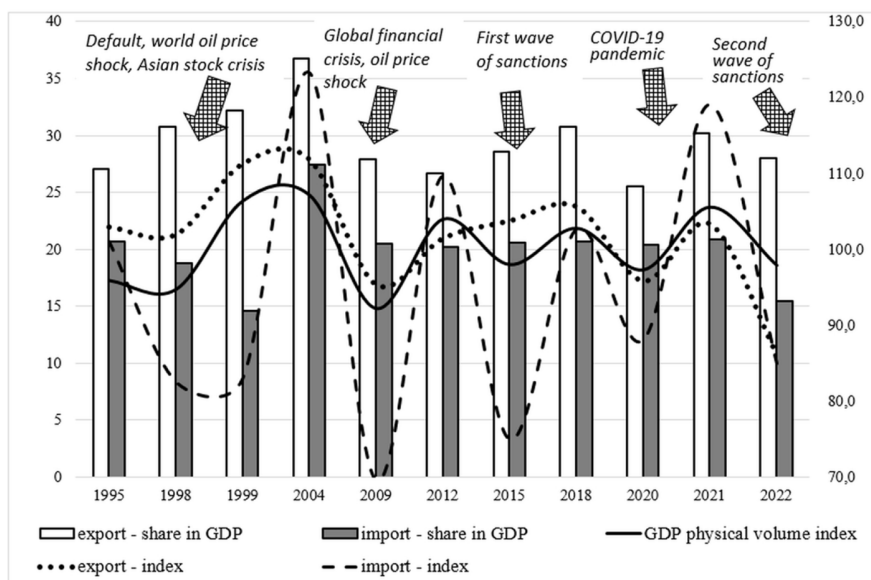


Fig. 5. Structural dynamics of exports and imports in Russia, % (shares in GDP – left scale, indices – right scale) (drawn by the Authors based on data: (ROSSTAT, 2024))

ing Economics, 2024). In the very structure of private savings in the Russian economy, participation in the capital of other firms, including the purchase of shares (less than 30 %), takes a subordinate place (Bank Rossii, 2023). This indicates that the infrastructure of investment activity in the Russian economy remains underdeveloped, which hinders the growth of the savings rate and weakens the economy resistance to external shocks.

The analysis of the reproductive structure of the Russian economy from the part of GDP utilization in terms of export and import dynamics is presented in Fig. 5.

The chart in Fig. 5 demonstrates, first of all, the resistance to import and export shocks. The share of exports in GDP did not fall below 15 % in 1999 and 2022 (20 % on average), and exports did not fall below 25 % of GDP (30 % on average). This confirms the leading role of

the main exporter in the Russian economy – the extractive sector – as a source of investment resources, which negatively affects the resistance of the economy to external shocks in the means of production market, the foreign segment of which is partially “closed” under sanctions.

Structural dynamics of GDP creation in the Russian economy

The structure and dynamics of gross domestic product creation “by income” in the Russian economy is presented in Fig. 6.

The diagram (Fig. 6) clearly demonstrates high sensitivity to shocks of profit in the business sector, which reduces its share in GDP by 3–5 % on average with a lag of 1 year from the occurrence of one or another shock. At the same time, this component in the GDP structure is “replaced” by labor remuneration, the share of which increases by a similar amount. Against this background, the share of net taxes in Russian GDP has been declining since 2009 (from 16.6 to 8.0 % in 2022), which also indicates a higher sensitivity of the business sector in Russia to the impact of shocks, compared to the public sector, largely represented by exporters – extractive state corporations and state banks, which receive support from the state.

Structural dynamics of technological modernization of the Russian economy

Stability of the reproduction structure and, consequently, of the whole economy to shocks is largely determined by its ability to maintain the efficiency of production factors and value added, the long-term trends of which should be strictly positive. This, in turn, is determined by the rate of renewal of production technologies and the intensity of diffusion of innovations between industries and sectors of economy.

The dynamics of innovation activity indicators, which determine the intensity of reproduction in terms of investment in obsolete equipment replacement with new ones, growth of labor and capital efficiency, as the share of R&D expenditures in GDP, the share of high-tech and knowledge-intensive industries in GDP, the share of innovation-active organizations (NTR RF, 2024) is shown in Fig. 7.

