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Monetary Policy REVIEW

NEW CHALLENGES TO MONETARY POLICY

ANALYTICAL NOTE

Z. Smirnova

CONTENTS

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E-mail: smirnovazhi@cbr.ru

12 Neglinnaya Street, Moscow 107016
Bank of Russia website: www.cbr.ru

NEW CHALLENGES TO MONETARY POLICY

Summary

The current monetary policy (MP) in Russia, based on the inflation targeting (IT) regime, is just under 10 years old. The entire period was accompanied by an increased number of shocks to financial stability caused by external economic and geopolitical factors. These include the imposition of sanctions in 2014, the fall in oil prices in 2015-2016, the COVID-19 pandemic, and the massive external constraints of 2022. Nevertheless, even under these conditions, the monetary policy has delivered a much lower average price level than in the previous much calmer 15 years. In addition, for the first time, the Bank of Russia was able to pursue stimulative monetary policy. In 2020, in response to the pandemic crisis, the key rate was summarily reduced to 4.25% which was the lowest level in recent history. The key element of improving the effectiveness of the monetary policy was the transition to the inflation targeting regime. It provided sufficient flexibility to deal with both cyclical and structural crises while keeping the main objective of returning inflation to the target level unchanged.

The coming decades are likely to be characterised by increased yet multidimensional uncertainty.

The processes of de-globalisation, which began to manifest as early as 2018-2019 along with trade disputes and contradictions, multiplied in 2022 amid rising geopolitical tensions. Friendshoring and reshoring of industries are shortening supply chains and fragmenting global trade. Search for new payment solutions in foreign trade activities, revision by countries of the established role of traditional reserve currencies – to the fragmentation of the financial system. Geopolitical disagreements are reinforcing countries' aspirations for renewed long-term development strategies, which are now likely to focus less on comparative advantage and more on self-reliance and maintaining higher levels of national security, especially in critical areas.

There is a growing debate about the need for climate policy measures to limit the rate of global warming. Climate change is becoming more noticeable, with nine of the hottest years on record registered in the last 10 years. Climate policy will have to balance the costs of carbon regulation in the medium term against the damage to the economy from increased intensity of physical risks in the long term. At the same time, it is hardly possible to develop a single policy for all countries, as countries differ significantly in energy resources, per capita income and technological development. At the same time, the success of climate policy largely depends on the synchronisation and orderliness of the measures taken, so the search for balanced parameters of climate policy may take a long time.

The financial architecture continues to change, accelerating with the development of new technologies. Opportunities have emerged for large-scale realisation of the idea of digital currencies, the development of which began back in the 1980s. The active development of the cryptocurrency and cryptoasset market has shown that distributed ledger technology can help improve the efficiency and accessibility of payment and settlement infrastructure. This in turn has prompted central banks to start developing their own digital currencies. At the same time, the emergence of online platforms and mobile applications, simplification of account opening and transaction procedures have increased the availability of investment instruments for retail investors. Transactions on financial markets have become available to almost everyone on a smartphone screen. Retail investors have begun to play an increasingly prominent independent role in financial markets around the world.

Socio-demographic challenges also remain relevant. In most countries of the world, economic development is accompanied by the problem of inequality. It is a multidimensional phenomenon involving inequality of income, consumption, assets and opportunities, and the degree of inequality varies. In addition to the problem of inequality, the world's population continues to age. In some countries, it is also exacerbated by a shrinking population, and thus labor force.

All these processes are reflected in the Russian economy and will affect it in the future. At the same time, in 2022 the Russian economy additionally faces shocks related to changes in external conditions. Restrictions were imposed on Russian exports and imports, and a number of large financial institutions were unable to conduct many international transactions. Goods of Russian exports began to be sold at a discount, Russian producers lost the

opportunity to supply to European countries, a number of companies refused to supply products to the Russian Federation and ended their activities in the country. Consumers were faced with getting used to new products, brands and models. All this together launched a multi-stage process of structural transformation of the Russian economy. It involves reconfiguration of logistics routes, search for substitutes for intermediate goods in production chains, development of compensating and new technologies, changes in the range of available goods and consumer habits and preferences, rebalancing of the importance and size of industries, and adjustment of the labor market. As a result, the industry structure will change: some industries will be more in demand in the new environment, especially those with greater import substitution potential. Some companies will have to significantly change their product line, and some will even have to leave the market due to their inability to make a profit in a new environment. Structural transformation is the central challenge for the Russian economy in the coming years.

Many of the processes noted are shaping challenges beyond the influence of the monetary policy. Nevertheless, they may complicate the implementation of the monetary policy in the future.

Much of this will be due to supply-side risks. Structural transformation, decarbonisation, de-globalisation, demographic changes, both individually and in combination, can lead to higher costs, reduced supply, and lower productivity. As a consequence, supply shocks may occur more frequently. Unlike demand shocks, supply shocks move prices and output in different directions. In such a situation, the monetary policy cannot stabilize inflation and output simultaneously (i.e. there is no divine coincidence). This means that the central bank will have to choose more frequently and explicitly between inflation or output. The traditional prescription for central banks is that in the case of supply shocks, the choice is to issue. In other words, there may be some temporary deviation of inflation from the target level.

However, assessing the risks of secondary effects is of key importance. The magnitude of these risks is determined by the duration of the shock and the degree of anchoring of inflation expectations. If the shock is rather long-lasting, price increases will be increasingly reflected in the expectations of economic agents. In addition, an increase in the frequency and duration of supply shocks can complicate the task of determining which phase of the cycle the economy is in. At the same time, a delay in tightening the monetary policy may lead to the need for stronger tightening later, which may entail additional output losses. Taken together, this means that in the coming decades, inflation and output fluctuations in many countries may occur more frequently than in recent history, the amplitude of their changes may be larger, and the persistence of deviations from the equilibrium level may be higher. In an economy with unanchored inflation expectations, supply shocks may require a more active response from the monetary policy.

At the same time, changes will also occur on the demand side. The heterogeneity of economic agents will increase – both due to demographic processes and the problem of inequality, but also due to growing environmental awareness and financial empowerment. As a result, preferences of economic agents will change, and with them consumer, as well as saving and investment behaviour. This in turn will determine the difference in responses to economic shocks and to monetary policy decisions, affecting the monetary policy transmission mechanism.

Despite the complexity of the upcoming period, the main task of the Bank of Russia remains the same – to ensure price stability and maintain inflation close to the target level. The Bank of Russia's research in the Monetary Policy Review on data on the Russian economy points to the advantage of the IT regime under various shocks, including supply shocks. One can also find ample evidence in the literature that the IT regime is capable of handling challenges of any nature.

Since 2015, the Russian economy has largely adapted to the IT regime. However, inflation expectations remain highly volatile and unanchored. The more complex environment of the coming period creates additional risks of deviating from their goal. The economy may be in a "high-inflation" mode, the price of which is a tighter monetary policy. This, in turn, will amplify the resulting supply shocks. In this regard, the main focus of the monetary policy in the coming period should be to anchor inflation expectations.

The first priority is to bring inflation back to the target level after a period of intensive adjustment of relative prices to 2022 shocks. On the long-term horizon, fluctuations in relative prices are a normal part of the process of economic development and have no discernible impact on inflation. Further structural adjustment should take place in an environment where inflation is near the target level. The longer inflation stays near the target, the less economic agents will react to its spikes, regardless of the shock that caused them.

Communication also needs to be enhanced and more effective. Between 1980 and 2010, economies were more likely to experience cyclical demand shocks. Meanwhile, the response of central banks to supply shocks is different from the response to demand shocks. If the number of shocks increases and they alternate or even intertwine with demand shocks, there will be a need to provide more explanations as to which shocks the monetary policy responds to and why. In addition, financial literacy programs should be developed, both among investors and those who are not involved in the financial market. Financial literacy is an essential element of a "low-inflation" regime with anchored inflation expectations.

Finally, to anchor inflation expectations, it is also possible to lower the target. The current target inflation rate remains higher than in many trading partner countries. Aligning the target will reduce the differential with foreign inflation, limiting spikes in pro-inflationary pressures from the exchange rate.

At the same time, under current conditions, not only monetary but also fiscal policy plays a significant role in anchoring inflation expectations. The monetary policy is aimed at smoothing short-term fluctuations in prices and output, and its impact is translated through short-term money market rates. However, inflation expectations of economic agents – especially those of financial market participants and businesses – depend on perceptions of inflation dynamics on the long-term horizon. If economic agents expect fiscal imbalances to increase in the future, inflation expectations will rise. This will increase the long-term stakes in the economy. If, in addition to this, the fiscal imbalance grows in fact, it will be necessary to tighten the monetary policy substantially in order to limit inflationary pressures and cool inflation expectations. The combination of fiscal imbalances and an inevitably tight monetary policy will limit the economy's ability to withstand various external shocks. Thus, in order to mitigate possible negative effects, new challenges, the fiscal policy should be formed taking into account the need to maintain low inflation and inflation expectations.

The anchored inflation expectations will allow full utilisation of the benefits of the IT regime, which until now have remained undiscovered.

First of all, the anchored inflation expectations will expand the possibilities to conduct a full-fledged countercyclical (anti-crisis) monetary policy. By now, the Bank of Russia has had experience with countercyclical policy in 2020, preceded by a three-year period of historically minimal inflation. However, due to high inflation expectations, the level of the effective minimum interest rate, to which it was possible to reduce rates without jeopardizing financial stability and a spike in inflation, turned out to be quite high. Therefore, at the current stage, the anti-crisis policy task is accomplished to a limited extent. The anchored inflation expectations will lower the effective interest rate frontier and widen the range for countercyclical monetary policy.

In addition, anchored inflation expectations will support financial markets. Low inflation and anchored inflation expectations reduce the risk premium associated with macroeconomic volatility, lowering long-term rates in the economy. In other words, when calculating the expected return on an instrument, economic agents begin to focus to a large extent on the characteristics of the investment object rather than on the risks of the macroeconomic environment. In addition, a steady decline in inflation is accompanied by a decline in deposit rates, and they are becoming less attractive compared to the possibility of multiplying capital in the financial markets. The anchored inflation expectations allow economic agents to plan investments in different asset classes over the long-term horizon. In turn, this will contribute to the development of those channels of the monetary policy transmission mechanism that are now less active – the wealth channel, the asset channel, the "risk-taking" channel, and will compensate for some possible decrease in the effectiveness of the interest rate channel due to certain new challenges (e.g., under large climate risks). In addition, the lengthening of the financial planning time horizon, combined with low long-term rates, will support an increase in the amount of long money in the economy and investment activity, thereby helping to reduce the frequency and amplitude of supply shocks.

Thus, although the coming years are characterised by an increased degree of uncertainty, the monetary policy aimed at maintaining low and stable inflation, as well as responsible fiscal policy can significantly limit the possible volatility of macroeconomic indicators, while creating an environment that will allow the economy to pass through the difficulties of structural adjustment and move to a new vector of development.

THE STRUCTURAL TRANSFORMATION OF THE RUSSIAN ECONOMY

In 2022, the Russian economy faced external constraints that triggered a large-scale process of structural transformation. On the short-term horizon, it is accompanied by a pronounced adjustment in relative prices. In this regard, a short-term deviation of inflation from the target level is possible. This makes the process of short-term structural adjustment smoother and with fewer long-term consequences for the economy. At the same time, it is important to avoid a decline in confidence in the Bank of Russia's policy aimed at maintaining price stability: a decline in confidence may lead to a sustained increase in inflation expectations and the economy's transition to a state of high inflation. Therefore, the subsequent processes of structural transformation should follow in conditions when inflation is close to the target value.

Structural transformation on the long-term horizon will be influenced by global trends – reconfiguration of world trade and increasing fragmentation of markets, inter-sectoral reallocation of production factors under the influence of the "green" transition, increasing global competition for labor against the background of the growing share of services in the world. Accordingly, the process of structural transformation of the Russian economy will depend on the availability of factors of production and their productivity. Limited availability of capital and labor shortages can lead to ripple shocks to productivity. Negative productivity shocks are likely to prevail over the next few years. Pro-inflationary pressures could intensify. Monetary policy aimed at keeping inflation near target will improve the outlook for productivity growth and return the economy to a sustainable growth trajectory.

Fiscal policy is an important element of ensuring low inflation in the long run. To support structural transformation, it should aim to keep long-term rates in the economy low. This implies that the size of the budget deficit and the level of public debt should be aligned with the current inflation target. Fiscal policy changes should take into account a possible increase in long-term rates through rising inflation expectations. In general, the transition of the economy to a sustainable growth trajectory assumes the absence of inflation caused by budgetary factors, i.e. neutrality of fiscal policy and its long-term sustainability.

