



NATIONAL UNIVERSITY OF
KYIV-MOHYLA ACADEMY

**Financial Policy of Ukraine
for the Maintenance
of Macroeconomic Stability**
The Collective Monograph





НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
«КИЄВО-МОГИЛЯНСЬКА АКАДЕМІЯ»

Financial Policy of Ukraine for the Maintenance of Macroeconomic Stability

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The development of theoretical and methodological foundations in the field of state financial policy has been the subject of numerous works by both domestic and foreign scholars. Despite this, in contemporary conditions, the issues of state regulation require further resolution. The relevance of this research is strengthened by the complex socio-economic situation arising in Ukraine since the onset of a full-scale invasion, the growth of external and internal risks, social and financial instability, the increasing outflow of skilled labor, and the economic decline, significantly limiting the application of classic macroeconomic regulation tools.

The significance and complexity of these problems, both in theoretical and practical aspects, underline the importance and value of research in this direction, which should make a substantial scientific and practical contribution to enhancing the effectiveness of management decisions to ensure the macroeconomic stability of the state. Accordingly, the research aims to develop theoretical and methodological provision and contemporary economic-mathematical tools to form a financial policy strategy, which has the goal to ensure economic stability, to increase the competitiveness of the national economy, and restore economic growth in Ukraine.

For students of economic specialties, graduate students, teachers, civil servants, specialists and everyone who seeks to master the theoretical and practical aspects of building dynamic macroeconomic and simulation models for the formation of medium-term and long-term economic policy of the state, aimed at achieving macroeconomic stability even under unpredictable conditions of rapid development of external and internal crisis phenomena.

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INTRODUCTION

The financial policy of a state is a key tool for economic governance, which has the aim to supervise the economic processes and support of sustainable economic growth. However, macroeconomic instability presents significant obstacles to the effective implementation of financial policy, influencing its development, execution, and results. For instance, high inflation adversely impacts the efficiency of monetary tools, making control over the money supply and interest rates more complicated. Current reductions in state revenue and increase in budget deficits limit the ability to fund economic programs. Moreover, high levels of volatility heighten risks for investors, leading to decreased investments and complicating the execution of long-term financial strategies.

The current state of the Ukrainian economy exemplifies the realization of these risks, characterized by significant socio-economic disparities and the destruction of traditional economic links. In these conditions, financial policy must be sufficiently flexible to quickly adapt to changes in the economic environment, and needs constant review and adjustment of strategies and approaches. An essential tool in this process is the application of economic-mathematical modeling, providing thorough analysis, the ability to simulate complex financial-economic processes, and forecasting a wide array of macroeconomic indicators to justify adequate financial policy for achieving macroeconomic stabilization and recovery in Ukraine.

The development of theoretical and methodological foundations in the field of state financial policy has been the subject of numerous works by both domestic and foreign scholars. Despite this, in contemporary conditions, the issues of state regulation require further resolution. The relevance of this research is underscored and intensified by the complex socio-economic situation arising in Ukraine since the onset of a full-scale invasion. This situation is characterized by increased external and internal risks, social and financial instability, the increasing outflow of skilled labor, and the slowdown in economic growth rates, significantly limiting the application of classic macroeconomic regulation tools.

The significance and complexity of these problems, both in theoretical and practical aspects, underline the importance and value of research in this direction, which should make a substantial scientific-practical contribution to enhancing the effectiveness of management decisions to ensure the macroeconomic stability of the state. Accordingly, the research aims to develop theoretical and methodological provision and contemporary economic-mathematical tools to form a financial policy strategy aimed to provide financial stability, to raise the competitiveness of the national economy, and restore economic growth in Ukraine.

Achieving the aim of the research requires addressing the following tasks:

- Analyze the theoretical aspects of conducting monetary policy in Ukraine and other countries during and after war periods.
- Summarize existing approaches to defining macroeconomic instability, its main factors, and consequences.
- Determine the role of state regulation in forming policies for sustainable economic growth.
- Develop a system of original econometric and system-dynamic models for systemic analysis of processes in the financial sphere.
- Investigate the peculiarities of using monetary and fiscal policy tools in contemporary conditions.
- Develop recommendations for financial policy measures aimed at stabilizing the economic situation in Ukraine and ensuring further economic growth.

The research object encompasses fiscal and monetary processes under the influence of undermining factors and the mechanisms for achieving macroeconomic stabilization. The research subject involves theoretical-methodological principles and the mathematical modeling toolkit for examining the impact of coordinated fiscal and monetary policies on the macroeconomic stability of the state and ensuring its sustainable economic development.