The diagram presented in Fig. 7 clearly shows the stability of R&D “underfinancing” by Russian business and government (during the last two decades this indicator has not exceeded 1 % of GDP). Against this background, since 2015 there has been a steady decline in the share of innovative products in GDP –

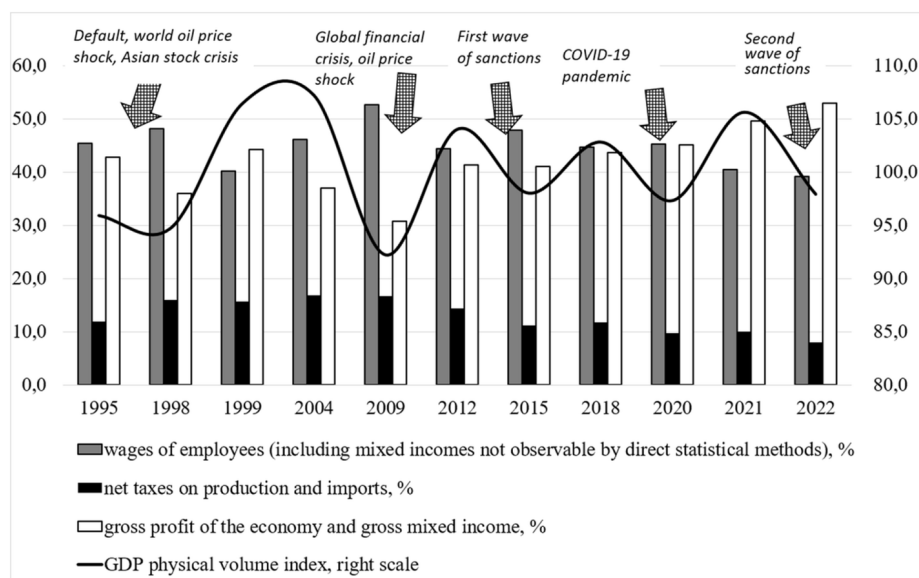


Fig. 6. Structural dynamics of Russia's GDP creation “by income” (drawn by the Authors based on data: (ROSSTAT, 2024))

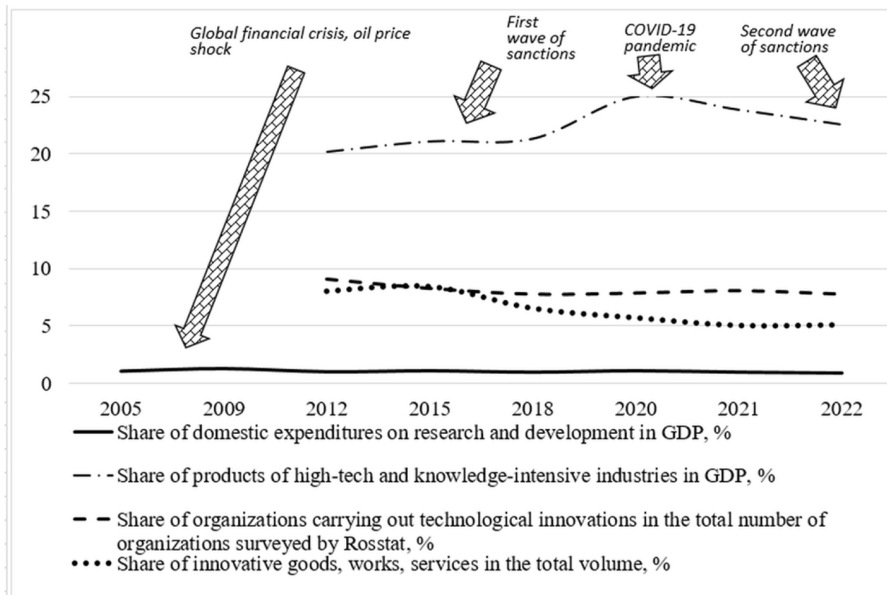


Fig. 7. Dynamics of Innovation and Technology Sector in Russia (drawn by the Authors based on data: (ROSSTAT, 2024))