External restrictions and retaliatory measures have significantly altered the way the foreign exchange channel of the monetary policy transmission mechanism operates. Previously, the decision on the policy rate was directly translated into the value of financial instruments and then into the exchange rate – now it has a significant impact first on the demand for imported goods through the interest rate channel and then on the exchange rate.

The impact of external constraints and structural transformation of the economy on the real neutral rate is ambiguous. There are more factors contributing to its increase, at least on the short-term horizon. These could include additional costs in the financial sector, increased investment needs, a possible increase in the structural budget deficit, and an increase in the risk premium.

1. In 2022, the Russian economy faced external constraints. Russian producers of export goods lost the possibility of supplying to European countries, a number of companies refused to supply products to the Russian Federation and ended their activities in the country. At the same time, consumers had to get used to the changing range of available goods, to the replacement of long-known goods and brands with new ones. All this together launched process of structural transformation of the Russian economy.

On the short-term horizon, structural transformation involves an initial adaptation to changed conditions. This is the initial response of the economy to simultaneous shocks to external supply and external demand, to the breakdown of established linkages. It includes reconfiguration of logistics routes, search for substitutes for intermediate goods in production chains, and setting up production of similar goods on existing production lines.

2. One of the main **mechanisms of structural transformation on the short-term horizon is large-scale adjustment of relative prices**. As a rule, the impact of relative price adjustment processes on the overall price growth rate is small. In the short term, prices are "rigid"; in practice, this means fairly infrequent price list revisions. When it happens, price increases are usually plotted against expectations of future marginal costs, which are close to the inflation target in the absence of shocks. A strong change in relative prices can be the result of unexpected and multidirectional structural changes in supply and demand. In this case, relative prices change

across a wide range of goods and services, and the degree of rigidity becomes markedly less. Enterprises are forced to revise prices as virtually all components of pricing are updated, from inputs and components to the supply of substitutes and complementary goods and changes in demand for them. Relative prices become more volatile, and their adjustment for some period may become an independent cause of higher inflation in the economy (Bank of Russia, 2022).

Historically, such changes in relative prices have been associated with **large-scale constraints of a non-economic nature.** For example, a study by Davis and Haltiwanger, 2001 analyzed the experience of structural adjustment of industries in the United States during the 1970s oil shock. Before the shock, automobile production and all related products and services (components, dealerships, marketing, and even research and development) were geared toward large size and large capacity models. The rise in oil prices due to the embargo imposed by a number of Arab countries led to a structural adjustment – industries had to switch to the production of small cars with low capacity. The process of reorientation of production and related services, as well as the formation of new knowledge (both in terms of technical and marketing characteristics of new models) took about two years. Another example is the recent COVID-19 pandemic, which in many countries caused a dramatic shift in demand from services to goods while at the same time squeezing the supply of goods due to anti-epidemic restrictions (OECD, 2022). During the acute period of the pandemic, this necessitated a reallocation of labor from the production of services to the production of goods, relative prices began to change dramatically. For example, online events have become commonplace, leading to changes in demand for both services (passenger transportation has fallen in demand, while IT services have risen) and goods (demand for technology has risen markedly, while demand for travel goods has fallen) (Thwaites et al., 2021; Bloom et al., 2020; Andrews, 2021; Barrero, 2021; Ferrante, 2023).

In the Russian economy, the large-scale change in relative prices was a consequence of a dramatic change in economic relations. At the same time, the imbalance was caused by simultaneous reduction in external demand for Russian export goods and reduction in external supply of imported goods with a parallel growth in domestic demand for certain imported goods. As studies such as Werning et al, 2021 show, in the case of shocks that cause large-scale changes in relative prices, the monetary policy may allow inflation to rise slightly above the short-run target. In general, this limits price reductions in low demand industries while making goods in high demand industries less attractive. For Russian enterprises during the sanctions crisis, the key problems were rising prices for raw materials, materials and components, as well as problems with logistics and procurement of necessary imported goods and services (Simachev et al., 2023). After a spike in inflation in 2022 the Bank of Russia has allowed a slower return to the target of bringing inflation down to 5-7% in 2023 and back to 4% in 2024. This supported the profitability of companies in the face of higher costs, especially those that had to divert products from foreign markets to domestic markets. For example, according to the survey (Simachev et al., 2023), every tenth firm in the sample managed to increase its share in traditional markets by the end of 2022, 7% of firms found niches for new products, and 6% entered new markets. In the case of tightening the monetary policy to bring inflation back to target as soon as possible, enterprises in these industries could have lost these opportunities to a large extent – a tight monetary policy would have markedly limited domestic demand. A slower return to target makes the process of short-term structural adjustment smoother and with fewer long-term consequences for the economy. This is confirmed by statistical data: according to the results of 2022, the Russian economy shrank by 2.1% with initial forecasts of a decline in the range of 8-10% (Bank of Russia, 2022). In addition, the growth rate of consumer prices was also slightly lower than the Bank of Russia expected at the beginning of the structural adjustment. Following a meeting of the Board of Directors of the Bank of Russia, the inflation forecast for 2023 was lowered to 4.5-6.5%. In other words, the level of potential GDP has shrunk less and the return to growth will be faster. The change in relative prices will still continue, but will be less pronounced. At the same time, while in 2022 the change in relative prices in the Russian economy was mainly due to restrictions on imports and non-oil and gas exports, in 2023 the main impact will be made by restrictions on oil and gas exports and lower energy prices.

3. Adjustment to the new environment will continue beyond 2023. However, **on the long-term horizon, fluctuations in relative prices are a normal part of the process of economic development** and have no discernible impact on inflation. Moreover, a prolonged deviation of inflation from the target can lead to the

unleashing of inflation expectations and move the economy into a state of high inflation, which deteriorates public welfare (BIS, 2022). Stimulating demand will only exacerbate supply-side tensions and force companies to turn to temporary and less effective solutions. As a result, this will entail a slowdown in the process of structural transformation and a lengthening of the period of transition to a new equilibrium. Therefore, further adjustment processes should take place when inflation is near the target value.

In addition to adjusting to new parameters of external interaction, the process of Russian structural transformation will also be affected by trends in global structural changes. Global trends can take decades to form, so their effects will only fully manifest themselves later. Nevertheless, even in the coming years they will determine the way various economic processes, including those in the Russian economy, develop.

The first trend is the **ongoing reconfiguration of world trade and increasing fragmentation of markets**. Global trade tensions began to rise during the 2018-2019 period of trade disputes and protectionist measures. Many countries have started to consider moving companies' production facilities back to the national jurisdiction or at least to locations with which there are no political disputes (reshoring and friendshoring instead of the former offshoring) (ECB, 2017; OECD, 2020). The COVID-19 pandemic has increased the impetus to reduce the length of supply chains. The escalation of geopolitical contradictions in early 2022, accompanied by sanctions, unprecedented financial blockades and early termination of existing contracts by multinational companies, has shown that localisation of production chains and fragmentation of global trade seem to be part of the new reality for the world economy (OECD, 2020; IMF, 2022). Research shows that the inclusion of the Russian economy in global supply chains is relatively low and less than for many other countries of comparable size. However, a number of industries have significant dependence on critical imports (Karpov, 2022; HSE, 2023). In addition, imported goods stimulate competition and productivity growth in the domestic market. Free global market-oriented firms have more incentives to invest in R&D (Bloom et al. 2015; Craft, 2016; Grossman and Helpman, 1989, 1991; Broadbent, 2022). Thus, the cumulative effect of the imposed restrictions on imports and technological cooperation may limit the technological progress of Russian companies and reduce the speed of technology diffusion in the Russian economy.

The second trend is the **inter-sectoral movement of factors of production under the influence of climate change and decarbonisation policies**. Climate change is worsening the physical characteristics of work in some industries (e.g. heat waves make it harder to work in agriculture and construction), and decarbonisation policies are reducing the profitability of "brown" industries, which have *higher*greenhouse gas emissions, and increasing the profitability of "green" industries, which have no carbon footprint. A growing number of large investors are claiming to include ESG criteria in their investment decision-making, which is affecting the global reallocation of capital flows. As a result, labor, capital, and financial resources are shifting to sectors that are less vulnerable to climate change or reflect the greening of the economy (Albert, 2022; McKinsey, 2022; NGFS, 2020; Liu et al., 2021).

The third trend reflects the continuing process of **increasing the share of services in output**, a process that has been observed in most large economies since the late 1980s. Although the contribution of industry has started to increase in the last few years in a number of countries, the trend of maintaining a high share of services in general has continued. The main driving force is the development of information and communication technologies. The provision of communication services, financial services, and logistics services account for an increasing share of the value added of large countries. Additionally, the contribution of services to output is enhanced by the increasing demand for catering and personal services, driven by rising living standards and increased life expectancy(Galesi and Rachedi 2016); Kongsamut et al., 2001; Duarte and Restuccia, 2010; Buera and Kaboski, 2012; Herrendorf et al., 2013; Kuzntes, 1973).

The fourth trend is the **declining birth rate and aging of the population**. Fertility in most developed countries, including Russia, does not ensure simple reproduction of the population. Population growth is possible mainly due to an increase in incoming migration flows. Given the growing share of services in the most developed economies, a declining and aging labor force means **increased global competition for human capital, for human resources**.

4. These global trends indicate that the **process of structural transformation of** the Russian economy in the long term will **depend on the availability of factors of production and their productivity.**

Restrictions on technological imports make unavailable some of the capital that was previously employed in production processes. And the analogs may be of inferior quality or not available at all. As noted by Simachev et al., 2023, the lack of real analogs of the required machinery and equipment in Russia in 2022 was noted by managers of 40% of surveyed enterprises. To the greatest extent in the electrical and electronics industry, transportation engineering and the pharmaceutical industry. In addition to the limited availability of the right analogs, another factor is the narrowed space of choice for applying capital in the production of consumer or investment goods. At the same time, the production of import-substituting investment goods compared to consumer goods may be less efficient and more costly. In combination, both of the factors noted above can cause the overall nomenclature of goods in the economy to decline and the quality of goods to deteriorate (Sinyakov, 2022; Datas-Panero, 1971; Irwin, 2020).

The current demographic structure indicates a gradual decline in Russia's labor force over the long term. These trends were further worsened by the relocation of Russian citizens and the departure of skilled foreign labor due to the restrictions imposed. At the same time, the development of new import-substituting industries will require an additional inflow of skilled workers. Labor shortages may mean the need for increased investment in robotisation and automation of production facilities and processes, but these technologies are currently heavily dependent on imported components, the supply of which is also limited. With less automated and efficient equipment, the demand for less skilled labor will increase.

As a result of limited availability of capital and growing labor market deficits, **the Russian economy may experience productivity shocks** – both productivity of labor and capital separately and total factor productivity. Moreover, their manifestation may be of a wave-like nature – faced with a shortage of familiar factors of production, companies will try similar technological solutions from different manufacturers and develop their own projects. Productivity may initially decrease, later on – as production processes are tuned – it may increase. For example, in the US and the UK in the second half of 1990, increased investment in high-tech equipment initially depressed productivity. Firms have had to divert existing resources to install new equipment and learn how to use it properly. After the adaptation process was completed, performance improved (Basu et al., 2001).

According to real business cycle theory, productivity shocks are an integral part of economic development. However, the difference in the Russian situation is in their external nature. In particular, replacement of equipment and search for new solutions may be caused not by the desire to improve the manufacturability of production and return on capital, but by the forced search for any analogs that give an acceptable result under conditions of constraints. New equipment can break down more quickly and require frequent repairs, which can prompt companies to look again for alternatives. The process of technological adaptation will take place at different times in different industries, which may lead to fluctuations in productivity. The **ripple effect may be exacerbated by additional emerging sanctions and their secondary effects**.

Negative productivity shocks are likely to **prevail** over the next few years. Negative productivity shocks lead firms to increase costs and reduce supply, so pro-inflationary pressures may intensify. Additionally, deterioration in the quality of goods may increase interest in affordable imported goods (including directly in marketplaces). This in turn will increase pressure on the balance of payments and may lead to pro-inflationary pressures due to exchange rate dynamics.