The structure of the work reflects a comprehensive approach to analyzing Ukraine's financial policy and all of its components and directions, considering both theoretical considerations and practical challenges that the country faces during and after the military invasion. The study's theoretical outcomes, along with the

macroeconomic models developed based on them, can dynamically reproduce interrelations among elements and subsystems of the Ukrainian financial system. These models adequately describe the system's behaviour even when facing significant internal and external disturbances. This contributes to the advancement of new scientific knowledge. This knowledge aligns with the best Western analogs and can serve as a foundation for justifying and forming state policies to stabilize and reform the Ukrainian economy. The theoretical and empirical results of the research can be utilized to confirm or refute hypotheses, particularly regarding the presence of specific effects in the Ukrainian economy that are characteristics of well-known economic theories. This simplification facilitates further exploration and substantiation of effective tools for state regulation. This work utilizes a new and promising scientific-practical approach seen in global practice, which involves applying system dynamics methods to construct macro models of economic systems in transitional economies. This approach has enabled the adequate description of nonlinear stochastic interrelations among elements and subsystems of complex systems with ambiguously defined structures dynamically, exemplified by the Ukrainian economic system. It also facilitates the assessment of the impact of destabilizing factors, which can provoke both a change in the overall system structure and alterations in the structure of individual subsystems.

Furthermore, these results can be applied to address other strategically important theoretical and practical problems, including the assessment of the macroeconomic and financial stability of the Ukrainian economy, evaluation of the effectiveness of monetary tools, identification of mechanisms for managing the state debt, development of a resilient currency policy, assessment of the budget deficit and defining of budget-balancing strategies aimed at the support of macroeconomic stability in the country.

CHAPTER 1. SYSTEMATIC ANALYSIS OF STATE REGULATION EFFECTS ON MONETARY, FISCAL, AND SOCIO-ECONOMIC SECTORS

1.1. The implementation of financial policy as an instrument of state regulation

In the current stage, under martial law conditions, achieving sustainable economic development is unfeasible without comprehensive economic regulation and an effective state financial policy. Precisely, effective state regulation of the economy, its targeted impact in the economic management sphere with the objective of directing economic processes in line with the goals, tasks, and interests of the country, is a key factor in macroeconomic shifts needed by the country. The concept of "state economic regulation" should take into account the unstable state of the country's modern economy, its dynamism, instability, and align with the changing directions, aims, and objectives of the state's economic policy. Hence, this mechanism must be unique, adapted to any changes in directions, goals, and objectives of the state's economic policy [1, p. 2].

The primary forms of state regulation of socio-economic processes include macroeconomic planning and forecasting, state ordering, and programming [2, p. 38]. These tools play a crucial role in defining the strategic direction of economic development, helping the government adapt to global changes and challenges. Macroeconomic planning and forecasting allow governments to effectively allocate resources, anticipating economic cycles and changes. This includes analyzing factors such as GDP, inflation, unemployment, and trade balance. Effective planning helps prevent economic crises and promotes stability. State governing, as a regulatory tool, plays an important role in stimulating economic activity. Through state contracts, governments can influence the development of certain industries, fostering innovation and job creation. Programming is another significant form, involving the development of comprehensive development plans for certain economic sectors or regions. It allows governments to target economic development, promoting the balanced development of different territories and sectors.

The mechanism of state economic regulation is based on a totality of interconnected financial-economic tools, forms and methods of influence on the process of increase of the productive forces of society, considering the goals and interests of economic relation subjects. Depending on development priorities, the objects of state regulation include the economic cycle, the structure of the national economy, balance of payments, labor market, monetary circulation, foreign economic activity, etc. [2, p. 38]. State influence on economic processes is realized through financial policy, developed and implemented by the central bank, government, the ministry of finance, financial market regulators, and budget and finance committees. State financial policy, as a component of the state's economic policy, comprises predetermined and approved measures, forms, and methods of mobilizing, distributing, and utilizing financial resources by state institutions to fulfill the state's functions in line with the strategic and tactical goals of its economic and social development. This system combines financial relations, materialized in the form of national plans and programs, managerial decisions arising in the process of formulating and implementing a strategy for the functioning and development of state finances.

Financial policy is one of the most critical tools of state regulation, playing a key role in determining the direction of economic development and stability of the country. This policy includes a broad range of measures concerning the tax system, government spending, management of public debt, as well as currency and credit policy. The methods used within financial policy can be classified as administrative, market-based, or mixed, each with its features and areas of application.