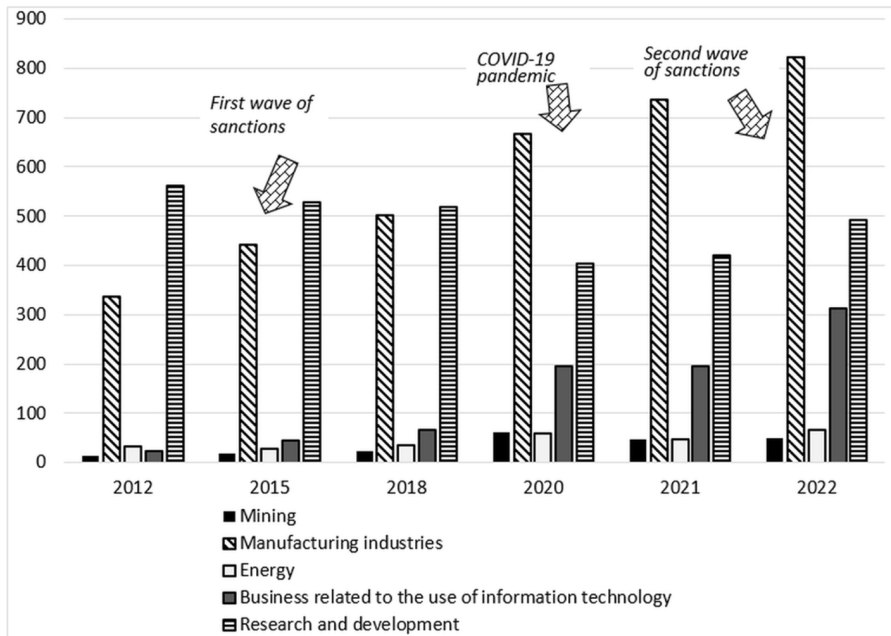


Fig. 8. Sectoral structure of national advanced manufacturing technologies in Russia (units) (drawn by the Authors based on data: (ROSSTAT, 2024))

half by 2022, and stagnation of the share of innovation-active organizations in their total number (no more than 8 %). In terms of the share of products of high-tech and knowledge-intensive industries in GDP, the growth from 20.1 to 25.1 % occurred in 2020, in the process of a surge in demand for digital assets, with a subsequent decline to 22.5 % in 2022.

Such negative structural dynamics of financing in the Russian research and innovation sphere has generated significant distortions in the sectoral structure of development of national advanced production technologies (Fig. 8).

The diagram (Fig. 8) reflects the slowdown in the creation of advanced production technologies in Russia during the periods of shocks, statistically observed since 2012, as a result of which the “basis” of future technological development is shrinking. Meanwhile, the creation of production technologies for IT and manufacturing sectors accelerates during the periods of shocks. However, the segment of creation of advanced technologies for the extractive and energy sectors is the most sensitive to shocks. At the same time, the greatest slowdown in the technological development of the Russian economy was observed in the periods of the beginning of sanction confrontation in 2014–2015 and the 2020 pandemic.

Discussion

Principal Findings

Based on the results of the analysis of quantitative data characterizing the impact of external shocks on the structure of the Russian reproduction system, the following conclusions were made:

1. The development of structural disproportions in the reproduction system of the Russian economy occurred during the period of internal shocks in the early 1990s (exogenous shock of market reforms and privatization, endogenous shocks of hyperinflation, devaluation and default). Negative structural shifts in the reproduction system were manifested in the decline in the rate of accumulation, the subordinate position of investments in R&D and replacement of fixed assets of enterprises, and high savings rate. Since the 2000s, the impact of shocks on the Russian economy was external,

mainly exogenous (except for the global shock of 2008 on the part of financial and raw materials markets), which caused a drop in technologically related foreign investments and the need to compensate them by state investments with low technological and economic efficiency. This made the extractive and R&D sectors of the economy critically dependent on technology imports and the Russian economy as a whole susceptible to technological shocks. This is confirmed by the fact that in the last decade the number of Russian advanced production technologies (including cross-cutting ones) is by far below the number of such technologies used in the economy, most of which are foreign know-how. And fundamentally new domestic advanced production technologies are also no more than one ninth of Russian developments.