5. An important factor **for returning the economy to a sustainable productivity trajectory is low inflation**. Studies note that high inflation rates have a negative impact on productivity. Thus, in OECD countries, productivity was low during the high-inflation period of 1970 and partly in 1980, and high during the low-inflation period of 1990 (Bullman, Simon, 2003). High inflation complicates financial planning and increases pressure on companies' cash flows: costs can rise faster than the price of final goods. In addition, when inflation is high, the price mechanism loses its signaling function – it is more difficult for companies to distinguish between general price increases and price increases for a particular intermediate good. As a result, firms are significantly more involved in resource management and pricing and less in new research and development. On top of that, increased uncertainty due to unpredictable inflation increases the risk of entrepreneurial error, which, together with lower

real returns, leads to a reduction in investment. Thus, high inflation limits the build-up and diffusion of new technologies, reducing aggregate factor productivity (Bulman, Simon, 2003; Evers et al., 2006; ECB, 2021).

The process of technological improvement requires a substantial amount of funding. Low inflation near the target level means lower and more manageable inflation expectations and, as a result, higher and more stable real investment returns. Predictable profitability makes it easier to find financial resources for existing and new projects – both through bank lending, financial markets and venture capital financing. In addition, keeping inflation near the target allows the hysteresis effect to be overcome – that is, firms will be able to overcome the effects of the shock and adapt to the new environment more quickly. (Vitale, 2007; Draghi, 2015; Lane, 2021).

Thus, monetary policy aimed at keeping inflation near target will improve the outlook for productivity growth. The growth rate of potential output of the Russian economy will depend on the extent to which the economy can switch from compensatory production of import-substituting goods to the production of original goods. For this purpose, the development of new partnerships, integration into new value chains, and the search for new formats of interaction with other countries are essential.

6. Fiscal policy plays a special role in the conditions of structural transformation.

At the stage of **short-term structural adjustment, budget support allows the economy to adapt more quickly to new conditions**, especially if this support is distributed in a targeted manner – for the most affected groups of the population, enterprises and industries. The relevance of this approach is clearly illustrated both in the experience of recovering from pandemic structural shocks and adapting to the external shocks of 2022. However, the consequence was also an expansion of the role of the state in the economy. Afurther increase in this role could pose risks to macroeconomic stability.

Therefore, one of the main functions of fiscal policy in the long run is to create conditions for transition of the economy to the trajectory of sustainable growth. This primarily means that fiscal policy should aim at keeping long-term rates in the economy low. There are two main channels for this.

First is the rate of inflation. It is traditionally believed that the monetary policy can smooth out any spikes in inflation, including those caused by temporary imbalances in fiscal policy. Inflation returns to target by raising the monetary policy rate. However, the larger the additional level of fiscal deficit, the higher the rate of monetary policy is needed to bring inflation back to target. At the same time, the larger the size of the rate increase is required, the more the effect of economic contraction due to tightening of the monetary policy will prevail over the possible expansion due to additional fiscal stimulus. This is a consequence of the fact that, compared to fiscal policy, monetary policy affects the economy more broadly – through the entire chain of channels of the monetary policy transmission mechanism. Therefore, the result of **higher budget deficits** over the **medium- to long-term horizon** is not support for the economy, but **higher interest rates with subdued demand**. This will limit the structural adjustment capacity of industries. And the insufficiently strong reaction of the monetary policy to the increase in the deficit also has negative consequences in the form of high uncontrolled inflation and deflating inflation expectations. Structural adjustment will slow down a lot and the country's welfare level will fall. In addition, higher rates also mean higher interest payments on federal government bonds (OFZ). An extreme case is when all new borrowing goes to pay for payments on existing debt. To support structural transformation, fiscal policy should preemptively target a level **of fiscal deficit** and **public debt level** that is **consistent with the current inflation target**.

Second, fiscal policy can keep rates low in the economy through the expectations channel. Long-term rates in the economy are shaped by expectations about future macroeconomic policy. In a period of structural shifts, economic agents pay particular attention to the trajectory of fiscal policy. If they forecast additional borrowing that increases the fiscal imbalance, long-term rates will rise. Research shows that if economic agents assess the probability of increasing fiscal imbalances as high and do not believe that the trajectory of fiscal policy is consistent with price stability objectives, they will respond to a tightening of the monetary policy to a very small extent (Bianchi and Melosi, 2022; Banerjee R. et al., 2023). Inflation will rise and the central bank will have to raise the rate even more. If expectations regarding the trajectory of fiscal policy do not change, the economy may move into a state of "fiscal stagflation": inflation will deviate further and further from the target, and the output

growth rate will slow down to around zero. This state of the economy will severely limit the ability of the monetary policy to smooth external shocks.

Thus, the transition of the economy to a sustainable growth trajectory implies the absence of inflation caused by fiscal factors. In addition, the fiscal policy in the future will have to be formed on the basis of a lower level of export revenues. Under these conditions , it is important to rely on market mechanisms and increase the space for private initiative. If there is a deviation from the announced fiscal policy trajectory, it is necessary to return confidence to economic agents that fiscal policy is aligned with the inflation target. All this will ensure low long-term rates in the economy, which will support the expansion of production and new investment projects that will help the economy transition to a new development trajectory.

7. External restrictions and retaliatory measures significantly changed the operation of the **monetary policy transmission mechanism**. The main change is related to the operation of the currency channel. In an economy in which there are no capital controls, the exchange rate of the national currency is determined by both the current account and the financial account. Active participation of national and foreign financial institutions in the foreign exchange market makes it possible to smooth seasonal fluctuations of the exchange rate. In an economy with capital controls, the impact of capital flows on the exchange rate is significantly reduced, and current account flows become the main factor shaping the dynamics of the exchange rate. In particular, this means that the ruble exchange rate is determined to a greater extent by the balance of importers' demand for currency and exporters' supply of currency. The impact of the monetary policy on the exchange rate becomes longer and more indirect. If before the introduction of restrictions the decision on the rate of the monetary policy was translated into the value of financial instruments and further into the exchange rate directly, now it affects first the demand for imported goods through the interest rate channel and then on the exchange rate. The exchange rate reaction in response to a rate change becomes smaller. For example, after a key rate cut, the exchange rate does not weaken to the same extent and hence inflation stays at the same level for longer due to a stronger exchange rate. As a consequence, a more substantial response from the monetary policy may be required to bring the economy back to equilibrium – the monetary policy would then effectively offset part of the currency channel (Bank of Russia, 2022).

8. The impact of external constraints and structural transformation of the economy on the real **neutral rate** is ambiguous, although there are more factors contributing to its increase. On the one hand, external constraints in the financial sector mean that a larger share of intertemporal consumption smoothing operations will be domestic – that is, the funds available for investment will increase. This, however, may be offset by the fact that non-resident funds have declined in the economy. That is, the final amount of funds available for investment may not change. On the other hand, the change in the operation of the currency channel means that the Russian economy faces additional costs associated with adjusting to constraints in the financial sector (e.g., portfolio change costs). This could put upward pressure on the neutral rate. In addition, structural transformation requires substantial additional investment with greater uncertainty in project outcomes. This could also support a rise in the neutral rate. Moving the structural budget deficit to a higher level would also increase the neutral rate. Finally, an increase in the risk premium due to uncertainty in the external environment would also increase the neutral rate.

THE EVOLUTION OF FINANCIAL ARCHITECTURE

Financial architecture evolves with the expansion of technological capabilities. In recent years, digital currencies have received close attention. Technology allows for more efficient payment and settlement infrastructure, so central banks have begun to develop their own digital currencies. The Bank of Russia pioneered in the developing of a digital ruble. The digital ruble is a third form of money. Digital accounts will be accessed through the banking sector. In the first phase of implementation, increased uncertainty about customer flows may have a small "noise" effect on the monetary policy signal transmission, but in general, the introduction of the digital ruble does not imply significant changes in the monetary policy transmission mechanism.

In the last 5–10 years quick access to financial markets and technological advancement have boosted the number of retail investors worldwide. In Russia, an important additional factor was the transition to the IT regime and stabilisation of inflation. This has reduced the macroeconomic risk premium and increased the attractiveness of financial market investments. The growth of the number of retail investors leads to an increase in market liquidity, an improvement in the monetary policy transmission, and a more efficient allocation of capital in the economy. At the same time, it is important to expand financial literacy programs and take measures to protect the rights of investors to limit the risks associated with emotional or insufficiently informed actions of investors. In addition, in the absence of non-residents, the development of the expectations channel is important. It also involves the expansion of financial literacy programs.

The infrastructure of the cross-border payment system is also changing under the influence of new technologies. The options under consideration include digital currencies, alternative systems for transferring financial messages, unification of payment systems, integration of fast payment systems, and others. A significant trend in cross-border settlements is the transition to settlements in national currencies. At the same time, some settlements will inevitably remain in traditional reserve currencies. It is necessary to develop currency arbitrage instruments, hedging instruments for foreign trade and financial transactions, and develop a market for financial derivatives to smooth out possible currency imbalances.

1. The financial industry is constantly evolving, following the new needs of society. The rapid development of technology in the late 20th and early 21st centuries has set in motion a process of fundamental transformation in the industry worldwide. Cashless payment methods are increasingly replacing cash. New companies formed at the intersection of finance and technology are providing an increasing number of digital financial services to people and businesses. Investing on financial markets no longer requires visiting a broker's office and using special terminals – all operations on the stock exchange are available on a smartphone screen. Even in such a conservative segment of the financial industry as cross-border settlements, there is an increasing number of technological developments aimed at solving long-standing problems (low speed of payments, high cost, large number of intermediaries involved). In addition, heightened geopolitical tensions in 2022 have accelerated the exploration of alternative settlement mechanisms, including those based on digital currencies.

These trends will continue in the future, providing more and more opportunities for financial transactions, preservation and multiplication of capital. Each of these, in their own way, can affect not only monetary policy transmission mechanism, but also financial stability. For Russia, an additional significant factor affecting the development of the financial sector is the new configuration of interaction with the outside world, including the forced introduction of capital controls.

DIGITAL CURRENCIES

2. The idea of digital money dates back to the 1980s. At that time, the American scientist David Chaum, an information technology specialist and cryptographer, first described it in one of his articles. The main innovation was that digital money was proposed to be created using distributed ledger technology incorporating encryption algorithms. This is their difference from non-cash money, which is an electronic record in bank accounts.

In the future, the proposed solutions were clarified and various attempts were made to implement them. Advances in computing power contributed to a version of digital currency that could be scaled. This new period in the development of digital money began in 2009 with the publication of the article "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2009) by Satoshi Nakamoto, a pseudonym whose real identity is still a mystery.

Bitcoin and other cryptocurrencies that have subsequently emerged have been used to purchase a wide range of goods and services, from software and real estate to illegal substances. In addition to unsecured cryptocurrencies, there have been stablecoins (their value is tied to fiat currencies, precious metals or other underlying assets), as well as algorithmic stablecoins (stabilisation of their value is provided by an algorithm linking a standard stablecoins and an arbitrage cryptocurrency). Cryptographic technologies have also spurred the development of non-replaceable tokens (NFTs), which are unique digital certificates tied to non-financial digital objects (e.g., online games or digital artworks) (Bank of Russia, 2022).

As of early March 2023, there were more than 22,000 cryptocurrencies and stablecoins with a combined capitalisation of just over US$1 trillion, which, however, is significantly below the peak of US$2.8 trillion, which was reached in November 2021. Despite the significant market size, many cryptocurrencies remain inactive or fail to show any noticeable increase in value. Bitcoin dominates with about 40% of the market, followed by etherium (17%), and together they have about three times the share of the other top 20 cryptocurrencies.

An entire system of decentralised finance (DeFi) has grown up around crypto-assets, where many standard transactions (borrowing, lending, trading) are possible without traditional intermediaries such as banks or brokers. In the DeFi system, interactions occur through automatically executable smart contracts that track the fulfillment of transaction terms and cannot be blocked. This is one of the main differences from the traditional system, where financial institutions apply a Know-Your-Client approach to transactions and can stop a transaction if there is doubt about the source of funds or the purpose of the payment (Bank of Russia, 2022).

3. Despite the active development of the market, cryptocurrencies are not legal tender in most countries. The experience of cryptocurrencies accumulated so far, especially the experience of 2020-2022, has clearly demonstrated that **cryptocurrencies do not satisfy the basic properties of money: a measure of value, a medium of exchange, and a means of saving**.

Cryptocurrencies are too volatile to fulfill the "measure of value" and "medium of exchange" properties. For example, in 2020, after the WHO pandemic was announced, bitcoin lost 50% of its value in two days. In 2021, after China announced a regulatory ban on cryptocurrencies in the country, the value of bitcoin plummeted 30% in a single day. In 2022, due to a surge in demand for conversion, the TerraUSD algorithmic stablecoin lost its equivalent (1:1) peg to the dollar and its price dropped to 30 cents, with all transactions suspended. The volatility of cryptocurrencies is largely due to the rapidly changing expectations of market participants rather than economic or financial factors, so their value is quite difficult to predict and hedge. As a consequence, even in cases where cryptocurrency payments are allowed in a country, prices are set in one of the existing official currencies and settlements are made at the exchange rate on the date of the transaction.