Administrative methods include direct regulation and control by the state of financial flows and markets. This can involve setting tax rates, defining budgetary priorities, regulating the banking system's activities, and introducing or revoking financial sanctions and restrictions. Administrative methods are often used to stabilize the economy, combat inflation, and stimulate economic growth.

Market-based methods rely on the use of free-market mechanisms to regulate finances. This can include tools such as interest rates, regulated by central banks to influence investment and consumption, or the use of exchange rates to impact foreign

trade. Market-based methods play a significant role in shaping financial markets and stimulating the private sector.

Mixed methods combine elements of administrative and market-based approaches. They may include state stimulus programs, tax incentives for specific economic sectors, and the use of state funds for investing in key industries. Mixed methods are used to achieve a balance between stabilizing the economy and stimulating innovation and development.

Depending on the specific economic situation and the government's goals, a combination of these methods can be chosen. Effective combination of different types of regulation allows for a flexible and responsive financial policy that can adapt to changing conditions and challenges facing the economy.

The primary goal of state financial policy is to create and maintain a stable economic environment contributive to growth, development, and social welfare. This policy encompasses a broad spectrum of actions aimed at the efficient management of the country's financial resources. Using financial policy tools, the state makes significant influence on the volume and structure of the gross domestic product, the state of the balance of payments and public finances, the level of employment, inflation, etc.

Key tasks of financial policy can be defined as follows [3, p. 45; 4, p. 31-32]:

- Creating conditions for maximizing the volumes of financial resources formed by the state;
- Implementing mechanisms for rational allocation and use of formed financial resources;
- Ensuring proper regulation, stimulation, and control of economic and social processes using financial methods;
- Formulating, developing, and maintaining the functioning of the financial mechanism based on the goals and strategies of financial policy;
- Establishing an effective system of management of public finances.

In periods of macroeconomic instability and declining economic growth rates, the impact of financial policy on the state's economy intensifies, raising questions about searching for effective methods and tools for distributing financial resources in

the state, satisfying all necessary needs, and simultaneously stimulating business activity. It is crucial to create the financial system based on the interaction of state regulation of economic processes and self-regulation mechanisms, which requires a corresponding institutional system with developed financial institutions. Financial and budgetary activities are an important component of the state's economic strategy, ensuring economic growth with a clear direction. The directions and tools for their provision, management, and regulation are guarantees of financial stability of economic entities, sustainable development of the national economy and the environment, preservation of the united and stable financial system, and overcoming various threats in the economic and environmental spheres, as well as in the sphere of national security and defense [6, p. 128].

The primary goal of state financial policy is to create and maintain a stable economic environment conducive to growth, development, and social welfare. This policy encompasses a broad spectrum of actions aimed at the efficient management of the country's financial resources. Using financial policy tools, the state significantly influences the volume and structure of the gross domestic product, the state of the balance of public finances, the level of employment, inflation, etc. The priority directions of financial policy for the medium-term perspective should be the following:

- Ensuring macroeconomic stability: maintaining price stability, controlling inflation, ensuring a balanced budget, effective management of public debt, and currency policy. Issues of stabilizing the macroeconomic environment are a primary priority in the context of martial law in Ukraine and will be discussed in subsequent sections.
- Social protection of the population: ensuring effective social programs that support vulnerable groups of the population and introducing measures to reduce financial inequality.
- Stimulating economic growth: focusing on policies that encourage investment, innovation, and entrepreneurship, including tax incentives for business and support for research and development.

- Infrastructure development: investing in critical infrastructure, which can include transport, energy, and digital infrastructure, to promote long-term economic growth. In particular, developing public-private partnerships for implementing major infrastructure projects.
- Financial inclusion and digitalization: developing financial services and technologies that provide broader access to financial resources and promote the efficiency of financial operations.
- Ecological sustainability and achieving sustainable development goals: integrating sustainable practices into financial policy, including support for energy efficiency, renewable energy sources, and sustainable investments. Focusing on sustainable economic growth as an important priority of state regulation and support.

Thus, with the effective application of financial policy tools, it can contribute to price stability, create favorable conditions for investment, ensure a high level of employment, and reduce social inequality. At the same time, incorrect or insufficiently thoughtful application of these tools can lead to financial crises, inflation, and economic imbalances. Therefore, balancing different aspects of financial policy is critically important for ensuring macroeconomic stability and economic development.