2. In Russia, negative shifts in the reproduction system structure, being one of the consequences of various shocks impact on it, weakened the resistance of the entire national economy to them. Inertial reduction in the production factors efficiency, slowdown in the creation of advanced production technologies in the country and critical dependence on their imports, the low rate of accumulation and, accordingly, inadmissibly slow rate of basic capital renewal became the “conductors” of shock impact on the national economy.

3. Increasing the Russian economy’s resistance to external shocks requires positive structural shifts in the reproduction system: in the structure of GDP distribution – a radical increase in gross savings; in the structure of GDP creation – the share of entrepreneurial profit; in the structure of capital funds – the share of investment in advanced production technologies and new means of production. This, in turn, will significantly increase the efficiency of production factors – labor productivity, efficiency of funds, profitability of business, which can reduce fluctuations of reproduction indicators and GDP as a whole in the periods of future shocks, even in case of their intensification.

Policy implications

Reduction of the Russian economy’s exposure to external shocks is possible only in the system of a new type of structural policy aimed

at accelerating reproduction processes as a result of a series of positive structural shifts in the reproduction structure. Such structural policy should integrate measures of industrial, scientific and technical, foreign trade and fiscal policy in the following directions:

A) tax and credit incentives, state guarantees for technologically related investments, state guarantees for the replacement of critically worn-out means of production in order to increase the rate of accumulation, infrastructure development of using private savings to increase private investment;

B) taking long-term measures to increase the profitability of private business, in conjunction with the stimulation of private investment in the development of domestic advanced production technologies with their guaranteed implementation;

C) a comprehensive system of measures to accelerate the development of domestic advanced manufacturing technologies and stimulate their export, with a focus on the “future markets” of the National Technological Initiative;

D) a special role in the formation of a new structural policy in Russia should play institutional support of structural shifts in the reproduction system, including the development and adoption of laws on sectoral investment and venture banks, on public-private partnership in the high-tech sector, on network technology platforms.

Strengths and Limitation of the Study

This study proved the hypothesis that the economy’s resistance to external shocks decreases when its reproductive structure deteriorates and short-term anti-shock measures, such as increasing government expenditures, are taken. At the same time, a series of negative structural shifts in the reproduction system cannot be overcome without a significant adjustment of the government structural policy, otherwise the exposure of the whole economy to external and internal shocks will increase and economic growth will slow down in the long run. This actualizes future research in

the sphere of overcoming negative structural shifts in the reproduction system of the Russian economy in the context of the expected strengthening of external shocks and sanctions restrictions, as well as the decline in the efficiency of production factors. Particular attention should be paid to institutional support for accelerating capital accumulation and effective use of private savings, technological modernization of the manufacturing sector and growth of the share of national advanced production technologies.

Conclusion

In the conditions of growing external shocks, the study of increasing the economy’s resilience to them by accelerating reproduction processes becomes especially relevant. In the Russian economy since the beginning of market reforms under the influence of first internal and then external shocks there have been negative shifts in the structure of the reproduction system. They are associated with a reduction in the rate of accumulation and growth of private savings in the GDP distribution, shrinking share of entrepreneurial profits and taxes in the GDP creation, slowdown in the development of domestic advanced production technologies, especially those designed for the research and mining sector, energy. As a result, the slowdown of economic growth in the present is occurring along with weakening of the economy’s resistance to future shocks, which increases the risk of entering a long-term recession. In order to increase the resistance of the reproductive structure of the Russian economy to shocks, the article proposes the main directions of improving the state structural policy, which should take an integral character, combining the tools of scientific and technical, industrial, fiscal policy in a single complex. The research results in the form of the author’s conclusions and recommendations can be useful to the state administration bodies, forming the provisions of structural policy at the federal and regional levels, taking into account the need to strengthen the anti-shock protection in the future.

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