Cryptocurrencies are not only too volatile but also too unreliable to fulfill the "store of value" property – they lack a mechanism for long-term succession of issuers' liabilities. Unlike the state, a private issuer is accountable only to itself and can withdraw from the market at any time, settlements in the currency it issues will cease, and savings will depreciate. In the case of a decentralised currency with multiple issuers (e.g. bitcoin), it is possible that for some reason issuers will lose interest in further work with the platform (e.g. due to the emergence of a more profitable solution for them on the market). Then the use of the currency will effectively cease and the existing savings will also lose their value. In general, the asymmetry of information between issuers and users of currencies leads to the manifestation of so-called moral hazard. Decentralised issuers have no incentives to respect the interests of users, but they do have incentives to be driven by their own benefit at the expense of the interests of the system. The **failure of** the **"store of value" property is one of the main reasons for strict regulatory measures against cryptocurrencies by central banks**. If economic agents accumulate large amounts of savings in cryptocurrencies and their value drops sharply, the compensation of losses of a systemic nature will fall on the shoulders of the central bank and create additional risks for financial stability.

Although developers claim that the main advantages of cryptocurrencies are decentralisation and independence from central bank policy, in practice the main **disadvantages of cryptocurrencies are precisely the result of decentralisation** and the lack of unified control over the supply of currency in the system. The lack of control over the money supply and the proliferation of multiple alternative currencies in the system limits the ability to smooth the business cycle. Technological limitations of private issuers do not always allow for a rapid increase in money supply in response to a negative demand shock. Moreover, some cryptocurrencies have a quantitative limit on their possible aggregate volume. This inflexibility of the money supply will cause recessions to be more prolonged, to the point of creating a prolonged deflationary spiral (Bruegel, 2018; Fernandes-Villaverde and Sanches, 2018). The **existence of a central bank and the singularity of the settlement currency enable active monetary policy, facilitating intertemporal consumption smoothing**, especially when multigenerational lives are taken into account (Weiss, 1980). Historical experience also shows that centralised control of monetary circulation is more conducive to economic development than the simultaneous use of multiple currencies. For example, banknotes issued by many private banks and representing an obligation to issue a given amount of metallic money to the bearer were in circulation in the United States in the 19th century. At the same time, each bank had a different exchange rate. In a recent study (Xu, Yang, 2022), it was shown that the shift from multiple private banknotes to one centralised banknote had a marked positive impact on the real sector. In particular, the availability of stable money allowed manufacturing enterprises to produce more due to the fact that it became easier to pay for components, there were more opportunities to diversify suppliers; companies became more active in entering new markets, and innovation activity increased. In addition to this, a study (Dowd, Greenaway, 1993) noted that network effects and cognitive constraints make a monetary system with multiple currencies unsustainable and unable to adequately provide the financial component of economic development.

The existence of centralised control of the money supply also helps to manage risks to financial stability that may be caused by imperfections in the real financial market. For example, in the event of a sudden loss of confidence of economic agents, private issuers may not be able to cope with an influx of requests to withdraw funds, convert to another currency or underlying asset. Despite the fact that initially only one organisation may have problems, difficulties with the return of their funds lead to the spread of the crisis of confidence and other financial institutions, eventually taking over the entire system – the so-called liquidity crisis occurs. At the same time, the central bank in similar cases has the ability to regulate the supply of currency and can provide additional liquidity to banks, thereby returning confidence to the market and preventing the development of the crisis. Moreover, historically, episodes of liquidity crises have played a crucial role in the emergence of the central bank, and later in the emergence of mechanisms such as the "lender of last resort" and the deposit insurance system. (Allen and Gale, 2000; Freixas, Parigi, and Rochet, 2000; Holmstrom and Tirole, 1998; Tirole, 2008).

Thus, **centralised control of the financial system and public monetary circulation contribute to public welfare**, while decentralisation can lead to irreparable losses for individuals and society as a whole. Meanwhile, an **inflation targeting regime** that stabilizes inflation over the long-term horizon, even in the face of technological changes in the financial sector, remains the most appropriate growth-enhancing regime (Bruegel, 2018).

4. However, the opportunities that arise with the development of digital currencies can contribute to the convenience and efficiency of payment and settlement infrastructure. Therefore, central banks in many countries have begun to explore approaches to developing and implementing their own digital currencies (CBDC). At the beginning of 2022, at least 100 central banks were involved in the development of CBDC at various stages. CBDC allow for the technological advantages of cryptographic algorithms, but at the same time retain all the safeguards inherent in fiat currency – for example, the permanently available exchange of digital currency into fiat currency at a 1:1 exchange rate (BIS, 2019).

The Bank of Russia pioneered in the developing of its own digital currency, the digital ruble. A Consultation Paper was published in October 2020, the Digital Ruble Concept was published in April 2021, and in 2022 the Digital Ruble passed the pilot testing stage in a group of 12 banks. In 2023 the Bank of Russia will begin piloting settlements by individuals among themselves, between companies and individuals, and testing the performance of smart contracts based on the digital ruble. In the future, it is planned to gradually connect credit institutions to the digital ruble platform, include the possibility of making payments in digital rubles to the state and from the

state to individuals and businesses, develop the offline mode and connect non-credit financial institution to the platform. The Bank of Russia also plans to cooperate with other central banks developing their own digital currencies and develop joint solutions for cross-border and foreign exchange transactions involving digital currencies (Monetary Policy Guidelines, 23-25).

The digital ruble is a third form of money (on a par with cash and non-cash), which implies a redistribution of the money supply rather than its expansion. Therefore, the introduction of the digital ruble will have no impact on inflation. The distinctive features of the digital ruble will subsequently include the possibility of offline settlements that do not require access to the Internet.

5. The introduction of the digital ruble by the Bank of Russia does not imply any significant changes in the monetary policy transmission mechanism.

Access to the digital ruble for households and businesses will be through the banking sector. Banks will conduct transactions with digital rubles on behalf of their customers. Customers will be able to open a digital account on the Bank of Russia's digital ruble platform, make payments in digital rubles, and find out the balance of their digital account via the banks' mobile applications. At the same time, digital rubles will be accounted for on the balance sheet of the Bank of Russia and will become its liabilities, on a par with issued cash. As a result, the introduction of the digital ruble will change the structure of the money supply: the shares of cash and non-cash funds will slightly decrease, redistributed in favour of digital rubles.

The impact on the balance sheets of credit institutions will depend on how the demand of economic agents is distributed among the three forms of money. The Bank of Russia's decision not to charge interest on digital account balances limits possible competition between digital wallets and customers' non-cash bank accounts. The absence of interest excludes the use of the digital ruble as a "savings vehicle" – this function will continue to be performed by bank deposit accounts of various maturities that accrue interest.

Thus, the scale of the transfer of funds into digital rubles from customers' bank accounts is likely to be insignificant. At the same time, the ratio between different forms of money will be influenced by a number of factors, including the convenience of their use, transaction costs and ease of converting funds from one form of money to another, as well as the level of interest rates on bank deposits, determining the attractiveness and competitive advantages of non-cash funds of banks (Grishchenko, 2022). According to preliminary conservative estimates, the share of digital ruble use in consumer sector transactions is likely to be limited (Grishchenko, Ponomarenko, and Seleznev, 2023). Banks with large amounts of free or nearly free liabilities – current, settlement and payroll accounts – are likely to see some reduction in profits associated with this competitive advantage. It is worth noting that increased competition from fintech and bigtech companies will in any case lead to a decline in banks' profits associated with "cheap" liabilities, regardless of the emergence of the digital ruble (Grishchenko and Sinyakov, 2021).

However, it cannot be ruled out that with the introduction of the digital ruble, the banking sector may move into a state of liquidity deficit. In other words, the amount of funds provided by the regulator to credit institutions will exceed the amount of funds placed by them on accounts with the Bank of Russia. It is important to note that such a situation was observed in Russia, for example, in 2012-2016 and at the same time did not limit the ability of the banking sector to expand lending to the economy and did not threaten the sustainability of the banking sector. The Bank of Russia has a flexible toolkit for providing liquidity against various collateral, which will make it possible to compensate in a timely manner and to the full extent for the possible outflow of customers' funds from bank accounts into the digital ruble. In addition, in order to reduce risks for credit institutions associated with the outflow of customer funds and to facilitate the adaptation of banks to the new conditions associated with the emergence of the digital ruble, the Bank of Russia will set a limit on the amount of funds transferred from bank accounts to the digital ruble[1].

At the first stage, the growing uncertainty about the spillovers to the digital ruble may have a small "noise" effect on the transmission of the monetary policy signal. However, the main point is that the introduction of the digital ruble does not change the operational procedure of the monetary policy. While managing the liquidity of

[1] The Bank of Russia intends to set this limit at 300,000 rubles per month.

the banking sector, the Bank of Russia will, as it does now, maintain with its operations the balance of liquidity supply and demand in the banking sector to form short-term money market rates near the key rate (Monetary Policy Guidelines, 23-25).

6. The introduction of the digital ruble will increase the availability of financial services, including in remote and inaccessible areas, increase the efficiency of public expenditures due to improved opportunities for their administration, reduce transaction costs for settlements and, as a result, reduce the cost of settlements. The widespread adoption of the digital ruble will create conditions for increased competition in the banking sector and more efficient redistribution of financial resources in the economy, which will contribute to the growth of its competitiveness (Monetary Policy Guidelines, 23-25).

FINANCIAL MARKETS

7. Advances in financial technology, the emergence of online platforms and easier access to financial markets for individuals, combined with a period of low rates and the absence of major economic shocks following the 2007-2008 financial crisis, have contributed to a significant increase in retail investor participation in financial markets around the world. The lockdown period during the pandemic, accompanied by large-scale budget support programs, further reinforced this trend. The number of financial market trading app users globally has grown from nearly 36 million in 2017 to over 150 million in 2021. Assets held directly by retail investors reached 52% of the global asset pool in 2021. Thus, while for *most of* history the dominant force in the global financial market was considered to be institutional investors managing the funds of their retail clients, in the 21st century the independent participation of retail investors is increasingly influencing market dynamics (WEF, 2022).

8. Similar trends are observed in Russia. The emergence of online platforms and mobile applications, simplification of account opening and transaction procedures have increased the availability of investment instruments, attracting more and more retail investors to the financial market. A separate **significant factor** contributing to the growth of interest of individuals in financial markets was the **transition to the inflation targeting regime**. Stabilizing inflation near the target reduces the risk premium associated with macroeconomic volatility. This, in turn, allows the calculation of the expected yield of the instrument to be largely focused on the characteristics of the investment object rather than on the risks of the macroeconomic environment. In addition, a steady decline in inflation is accompanied by a decline in deposit rates, and they are becoming less attractive compared to the possibility of multiplying capital in the financial markets.

Developed financial markets allow the economy to allocate capital more efficiently, providing firms with more resources for innovation and promoting economic growth (McKinnon, 1973; Stiglitz, 1989; 2010; Shin, 2013; Popov, 2017). Research shows (e.g., Kaniel, Saar and Titman, 2008) that a growth in the number of retail investors increases market liquidity and depth, especially for mid- and small-capitalisation firms. Retail investors, in turn, get the opportunity to diversify their assets with higher long-term returns compared to standard banking products. In the Russian financial market, liquidity also began to increase from 2019, when retail investors - both through brokerage accounts and collective investment funds - began to grow particularly prominently (Review, Q3 2022; Akhmetov et al., 2021).

However, the active growth in the number of retail investors in the market comes with risks. Unlike institutional investors, retail investors often lack the specialised knowledge and analysis necessary to compare risks and potential returns on investments. At the same time, the prevalence of social media makes it possible for everyone to post opinions on assets and tools and to echo each other's actions. This in turn can lead to losses not only for individual retail investors but also for large institutional funds. A recent example: an online discussion by retail investors on the social network Reddit in December 2020-January 2021 caused GameStop's stock price to rise 1,700% in one month. As a result, institutional investors who expected a decline in stock prices and therefore followed a short-selling strategy suffered heavy losses. A significant number of retail investors also faced losses. Some platforms were forced to suspend transactions in the company's shares for a while. The Russian financial market also has episodes of strong speculative price fluctuations in individual stocks that are not related to fundamental reasons. In the new environment, the number of such fluctuations may increase due to the cessation

of non-resident participation. After the withdrawal of non-residents, the share of individuals in the turnover on transactions in shares increased to 80% in the market as a whole and up to 100% in certain low-liquid securities (Review, Q3 2022).