During wartime, the financial policy of a country often undergoes significant changes to accommodate the extraordinary demands of war. These changes reflect the country's need to mobilize resources, support its military efforts, and maintain stability. In the post-war period, the financial policy is primarily focused on recovery, rebuilding, and transitioning back to a peacetime economy. This period often involves significant challenges and requires carefully chosen policies to promote stability and growth. In this work, the peculiarities of the financial policy of Ukraine during the war and its main priorities in the post-war period were considered.

1.2. Prioritizing macroeconomic stability within Ukraine's financial policy under contemporary conditions

Ensuring financial stability and minimizing vulnerability to external negative influences is a necessary tool for the sustainable development of national economic systems and their sustained growth. Currently, there are significant threats of macroeconomic imbalances due to the presence of convergent and divergent connections in the economic space. Global and internal economic changes, as well as financial market instability, impact aspects such as investment levels, employment, income distribution, and overall economic activity. The study of financial stability becomes increasingly important in the context of the complex socio-economic situation that has arisen in Ukraine since the onset of a full-scale invasion, with the increase of external and internal risks, social and financial instability, the outflow of skilled labor, and the slowing of economic growth, significantly limiting the application of classical tools of macroeconomic regulation. Consequently, the research, development, and implementation of appropriate mechanisms and algorithms to assess the impact of these factors become crucial for timely coordination and synchronization of state policy aimed at achieving macroeconomic stability in the context of intensifying globalization processes. Timely identification of negative trends in the qualitative and quantitative parameters of macroeconomic stability allows a prompt response to internal and external challenges, reducing the high level of uncertainty and negative consequences [6, p. 8].

For Ukraine's economic system, adapting to contemporary economic development conditions and developing mechanisms and tools for recovery from negative impacts is essential. Ensuring the stability of Ukraine's national economy, especially during and post-war periods, requires implementing a well-considered, scientifically-based macroeconomic policy to limit macroeconomic imbalances and achieve long-term economic growth. The formation of necessary proportions and limitations of imbalances ensures the functioning of the national economy as an superior integrity. Combined with acceptable rates of economic growth, such proportions and balances define what should correspond to the term "macroeconomic stability" [7, p. 10].

Based on the generalization of views of domestic and foreign scholars on the essence of the term "macroeconomic stability" of the national economy, the following classification of relevant approaches is proposed [8, p. 7-8; 9]:

1. Approaches defining "macroeconomic stability" as the absence of sharp changes in its components:
 - Dynamic: Macroeconomic stability is the absence of significant fluctuation in the main macroeconomic indicators relative to their average level. Here, the target vector of change in these indicators is not considered, but the level of deviation of actual indicators from the average value.
 - Equilibrium: Macroeconomic stability is the absence of significant volatility in the change of its main components relative to a given trend and the ability of the national economy to maintain this trend. In this case, both the degree of deviation of the indicators and adherence to the target vector of their change are considered.
2. Approaches defining "macroeconomic stability" as the capability of the national economy to maintain shocks and manage its functional capability:
 - Functional: Macroeconomic stability is the capability of the economic system to maintain its institutional-functional stability on a long-term basis without disruptions.
 - Resultant: Macroeconomic stability is the ability of the economy to create GDP and ensure the target level of other macroeconomic indicators over a long period.
 - Resource: Macroeconomic stability is the resource capability of the national economy to meet the growing needs of the subjects of the economic system stably and without disruptions, fulfilling obligations to citizens and domestic and foreign counterparts).
3. Approaches defining "macroeconomic stability" of a country's economic system through the stability of its system-forming elements or main parameters:
 - Structural-equilibrium: Macroeconomic stability is such a state of development of the national economy in which, over a long period, the balance of its system-forming elements is maintained; for example, the

structural ratio between the financial and real sectors of the national economy is not disturbed, and the balance of the main parameters determining the macroeconomic stability of the national economy is achieved.

- **Elemental:** Macroeconomic stability is such a state of development of the national economy in which targeted values of one or two macroeconomic parameters are maintained, chosen as the basic parameters of macroeconomic stability of the national economy (most often, the level of GDP, the rate of inflation, the level of unemployment).