Therefore, the expansion of retail investors' activity in the financial market should be accompanied by measures to improve financial literacy, which enables more rational and informed investment decisions (Calcagno & Monticone, 2015; Clark et al., 2020; Lusardi & Mitchell, 2014; Batsaikhan, Demertzis, 2018; Carpena et al., 2011). Financially literate population is more careful in choosing financial products and their providers, and constantly monitors market offers and conditions. Using Russian data (Tumanyants, 2022), it has been shown that a higher level of financial knowledge is associated not only with a higher propensity to save and a longer time horizon for financial planning, but also with a more accurate estimate of current interest rates in the economy. Another necessary element accompanying the increase in retail investor activity in the financial market is strict investor protection measures that, among other things, restrict the sale of knowingly unsuitable products (misselling) to them (WEF, 2022).

9. Financial markets are involved in the functioning of several channels of the monetary policy transmissions (currency channel, wealth channel, asset channel), so greater liquidity and depth of markets increase the efficiency of the monetary policy impact on the financial and real sectors of the economy. Using Russian data (Vikharev et al., 2023), it has been shown that increasing household involvement in the financial market reduces the fluctuations of macro variables and enhances the monetary policy transmission.

Until February 2022, non-residents actively invested in the Russian financial market. Non-resident financial market participation in emerging markets can lead to increased volatility of capital flows and increased dependence of local financial markets on global economic developments, amplifying risks to financial stability and triggering stronger monetary policy reactions than are driven by in-country factors (Rey, 2015; Forbes & Warnock, 2012; Obstfeld, 2015; Davis & Presno, 2017). Sanctions restrictions, including blocking of assets and operations of financial institutions in 2022, as well as forced retaliatory capital protection measures have largely insulated the Russian financial market from the volatility associated with non-resident capital flows. However, limiting interaction with foreign and financial markets results in the loss of some benefits.

First, investing in foreign markets enables portfolio diversification and risk hedging. Restricting this possibility may result in risks associated with concentration of investments and risks associated with excess liquidity (investing in high-risk assets) for domestic investors. In the future, this may cause increased risks to financial stability.

Secondly, non-residents investing in Russia consisted mainly of institutional investors. This category of investors responds to the monetary policy largely through the expectations channel, that is, by forming expectations about future inflation and future rate trajectory. In turn, when inflation targeting policy is implemented, this contributes to lower long-term rates in the economy. Thus, the importance of the task of **strengthening the expectations channel is reinforced** for the future development of financial markets. If earlier it was implemented to a large extent through the assessment of non-resident investors, in the new conditions a similar connection should be built with domestic investors.

10. The most effective monetary policy regime for managing inflation expectations is inflation targeting. Studies show that the lower the inflation rate, the better financial markets develop (Hung, 2003; Batayneh, 2021). The main mechanism is related to the fact that economic agents have some internal "threshold level" of inflation to worry about. Once inflation approaches or exceeds this level, the main objective of financial behaviour of economic agents becomes the protection of assets from the risks of further depreciation of their savings, which often involves investments in real estate, precious metals or currencies of other countries. If inflation is below this threshold, economic agents start investing in financial markets. Inflation expectations anchored near a target below the "threshold level" allow economic agents to plan investments in different asset classes over the long-term horizon, while diversifying the domestic investment base (Blanchard, 2022; BIS, 2021).

In addition, strengthening central bank communication and improving financial literacy can also serve as a tool for dealing with inflation expectations. As studies show, understanding the mechanism of functioning of

financial markets and the economy as a whole leads to a decrease in inflation expectations (Bruine de Bruin et al., 2010; Rumler, Valderrama, 2020; Burke, Manz, 2014). Russian respondents with high levels of financial knowledge give lower estimates of current and upcoming price dynamics and tend to rate more highly the central bank's ability to control inflation (Tumanyants, 2022).

CROSS-BORDER SETTLEMENTS

11. The infrastructure of the modern cross-border payment system was formed about 40 years ago. It includes financial messaging system (SWIFT is the most used) and correspondent relations between banks. In practice, however, it often turns out that a transaction must pass through a chain of correspondent accounts before it reaches the addressee. As a result, payments are slow (given the working hours of all banks in the chain and verification through know-your-customer procedures), at high cost (each correspondent bank in the chain has its own tariff) and with limited traceability (the first bank in the chain has no information from the third bank in the chain) (Rice et al., 2020; BIS, 2021). In addition, the aggravation of geopolitical contradictions in 2022 has shown that high concentration of international payments within one financial messaging system may be accompanied by the use of monopoly power on the part of this system, including the disconnection of its individual participants. But in general, despite the inclusion of many banks in the system of correspondent relations, cross-border transactions are not accessible to all – especially when it comes to small payments or currencies of low prevalence. Financial technologies allow to find new, more efficient solutions for cross-border settlement system. Most of these solutions are aimed at facilitating the process of cross-border transactions between the individuals. For payments between two companies or between an individual and a company, a traditional system with correspondent accounts is still required in most cases. According to experts, CBDC may become just that fundamentally new instrument that will significantly change the whole system of cross-border settlements (Bindseil, Pantelopoulos, 2022; BIS, 2021). Other infrastructure solutions being considered by countries include the development of alternative financial messaging systems, interconnection of payment systems, integration of fast payment systems, and so on.

12. In 2022, another significant trend in the practice of cross-border settlements – the transition to settlements in national currencies in foreign trade transactions – was further developed. In general, there are three main ways to price export goods: local currency pricing, producer currency pricing and dominant currency pricing. The concept of dominant currency emerged from empirical research that showed that countries in practice rarely set the price in their own currency (both sellers and buyers), but more often use a compromise third currency – usually a reserve currency. The dominant currency for the past 20 years for most transactions has been the US dollar, although for transactions on the European continent, the euro holds a significant share (Gopinath, 2009; Adler et al., 2020; Casas et al., 2017).

A country's current cross-border settlement practices are reflected in a chain of interlocking elements: (1) the currency of contracts, (2) the currency of settlement, (3) the currency structure of banking products, and (4) the currency structure of central bank reserves. In the dominant currency paradigm, all these elements of the chain rely heavily on the main currency of foreign trade settlements (which, however, does not exclude the use of other currencies, but their share is much smaller).

When switching to settlements in national currencies (i.e. in the "supplier's currency" scheme), the link between the elements of the chain is broken. The currency of the contract can remain unchanged – especially if the parties have no desire to regularly renegotiate the contracts due to the volatility of bilateral exchange rates. In addition, studies show that prices in international contracts tend to be "rigid", meaning that transacting parties prefer to fix prices for a long period of time (Gopinath, 2009). The currency structure of banking products may also remain unchanged. First, economic agents unrelated to foreign trade may not develop an interest in other currencies – for example, due to their risk-return preferences. Secondly, the banks find it more convenient to manage their open currency position within a limited basket of stable currencies.

Thus, the main change concerns the actual settlement operations – the transition to the supplier's currency. In the case of Russia, this currently means a shift in the currency structure of settlements in favour of currencies

of friendly countries. At the same time, bilateral foreign trade flows are becoming less balanced. Russia has a trade surplus with many friendly countries. This means that the need to buy imported goods from each particular country is less than the need of these countries to buy Russian exports for rubles. At the same time, part of import settlements, including critical imports, remain in the dominant currency, with receipts of this currency declining due to the shift to paying for exports in local currency. According to the theory, if bilateral markets and arbitrage operations function efficiently, the transition to settlement in national currencies should not affect the exchange rate. However, with limited opportunities for arbitrage operations (for example, due to high transaction costs in these markets), the ruble may strengthen against the currencies of friendly countries due to surplus in bilateral trade and weaken against the currencies of those countries experiencing a deficit in bilateral trade. Taken together, this can increase bilateral exchange rate imbalances, complicating further calculations. In addition, the growing number of currency pairs used in foreign trade operations will increase the burden on direct and indirect participants of foreign trade relations (real sector companies and banks) in terms of exchange rate risk management – both transaction and operational costs will increase.

It is necessary to develop currency arbitrage instruments, hedging instruments for foreign trade and financial transactions, and develop a market for financial derivatives to smooth out emerging imbalances. This is a lengthy process and requires the development of appropriate infrastructure and counterparties in the countries concerned.

DECARBONISATION AND GLOBAL WARMING

The climate is changing under the influence of an increasingly marked increase in the Earth's average surface temperature. If the rate of global warming does not slow down, in a few decades its effects may become irreversible, some ecosystems will cease to exist. An increase in extreme weather events and natural disasters has also been associated with an increase in the Earth's temperature. All these unfavourable manifestations of the climate change process are commonly referred to as physical climate risks. They lead to lower output and spikes in inflation. At the same time, the more frequent destructive natural events occur, the more the economy is forced to work in recovery instead of development.

Limiting the rate of global warming requires decisive and synchronised climate policy. If global policy is orderly, the risks arising from the transition to a low-carbon economy, including measures taken by governments and regulators (so-called transition risks), will be relatively low. However, because countries around the world differ markedly in energy endowment, per capita income, and technological development, the likelihood of an orderly global climate policy is extremely low. Disorderly climate policy will lead to increased energy product costs, resulting in volatile and sustained inflationary pressure and potentially significant growth in inflation expectations. Economic output may decline due to the need to restructure production processes.

For the Russian economy, the transition risks actually started to emerge in 2022. Moving forward, transition risks will be linked to the ongoing decline in global demand for high-carbon footprint goods, stricter ESG reporting requirements from trading partners, and the implementation of cross-border carbon regulation.

Inflation targeting remains most appropriate monetary policy regime for the economy amid climate change. Yet the importance of communication significantly increases, particularly during times when the central bank does not react to inflationary shocks related to climate change or transition policies.

1. The increase in the temperature of the Earth's surface (and, as a consequence, of the atmosphere and the waters of the World Ocean) has been observed at least since the end of the 19th century. As climatologists note, by now the average temperature has risen by 1.1°C relative to pre-industrial levels. Most of the temperature increase has occurred since 1975, and the nine hottest years on record were registered in the last decade. It is believed that one of the main causes of global warming is the increase in greenhouse gas emissions, especially CO_2, due to increasing human use of carbon-based energy carriers (coal, oil, gas) (National Research University Higher School of Economics, 2022; NGFS, 2020; IPCC, 2022) Russia ranks fourth in the world in terms of greenhouse gas emissions (НИУ ВШЭ, 2022). If the concentration of greenhouse gases in the atmosphere continues to rise, the temperature increase relative to the pre-industrial period could exceed 4-5 °C by 2100. At the same time, according to the estimates of the Intergovernmental Panel on Climate Change, the effects of climate change will be felt already at an average temperature increase of 1.5 °C, and at 2 °C some effects will be irreversible (for example, more than 99% of coral reefs will cease to exist, which will change the entire ecosystem of coastal marine waters) (IPCC, 2018). In addition, as temperatures rise, the frequency and duration of extreme weather events (e.g., prolonged hot weather without rain or, conversely, abnormally heavy and prolonged precipitation) and associated natural disasters and natural calamities (fires, floods, tsunamis, etc.) increase significantly. All these unfavourable manifestations of global warming are commonly referred to as **physical climate risks** to the economy.

2. In order to strengthen the coordination of joint actions to limit the global temperature rise to 2 °C by 2100, the UN member states entered into the Paris Agreement in 2015. However, the concentration of greenhouse gases in the atmosphere has continued to rise since then, which means more decarbonisation measures are needed and implies massive investments in renewable energy development. Climate policy shapes **transient climate risks** to the economy. These are risks arising from the transition to a low-carbon economy, including measures taken by governments and regulators to mitigate climate change (e.g. the introduction of domestic or transboundary carbon regulations). For some industries (e.g., coal), this largely means activity termination over time; for others, it means significantly changing the business model and restructuring production processes. However, even with an active climate policy and a significant limitation of current emissions, the concentration of greenhouse gases in the

atmosphere will remain high for a long time and, consequently, will continue to cause the manifestation of adverse effects of climate change.

As a result, the economy will be affected by both transitional and physical risks simultaneously. Key macroeconomic variables such as inflation, output, and the neutral rate will be influenced by structural changes in industries, pricing realignment processes in key input markets, and fiscal climate policy measures. Under these conditions, supply and demand shocks may be stronger than those observed in the last 50-60 years and accompanied by non-linear dynamics, causing long-run effects and posing challenges to price and financial stability (Mongelli et al., 2022; Andersson et al., 2020; Boneva et al., 2021).

3. The possible **impact of physical climate risks** on the economy is mainly studied by analyzing the effects of extreme weather events, natural disasters and natural calamities, which have occurred many times in history. Climate change is causing them to occur more frequently (IPCC, 2018). Empirical studies show that the result of all these developments is a decline in **output** and its growth rate in the short run (Batten et al., 2020; Cavallo and Noy, 2010). At the same time, the more frequent destructive natural events occur, the more the economy is forced to work in recovery instead of development. In addition, even though there is an influx of funding for post-damage reconstruction projects, over time, investments in regions most prone to frequent disaster events begin to decline. The population living there gradually spends less and less on consumption and saves more for emergencies or migrates to safer and more comfortable places to live.

Rising temperature of the atmosphere also has an unfavourable impact on the economy. Kahn et al., 2019, analyzed data over a nearly 60-year period and found that higher temperature turns out to be a significant factor limiting economic growth. And this effect does not depend on the geographical coordinates or income level of the country. Other researchers have noted that the processes involved in the gradual increase in temperature have a negative impact on factor productivity. High temperatures lead to poor health and reduced work capacity, some of the labor force may leave the labor market due to unsuitable conditions (NIU HSE, 2022; Fankhauser and Tol, 2005) Capital productivity may also decrease: equipment designed for a certain temperature regime may fail more often and will wear out faster. (Guidelines for the Single State Monetary Policy 2022-2024; Stern, 2013). At the same time, it should be noted that the influence of the atmospheric temperature increase is not uniform across climatic zones. In some regions, its positive effects may even outweigh its negative effects – for example, at higher latitudes, yields may increase (Ciccarelli and Fulvia, 2021).

For Russia, the most significant physical risks that may have irreversible consequences for the issue are the following:

- Thawing of permafrost in the northern regions of the country and the concomitant destruction of oil, gas, precious metals and stone mining infrastructure (Guidelines for the Single State Monetary Policy 2022-2024; Rosgidromet, 2022a).
- Increase in the number of droughts and decrease in crop productivity in the main agrarian areas of the country (Rosgidromet, 2022b; Bank of Russia, 2022).
- Increase in the number of dangerous hydrometeorological phenomena in all regions of Russia, which is confirmed by data for the last 10 years (Rosgidromet, 2022b; Bank of Russia, 2022).

If physical climate risks increase at the same rate, the long-term growth rate of **potential output** may begin to decline gradually (Gandhi and Cuervo, 1998; McKibbin et al., 2020). In turn, both lower potential growth and lower investment and higher contingency savings will lead to a decline in the **real neutral interest rate** (Cantelmo, 2020; Kozlowski et al., 2018; Dietrich et al., 2022; Auclert and Rognlie, 2018).

The impact of **physical climate risks on inflation** is determined by the prevailing shock: a **demand** shock associated with increased uncertainty and loss of some assets and income, or a supply shock**, caused by constrained or disrupted production capacity and** supply chains. In most disaster episodes, demand shocks are more pronounced than supply shocks, so prices do not show a marked increase (Batten et al., 2016; Heinen et al., 2019; Cavallo et al., 2014; Ciccarelli and Fulvia, 2021). However, when an extreme weather event affects commodity markets (e.g. food or energy markets), negative supply shocks are more pronounced. As a consequence, not only the prices of goods that are affected by supply reductions may rise, but also the prices of

other products in which these goods are inputs (Heinen et al., 2016; Parker, 2018). In general, an increase in the frequency of negative supply shocks in commodity markets can make inflation more volatile but less related to the standard course of the business cycle (Peersman, 2022). In addition, since food and energy products are classified as essential commodities, additional pro-inflationary pressure may be realised through the growth of inflationary expectations. Another channel of pro-inflationary influence is the gradual increase in costs due to the need to smooth the effects of higher temperatures. For example, it may be necessary to make more frequent repairs and maintenance of equipment, increase air conditioning and refrigeration costs (Andersson et al., 2020).

4. The **impact of transient climate risks** on macroeconomic variables depends largely on the orderliness of global climate policy and associated uncertainty and on the degree of confidence of economic agents. The orderliness problem itself arises from the need to find a trade-off between the costs of carbon regulation in the medium term and the damage to the economy associated with increased intensity of physical risks in the long term. At the same time, due to the trade and economic interaction of many countries, as well as the introduction of cross-border carbon regulation, external climate policy will affect the economy of a particular country as much as domestic policy.

The main climate policy tool under discussion today is the introduction of a carbon price per ton of CO_2. This can be realised in the form of a carbon tax (this option is more convenient to administer) or in the form of an initial auction price for emissions trading (this option allows for better control over the total amount of emissions) (Parry et al., 2022). Under the assumption of no new shocks, the orderliness of climate policy implies that the following components are defined in advance and transparently:

- Carbon price, the trajectory of its change over time.
- Charging mechanism (e.g., setting a fee for producers or consumers, including only the final goods or the entire value chain, including cyclical parameters that allow for a lower carbon price during recessions or their absence, etc.).
- Rules regarding the use of accumulated funds (e.g., subsidizing new technologies, supporting low-income consumers, repaying government debt, etc.).

If all these parameters are agreed between countries, it will allow to systematically reduce the total concentration of greenhouse gases (and thus limit the physical manifestations of climate change) and avoid the so-called carbon leakage. It is a consequence of the difference in climate policy between countries: businesses, wishing to reduce the costs associated with climate regulation, move production to countries with more lenient requirements. In the end, not only does it not reduce overall greenhouse gas emissions, it may even increase them.

A streamlined global climate policy is likely to create conditions for increased investment in energy efficiency and carbon-neutral energy technologies by reducing uncertainty (Benmir et al., 2020; Potashnikov, 2022). As theoretical modeling shows, in the absence of other shocks in the case of an orderly transition, **output** in the economy may decline slightly in the initial period due to the need to restructure production processes. But in the future, investment growth will ensure a rapid increase in both actual output and its potential growth rates. The **neutral rate** in such an economy would also rise. The impact of orderly climate policy on **inflation** may be very modest (Mongelli et al., 2020; IMF, 2022). Moreover, individual models show that with orderly policy and high confidence in it, instead of inflation, the economy can even face deflation: if economic agents know exactly the magnitude of the carbon tax increase in the future, they will start to reduce consumption today. As a result, this effect will override the price increase caused by the initial introduction of the tax (Ferrari, 2022).

According to model calculations by the Network for Greening the Financial System (NGFS), to limit global warming to 2°C, the world's flat carbon tax would need to rise from its current zero level to at least US$90 per ton of CO_2 by 2030 and to a level of at least US$240 per ton of CO_2 by 2050[2]. If the goal is to limit global warming to 1.5°C, however, the modeled value of the tax turns out to be about five times higher (NGFS, 2022). IMF calculations show that a differentiated approach is possible to limit global warming to 2°C. In this case, by 2030 the carbon price should be at least US$90 per ton of CO_2 for high-income countries, US$60 – for those with a

[2] Hereinafter in 2022 prices.

medium level and US$30 – for low-income countries, for all increasing thereafter (Chateau et al., 2022), (Parry, Black, & Roaf, 2021).

While most countries support the need to develop concerted measures to limit global warming, the willingness to implement a high carbon tax as soon as possible differs markedly. This is mainly due to differences in the availability of infrastructure to enable renewable energy and in the ability to finance both the development of such technologies and support consumers during the transition period. While the costs of generating energy from renewable energy sources have fallen markedly in the last two years, they are still quite high, and the lack of energy storage and energy storage capacity does not allow for an uninterrupted flow of energy in the amounts required to meaningfully replace carbon-based energy in the energy mix (Ciccarelli & Fulvia, 2021). Consumers (both organisations and households) in most countries continue to rely on carbon-based energy sources. Meanwhile, the least well-off tend to spend a larger share of their income on carbon-based energy (Murray, Rivers, 2015; Konradt, Weder di Mauro, 2022). The need to pay the full cost of carbon energy, including the market price and tax, can lead to increased social tensions. This is exemplified by the massive protests in 2022 that followed rising energy prices in 92 countries around the world. Simultaneously financing new infrastructure and supporting consumers requires significant additional budgetary resources, but many countries have already accumulated historically high levels of public debt and new large expenditures in the current rising rate environment could lead to a loss of macroeconomic sustainability.

5. Taken together, all of these circumstances mean that global climate policy is likely to be characterised by a low degree of orderliness in the near future. On top of that, the precise impact of imposing high carbon taxes (especially above US$90 per ton of CO_2) to actual emissions is currently difficult to calculate due to uncertainties associated with the economic and practical characteristics of new technologies (for example, carbon capture and storage technologies or advanced nuclear power generation technologies) (World Bank Group, 2021) . The disordered and unsynchronised trajectory of a carbon tax across countries will be reflected in the cost of energy commodities, causing, similar to a standard supply shock in the resource market, increased and volatile and likely prolonged **inflationary** pressures (Pisani-Ferry, 2021; Boneva et al., 2021; Mongelli et al., 2022). In addition, the introduction of new technologies will be accompanied by changes in relative prices. Volatile inflation, a marked change in relative prices, the need to pay an additional tax and the expectation of a tax increase can lead to an increase in **inflation expectations** and the formation of their secondary effects, up to and including the loss of target anchoring (McKibbin and Panton, 2017). That said, if the final price of carbon is formed in an auction, the disorderliness of climate policy can only increase price volatility. As the EU experience shows, even in the test conditions of past periods, the carbon price determined as a result of the auction was rather unstable (it fell from US$30 in 2008 to US$10 in 2012 and rose again to US$20 in 2018) (Andersson et al., 2020).

In the long run, switching to renewable energy sources can reduce the problem of inflation volatility due to fluctuations in energy prices. The main factor is the different cost structure of renewable and fossil energy sources. Fossil energy sources, which are limited in volume, require moderate capital expenditures during the development phase and ongoing operating and capital expenditures thereafter to maintain production levels. Renewable energy, in contrast, involves much higher capital costs during the development phase, but the marginal costs of subsequent production are very low – many energy sources (solar, wind, water) are themselves available at zero cost (Ciccarelli and Fulvia, 2021). Future energy prices based on renewable technologies may therefore be more predictable than those of fossil sources at present – especially if technologies emerge that do not involve the use of rare earth and precious metals in equipment, the supply of which is also limited. Adaptation of infrastructure, giving more opportunities to switch between different energy sources, will also contribute to more predictable prices. However, the current level of technological development suggests that the transition process may take several decades before it is finally stabilised.

Transition risks, associated with disordered climate policy, can lead to lower **output** in the short term due to a shock from a rising carbon tax, as well as the need to divest a number of assets, disruptions in resource supply, and temporary loss of efficiency in adjusting to new technology solutions (NGFS, 2019; ECB, 2021). In addition, sectoral reallocation of capital and labor for the transition to a low-carbon economy takes time, so the growth rate of output – both actual and potential – may be reduced during this period. At the same time, transition effects can

be offset to some extent by climate policy itself, if carbon tax revenues are channeled back into the economy (for consumer support or investment) (IMF, 2022).

The impact of the transitional risk associated with disordered climate policy on the **neutral rate** is difficult to determine unambiguously. Reductions in capital productivity, which may arise from the complexities of switching production processes to new energy sources, may cause a reduction in the neutral rate. In addition, if climate policy uncertainty is high, private investment will remain subdued, also due to uncertainty in the key parameters required to calculate acceptable project returns. Meanwhile, assets with high carbon footprints will be phased out. Taken together, this could lead to a reduction in the neutral rate (Noran et al., 2021). At the same time, in practice, investments in green technologies are growing. For example, venture capital investments in decarbonisation projects increased from US$418 million in 2013 to US$87.5 trillion for the period July 2020 – July 2021. Continued strong investment growth will be upwardly biased toward the neutral rate. In addition, public investment, which will play a meaningful role in the transition to a low-carbon economy, may contribute to the neutral rate – both by increasing potential output due to the synergistic effect of "green" investment on the innovativeness of the economy, and possibly through a higher level of structural fiscal deficit. Another factor that has an upward impact on the neutral rate and is characteristic of countries most exposed to transition risks (such as Russia) is the growth of the country risk premium amid the disorderliness of the global energy transition (Mongelli et al., 2022).

6. Climate policy in Russia today is largely determined by the Low GHG Economic Development Strategy until 2050. The strategy aims to achieve a carbon neutral economy no later than 2060. At the same time for the Russian economy the manifestation of effects comparable to the emergence of transition risks actually began in 2022 , with the introduction of sanctions restrictions on Russian oil and oil products, gas, coal. Going forward, the transitional risks associated with the continued **decline in global demand for** goods with high carbon footprints will intensify. More pronounced will be those risks associated with **stricter requirements of trading partners** for reporting on the carbon footprint of products and the need to reduce it. This will primarily affect the production of thermal coal, the oil and gas sector, non-ferrous and ferrous metallurgy, and the chemical industry. In addition, the **introduction of a cross-border carbon payment** in trading partners – primarily in Asia – is likely on the horizon for late 2020 and early 2030 (Банк России, 2022). This may require a commensurate **introduction of a domestic carbon tax**, including to offset it against cross-border payments. Burov et al., 2023 show that, depending on the intensity of the energy transition and foreign climate policy measures, the value of the domestic tax can range from US$20 to US$50 per ton of CO_2 by 2030. Output level losses by 2030 could reach between 3% and almost 5% compared to the baseline scenario. At the same time, distancing oneself from the international climate agenda will lead to the accumulation of technological backlogs (including against the background of restrictions on imports of high-tech equipment), which may lead to an increase in the costs of energy efficiency projects.

7. Both physical and transient climate risks shape risks to financial stability, which may reduce the effectiveness of the **transmission mechanism of** the monetary policy (Boneva et al., 2021; Schnabel, 2022). Natural disasters, in addition to physical damage to capital, lead to lower revenues for firms and their employees, which in turn can translate into loan defaults, higher insurance claims and lower asset values in the financial and real estate markets, reducing the sensitivity of the credit and asset channel (Boustan et al., 2019; Bank of England, 2015). If extreme events in a region occur markedly more frequently than the historical average, insurance companies and banks may take into account customer characteristics related to physical climate risks more than they do now when pricing financial products. As a result, the efficiency of the interest channel will decrease. In the case of transitional risks, the abrupt introduction of climate policies could cause the financial system to experience a rapid revaluation of carbon-intensive assets, with a significant impact on the wealth channel (ECB, 2021).

8. Climate change and decarbonisation measures will lead to an increasing frequency of both demand and supply shocks occurring simultaneously, and it will be more difficult to separate them from each other. This intertwining of shocks complicates the estimation of the output gap, one of the key parameters in monetary policy

decisions, and exacerbates the problem of choosing between inflation stabilisation and output stabilisation (Schnabel, 2022). In addition, more frequent shocks to commodity markets may make it more difficult to forecast inflation. The bounds of uncertainty about the most appropriate response of the monetary policy to the situation in the economy may become increasingly wide. Studies have noted that **inflation targeting** remains the most appropriate monetary policy **regime** under climate change conditions, but the role of communication increases significantly – especially in periods when the central bank does not respond to inflation shocks associated with climate change or transition policies (Boneva et al., 2020).

DEMOGRAPHIC CHANGES

One of the most notable demographic processes of the early 21st century is the aging of the population. This process affects most major countries. In many countries, the growing proportion of older adults is also accompanied by depopulation. Demographic processes in Russia combine both population decline and aging. This will primarily affect the size and productivity of the labor force and may lead to a reduction in potential output.

Demographic changes occur on both the demand and supply sides, so it is problematic to draw a clear conclusion regarding the impact of demographics on inflation. The main difference in research on this topic is in the perceptions of older adults' consumer behaviour. The assumption of lower consumption in older age cohorts is associated with deflationary pressures in the economy. The assumption that the population is more inclined to save during active working life, while after its completion it is more inclined to spend, is associated with pro-inflationary pressure. In addition, both a shrinking labor force and increased government spending on Social Security and pensions caused by an aging population can lead to increased pro-inflationary pressures.

The contribution of demographic trends to the level of the neutral rate is probably negative. The main reason is that rising life expectancy encourages more saving and the overall savings rate in the economy rises. At the same time, a decline in population leads to lower returns to capital and a fall in demand for investment, which together lead to a reduction in the neutral rate. Imperfect financial markets and the presence of the financial cycle may put some upward pressure on the neutral rate. However, this does not reverse the underlying trend – its decline as the proportion of older age cohorts increases.

Against the backdrop of an aging population, the impact of the monetary policy transmission mechanism on aggregate demand may decline somewhat. Seniors use little credit, are less interested in buying homes, durable goods, and risky assets. However, the inflation targeting regime remains optimal for such an economy as well.

1. The world's population is continuously growing, with the proportion of older adults increasing over time. The number of people over 65 surpassed the number of under 5s back in 2018. According to the UN population projection (UN, 2022), by 2050 the number of people over 65 will be twice as high as the number of children under 5. However, individual country dynamics are different – for example, in a number of countries in Africa, Asia and Latin America, the proportion of the population of younger ages will prevail for a long time to come.

In most G20 countries, including Russia, a gradual **increase in the share of older ages has been observed since the end of the 20th century**. The two main factors driving this dynamic are increasing life expectancy and declining birth rates. In addition, where, as in Russia, there is no steady migration growth, incomplete replacement of generations leads to an overall population decline. Thus, according to the UN medium variant forecast (UN, 2022), Russia's population will decrease from 146.2 million in 2021 to 139.2 million in 2035 and is likely to decline thereafter. At the same time, the proportion of people aged over 65 will rise from 16% in 2021 to 20% in 2035, and could reach 28% by 2100 (UN, 2022). At the same time, the labor force will decline and its average age will increase. The increase in the retirement age and, consequently, in the level of economic activity in older age groups, although it has somewhat smoothed out the process of labor force decline in Russia, has simultaneously increased the age of the labor force. According to the HSE forecast , 2022, the labor force by 2030 will be about 2 million fewer people than in 2021. At the same time, the share of ages under 40 in the labor force will decline from 42.0% in 2019 to 37.4% in 2030. By the mid-2030s, the situation will improve slightly due to the entry into working age of numerous generations born during the 2007-2015 fertility boom. However, the trend towards a declining labor force and its aging will continue.

2. Compared to other processes, the rate of demographic change is relatively slow – noticeable differences can be recorded only when comparing time series over several years. Nevertheless, they still affect the structural relationships that determine the dynamics of the main macroeconomic variables.

There is a broad consensus among researchers to estimate the impact of demographic factors on **potential output**. First, the labor force reduction itself reduces the economy's capacity. Second, an increase in the share of older ages in the labor force is usually associated with a deterioration in labor productivity. And this effect is

stronger the faster the rate of growth of technological progress. The more powerful the technological advances, the more the positive effects of the accumulated experience of older cohorts overlap with the negative effects of less receptivity to new, more productive methods of performing work tasks. Thus, in the absence of an equally large-scale introduction of compensating technologies (automation, robotisation), a **shrinking labor force and reduced productivity leads to a reduction in potential output in the economy** (IMF, 2019; Bodnár and Nerlich, 2022). According to the Bank of Russia's estimates in the Guidelines for the Single State Monetary Policy 2022-2024, the cumulative impact of demographic trends may take about 0.2-0.5 percentage points away from the growth rate of potential output of the Russian economy.

3. The assessment of the impact of demographic factors on **inflation** is less unambiguous. One reason is that demographic changes manifest themselves on both the demand and supply sides, with effects often intertwined through various indirect channels and the impact of other shocks (e.g., financial markets, regulatory environment), so it is **problematic to formulate a general theoretical model of the impact of demography on inflation**.

Empirical studies, mostly conducted on data from the Japanese economy, show that population aging coupled with population decline leads to the prevalence of **deflationary trends** in the economy. Researchers cite a reduction in aggregate demand due to changing societal preferences as the main channel of influence. **Seniors are consuming less overall**, especially durable goods. If supply does not adjust to the decline in aggregate demand, the economy will experience deflationary pressures (Imam, 2013; Anderson et al., 2014; Yoon et al., 2018). Researchers Bullard et al, 2012 add that older ages may be less tolerant of high inflation due to its redistributive effects, and may reduce consumption in response to rising prices, so the prevalence of older age cohorts may lead to the formation of deflationary pressures in the economy.

At the same time, a number of papers show that population aging can be **pro-inflationary**. The consumer behaviour of older adults is explained through the "life cycle" theory. The basic idea is that a person makes savings during the period of active labor activity and spends them after its completion. Having fewer children and increasing life expectancy only increases savings behaviour in "middle" age. Therefore, the propensity to consume may be higher at older ages and hence the effect of population aging is pro-inflationary (Berg et al., 2019; Yoon et al., 2018; Attanasio, Weber, 2010; IMF, 2019). This conclusion is complemented by economists Juselius, Takáts, 2015, who conclude that there is a U-shaped relationship between inflation and demography based on an empirical study of 22 countries using data from 1955-2010. A larger share of the young (under 19) and the elderly (over 65) in the economy is associated with higher inflationary pressures – these categories consume more than they produce. Accordingly, the working-age population, in contrast, produces more than it consumes, and its prevailing share correlates with lower inflation. Thus, an aging population will contribute to pro-inflationary pressures. The authors also note that **inflation expectations** are characterised by a similar **U-shaped relationship with the age of the prevailing cohort in the economy**.

Other channels unrelated to consumer preferences at different ages suggest a likely pro-inflationary impact of demographic change. One of the most obvious is the labor market. Reduced labor supply in a wide range of industries with rising demand for labor in services will lead to increased inflationary wage pressures (Yoon, 2018; Banksa, Munkasci, 2019). In addition, demographic changes put pressure on the fiscal system through increased spending on pensions, social support programs, and health care, which in turn can shake fiscal sustainability and add pro-inflationary effects on the economy (IMF, 2019; Bodnár, Nerlich, 2022).

Taken together, the different channels of influence of demographic change may lead to increased inflation volatility as the population ages (Banksa, Munkasci, 2019).

4. The impact of demographic factors on the **neutral rate** can be examined through two approaches.

According to the **traditional approach** based on the analysis of the dynamics of real variables, demographic changes affect the long-run neutral rate through the balance between savings and investment. Rising life expectancy induces more saving, while a declining population, assuming a constant aggregate amount of real capital, increases the amount of real capital per worker, which, with diminishing marginal returns, leads to a lower equilibrium real rate (Carvalho et al., 2016). The decline in available labor resources due to the aging of the

population in addition leads to a lower demand for investment by firms. It also reduces the marginal return to capital and the equilibrium real rate (Papetti, 2021; Grishchenko et al., 2022).

According to the **macro-financial approach**, when estimating the neutral rate, one should take into account not only real sector factors measured in natural units (such as the dynamics of savings and investment or, more broadly, wealth and capital in real terms), but also the impact of the dynamics of nominal (financial) variables (such as nominal interest rates, the volume of credit and investment in nominal terms, and the monetary policy regimes). The macro-financial approach assumes that **financial markets are imperfect**. In other words, they have inherent risk premiums, a maturity mismatch between assets and liabilities ("long" liabilities may be less than "long" assets), unbalanced capital flows (and thus may have external debts). Taken together, all of this could put upward pressure on the neutral rate. The equilibrium rate in such an economy will be higher than in the same economy under the traditional approach, which assumes that financial markets are perfect. At the same time, while researchers within the macro-financial approach point out that the traditional approach may overestimate the extent to which real neutral rates have declined, they nevertheless agree with the **general thrust of the estimates – an aging population leads to a decline in the neutral rate** (Juselius et al., 2017; Grishchenko et al., 2022).

According to the estimates of the Bank of Russia (Kreptsev et al., 2016), an increase in the value of future consumption (i.e. an increase in savings in response to expectations of longer life expectancy) leads to a decrease in the equilibrium rate for Rossi by almost 1 percentage point.

5. Demographic factors can influence the **effectiveness of the monetary policy transmission mechanism**. Most researchers analyze this issue through the structure of assets held by households at different life stages and through differences in credit behaviour.

Some researchers (Wong, 2018; Imam, 2013) have argued that less credit in the older generation may reduce the effectiveness of the interest rate channel of the monetary policy transmission mechanism – aggregate demand becomes less sensitive to rate changes. Since the older generation usually owns assets, they may respond through another channel, the **wealth channel** (Imam, 2013). For example, for households owning real estate and stocks, a decrease in the interest rate would also be a meaningful signal because it increases the value of their assets (Berg et al., 2019). However, if the predominant assets of the older generation are built up in deposits, lower rates reduce the amount of their wealth and this may have a dampening effect on consumption (Price, 2014).

Another channel related to asset structure is the **"risk-taking" channel**. Older ages tend to be less risk averse and more focused on stable income, so their asset structure is less risky compared to younger ages. For example, it may be dominated by deposits and real estate, while the amount invested in equities may be negligible. At the same time, the monetary policy transmission implies portfolio rebalancing by economic agents – in particular, in the case of falling rates, an increase in the share of risky assets such as equities and corporate bonds. This allows more companies to obtain financing for expansion. However, seniors are risk-averse because their time horizon is limited and the ability to recoup losses may not be there, so they don't add risky assets to their portfolio. As a result, the monetary policy is less effective (Price, 2014; Nakajima, 2020).

In addition to channels related to asset structure, researchers also look at the **labor and employment market channel**. The formation of large labor shortages caused by demographic trends can lead to a decrease in the elasticity of the labor market. As a consequence, it may respond more weakly to fluctuations in economic activity and prices may respond more weakly to the monetary policy (Isa, 2021). In addition, (Leahy and Thapar, 2019) on US data show that monetary policy is most effective when the demographic structure is dominated by the 40-65 age cohorts. The authors attribute this to the fact that middle-aged people are the ones with the most entrepreneurs, so they respond to the monetary policy not only with personal spending, but also by launching or expanding business activities, which affects other cohorts as well. However, the researchers also add that the prevalence of age cohorts older than 65 years of age does not significantly affect the effectiveness of monetary policy.

Thus, most studies point to the possible loss of effectiveness of monetary policy transmission mechanism associated with demographic processes. The lower sensitivity of older ages to changes in the interest rate may mean that a sharper change in the monetary policy is needed to bring inflation back to target, implying greater interest rate volatility. If deflationary pressures prevail in the economy, a decline in the real interest rate increases

the probability of hitting and the frequency of nominal rates hitting the zero bound (IMF, 2019; Bielecki et al., 2018). At the same time, researchers (Banksa D., Munkasci Z., 2019) argue that, despite the possible reduced impact of monetary policy transmission mechanism on aggregate demand, an inflation targeting regime **is generally optimal for an economy with a high proportion of seniors**.

INEQUALITY ISSUE

Inequality in one form or another can be found in all countries of the world. It is a multidimensional phenomenon that includes inequality of income, consumption, assets and opportunities. It is determined by the accumulated effect of various factors over a long period of time. In Russia, inequality has been declining over the past few years.

Monetary policy aiming at maintaining low and stable inflation indirectly contributes to the reduction of inequality. Low-income households have most of their funds in the form of cash or current accounts that are not hedged against inflation. When inflation is high and volatile, the purchasing power of cash is significantly reduced. In the event of an economic downturn, low-income groups are the first to suffer because, often having the lowest qualifications, they are the first to be made redundant. Monetary policy that aims to return the economy to potential allows the incomes of these groups to rise faster, thus preventing inequality from worsening.

Inequality can affect the efficiency of transmission of monetary policy decisions. The wealthier segments of the population change consumption only slightly in response to changes in monetary policy rates, so if inequality is large, the central bank's task of smoothing cyclical fluctuations becomes more difficult. It has to change rates more sharply when needed to stimulate or cool the economy. This can lead to output volatility and make it difficult to achieve the inflation target. Studies on the Russian economy show that the current level of inequality in the country does not affect the operation of the interest rate channel of the monetary policy transmission mechanism, it demonstrates high efficiency. At the same time, the inflation targeting regime is one of the most effective monetary policy regimes in the presence of economic inequality.

1. Economic inequality is a problem faced by most of the world's major economies, although the degree of inequality varies. According to various metrics, in Russia inequality grew in 1990-2000, then stabilised, and in the last 5-7 years it has even slightly decreased. According to the Gini coefficient, the current level of inequality in Russia, although higher than in most developed countries, is still below the level of many comparable emerging market countries.

In general, economic inequality is a multidimensional phenomenon that includes inequality of income, consumption, assets and opportunities. It is believed to be a **consequence of long-term structural factors**, and the most appropriate tools to combat it are social support and various institutional policies (increasing access to education, establishing labor market support mechanisms, removing barriers to internal migration, financial literacy programs, etc.) (Pereira de Silva et al., 2022; Dossche et al., 2021). Studies show that **inequality has a negative** and statistically significant **impact on economic growth** by limiting human capital development (OECD, 2014; Easterly, 2007; Mo, 2000; Lin and Yeh, 2009). In the Russian data, the negative relationship between inequality and output has also been confirmed (Tumanyants et al., 2023).

Recently, central banks have increasingly turned their attention to the problem of inequality. First, as bodies of public policy, they cannot remain aloof from discussions about a socially just society. The researched question in this regard is whether monetary policy can affect inequality. Second, the presence of inequality calls into question the accuracy of many macroeconomic models, which are based on the concept of a representative agent that reflects the entire society in a single person. In this regard, central banks are increasingly thinking about the necessity and expediency of taking into account the heterogeneity of economic agents in forecasting and modeling, the emergence of distributional effects due to the decisions taken on the monetary policy.

2. Different types of inequality are not always correlated and respond differently to shocks to the economy and measures of monetary policy, so researchers have not yet reached a consensus on the direct impact of monetary policy on inequality. At the same time, many agree with the conclusion that, **indirectly, the monetary policy does contribute to its reduction**.

First, the main task of a modern central bank is to keep inflation stable and low. **Low-income households have most of their funds in the form of cash or current accounts that are not hedged against inflation** (Coibion et al., 2017). When inflation is high and volatile, the purchasing power of cash is significantly reduced.

In addition, the incomes of the least well-off groups of the population are fixed in nominal terms. In case of high inflation, both wages and social transfers are indexed only partially and with a lag. As a result, higher inflation leads to lower real incomes for the most vulnerable groups and inequality increases (Erosa and Ventura, 2002). Finally, low-income groups tend to consume the minimum required set of goods, consisting mainly of foodstuffs. These are often the items that rise in price faster than others, and cheaper counterparts simply may not be available. It also leads to increased inequality (Binder, 2019). Thus, **maintaining low and stable inflation makes expenditures of low-income groups more predictable, allows budget planning, creates conditions for the formation of savings and limits the growth of inequality.** Empirical research confirms it: when countries with high inflation were able to control it and bring it down to 5% or lower, inequality declined (Carstens, 2021). Russian data also reveal that higher inflation rate leads to an increase in the Gini coefficient, which characterizes the growth of inequality, and vice versa (Arzhenovsky, 2023).

Second, the monetary policy is designed to smooth short-term cycles, which includes stimulative policies during recessions. On the one hand, the easing of the monetary policy contributes to the growth of the value of financial assets, which are mainly held by the most affluent groups of the population. But the formal increase in inequality in this case does not equal the actual increase in inequality: the value of financial assets is largely an "accounting" unit, and its increase does not necessarily lead to a comparable increase in the cash flow and consumption of their owner (Honohan, 2019). Studies show that only a small fraction of asset appreciation gains are allocated to consumption in the short run (Aladangady, 2017; Di Maggio et al., 2020a; Andersen et al., 2021). Moreover, if the assets of a wealthy household are represented by deposits rather than financial assets, there will be a reduction in wealth due to lower interest income when policy is relaxed.

On the other hand, **during recessions, the population with the lowest incomes suffers the most.** It is this category that has the lowest qualifications, demand for which is highly elastic, so their jobs are usually the first to be cut. In addition, the informal earning opportunities that low-income households typically use to compensate for temporary shortfalls in basic labor income are reduced. In these circumstances, a **monetary policy aimed at economic recovery allows the incomes of these groups to rise faster, thus preventing inequality from worsening**. In addition, with the easing of the monetary policy, low-income groups are able to reduce their credit burden by refinancing earlier loans, which also contributes to reducing inequality.

Actions aimed at maintaining financial stability have a similar effect. Financial factors amplify business cycle fluctuations. While high-income groups lose some of their assets in the event of a financial crisis, the main effect is felt by low-income groups who find themselves without jobs and other income. **Maintaining financial stability prevents the most vulnerable groups from deteriorating** (Carstens, 2021).

Thus, although the effect of the easing of the monetary policy on inequality turns out to be twofold, the effect of supporting jobs and wages of low-income groups during recessions turns out to prevail over the effect of increasing the value of financial assets in high-income groups, and this reduces inequality (Coibon et al., 2017; Ampudia et al., 2018; Amberg et al., 2021). At the same time, the impact of tightening the monetary policy on job losses of low-income groups in an overheated economy is somewhat smaller than on the decline in the value of financial assets of high-income groups. Therefore, in some cases, the resulting effect of a tighter monetary policy is a reduction in inequality. In particular, Russian data revealed that a 1 pp increase in the key rate in the current quarter is associated with a 0.7-1.2% reduction in income inequality a year later, with the effect being stronger in regions with higher average per capita incomes (Nelyubina, 2022). This implicitly suggests that financial assets, typically held by wealthier households, depreciate as the rate rises.

3. **The presence of economic agents with different income and asset profiles can affect the efficiency of monetary policy transmission** (Kaplan et al, 2018). The main factor is the difference in the marginal propensity to consume (Auclert, 2019; Tobin, 1982). The behaviour of economic agents may differ from the representation of the representative agent's behaviour, and the calibration of the monetary policy will deviate from the optimal calibration required in the actual economic situation.

For example, low-income groups typically lack financial assets and generally lack access to the financial market. They may also lack the ability to smooth consumption through borrowing if there are insufficient assets and income to support a loan application (Campbell and Mankiw, 1989). In addition, there may be limited

opportunities to accumulate "precautionary" savings to support expenses in the event of job loss (Gorneman et al., 2016). As a consequence, low-income groups are often in a "constant-liquidity-constrained" environment. The less income and wealth, the greater the liquidity constraint. This leads such households to expand consumption much more actively than the concept of a representative agent with unrestricted access to the financial market would suggest from the concept of a representative agent with unrestricted access to the financial market, while labor income increases in the face of a lower monetary policy rate (Auclert, 2019; Coibon et al., 2017).

High-income groups tend to have relatively high consumption and little need to increase it; as a consequence, they respond minimally to interest rates (O'Farrell et al., 2016). Meanwhile, a highly unequal society is usually characterised by the concentration of wealth in a small group of high-income people. In other words, aggregate consumption in such a society depends on the behaviour of high-income groups. The **neutral rate** in this case also **tends to fall** due to the increase in savings in the economy (Mian et al., 2021). As a consequence, it becomes more difficult for the central bank to stimulate the economy during recessions, the recession itself lasts longer, and this in turn increases inequality. When there is a need to cool the economy and tighten policy, the central bank is forced to do so to a greater extent than would be expected under the concept of a representative agent (Pereira da Silva et al., 2022). Moreover, the specificity of consumption of low-income groups can only increase the inefficiency of the monetary policy transmission mechanism. The consumption bundle of such households usually contains a large share of basic necessities, and this consumption is usually not transferable to the future (Andreolli and Surico, 2021). In addition, the growth of rates may cause an increase in mandatory payments (e.g. mortgage, rent, communication and housing and utilities tariffs). As a result, the consumption of low-income groups is not reduced in case of a rate increase and their economic situation worsens, leading to increased inequality (Chetty, Szeidl, 2007). Thus, **when inequality is high, the central bank's task of smoothing the cyclical fluctuations of the economy becomes more difficult, which can lead to output volatility and make it more difficult to achieve the inflation target**.

Empirical studies show that the current level of inequality in Russia does not affect the performance of the **interest rate channel of monetary policy transmission mechanism**, **which demonstrates high efficiency**. In particular, Tumanyants, 2023 found that when real interest rates fall, the share of consumption in household income increases. At the same time, the elasticity of the share of consumed income by interest rates is somewhat higher for wealthier households than for less wealthy households. The dynamics of loans (and deposits) of individuals is consistently positively (or negatively) related to the share of consumption in households' income. Tumanyants, 2022 determined that an increase in the nominal deposit rate reduces the willingness to make large purchases across the spectrum of the income distribution scale. This once again confirms the effective operation of the interest rate channel of the monetary policy in Russia.

4. Given the unambiguous impact on inflation, the **inflation targeting** regime is one of the **most effective monetary policy regimes in the presence of economic inequality**. At the same time, some studies note that taking into account the heterogeneity of economic agents can improve its performance. Hansen et al, 2020 suggests using a modified Taylor rule to account for differences in consumption behaviour of households with different incomes. Specifically, under this proposal, when the economy accelerates, the rate increase should be lower than assumed under the standard rule, which focuses only on the output gap and inflation. A lower rate cools the economy less, which supports the wages of low-income groups. In addition to reducing inequality, such policies achieve the inflation target more effectively and minimize output losses because there is no excessive restraint on the economy. As a result, the increase in aggregate welfare is higher than when using the standard Taylor rule. However, in practice, using models with different household preferences can be difficult - debugging the models requires granular data over a long period, and these are not always available.

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