Macroeconomic stability refers to a state where an economy experiences relatively low levels of volatility and uncertainty, characterized by steady growth, moderate inflation, sustainable fiscal policies, and a stable financial system. It is an essential condition for economic well-being and efficient resource allocation in any country. The classification of approaches to understanding the meaning of macroeconomic stability of the national economy conducted by Liulov O. V. provided a theoretical basis for defining this concept. It is proposed to specify it as a state of development of the national economy, which is characterized by a low level of volatility in the change of key macroeconomic parameters relative to the aimed tendency, dynamically stable or increasing institutional, functional, and resource efficiency of the economy to level the negative consequences of endogenous and exogenous transformations. The proposed definition allows for systematically reconciling the basic principles and axioms of equilibrium, functional, resultant, and resource approaches [6, p. 25]. In essence, macroeconomic stability is not about the absence of economic problems but the ability to manage and respond to economic challenges effectively without causing severe disruptions to the economy's overall functioning. It is crucial for fostering a favorable environment for investment, employment, and long-term economic planning.

In the practice of macroeconomic analysis, four sectors are distinguished: the internal real sector, the fiscal sector, the monetary sector, and the external economic sector. This allows for focusing on a specific sphere as a totality of the most interrelated processes, phenomena, and macroeconomic dependencies (Table 1.1).

Table 1.1. Characteristics of macroeconomic sectors

Economic Sector	Interrelated Processes and Dependencies
Internal Real Sector	A special sphere of the national economy within which real economic wealth is created, conditions for national welfare are formed, and productive resources are utilized.
Fiscal Sector	The part of the national economy associated with state finances, primarily the state budget, public debt, and the formation of its financing sources.
Monetary Sector	The sphere of the national economy where the demand for and supply of money are determined, the general price level is established, and the stability of the national currency is formed.
External Sector	The sphere of the national economy within which external economic flows are carried out, the country's balance of payments is formed, the national currency's exchange rate is determined, and, ultimately, the position of the national economy in the global economic system is defined.

Source: Developed by authors based on [7, 10]

The segmentation of the economy presented in the table provides a differentiated understanding of the complex system of economic interactions and regulatory mechanisms. Focusing on the internal real sector allows for assessing production potential and resource distribution, the financial sector highlights the management of state finances and fiscal policy, the monetary sector analyzes monetary circulation and credit activity, while the external economic sector examines international trade and financial flows. A comprehensive analysis of these sectors is necessary for developing effective macroeconomic strategies and policies. This approach allows justifying the parameters of macroeconomic and macro-financial stability and determining guidelines for effective management of the national economy (Table 1.2). The indicators identified in the table interact with each other, and their comprehensive consideration enables the government to effectively manage the economic and financial situation in the country, contributing to its stability and development.

Table 1.2. Parameters of macroeconomic stability of the national economy

Parameters	Characteristics	Key Indicators
Economic	Ensuring stable rates of economic growth, optimal use of natural and financial resources	Gross Domestic Product (nominal and real), GDP deflator index, real GDP index (physical volume), unemployment rate, investment volume
Fiscal	Ensuring necessary tax revenues and stable growth rates, increasing the efficiency of State budget expenditures	Balance of income and expenses, budget surplus, budget deficit, total volume and structure of income and expenses, structure of tax revenues, level of tax burden, volume of internal debt and level of debt burden
Monetary	Ensuring continuous monetary circulation and the balancing of the money supply with GDP; balancing real and nominal exchange rates of the national currency	Money supply size, monetary aggregates, monetary multipliers, level of dollarization of the economy, indicators: monetization of the economy, inflation rate, pace of inflation, volume of international reserves of the NBU, national currency exchange rate: nominal and real exchange rate
External	Ensuring resistance to external shocks, effectiveness of foreign economic and debt policies	Balance of payments surplus, current account balance, basic balance, liquidity balance, trade balance surplus, volume of external public debt, and structure of payments and servicing of external public debt

Source: Developed by the authors based on [6, 9, 10, 11]

Considering the above mentioned, an important component of macroeconomic stability is financial stability, which encompasses the stability and reliability of the financial system, as well as its interconnection with general macroeconomic indicators. Financial stability is considered through the ability of the financial system to simultaneously perform three key functions: facilitate the efficient allocation of economic resources in time and space; assess and effectively manage financial risks; absorb real and financial economic shocks and imbalances, ensuring its continuous performance of its functions [12, p. 15]. Therefore, among the main criteria for the stability of the financial system, the following can be distinguished:

- The financial system can perform the function of allocating free resources for productive investment opportunities and maintaining the payment infrastructure;

- The financial system does not exacerbate macroeconomic problems but instead affects the productive functioning of the economy through stable financial markets;
- The financial system, as well as its institutional units, are resilient to endogenous and exogenous adverse events and capable of absorbing shocks;
- The likelihood of adverse and unpredictable events does not exceed the level at which the financial system becomes unstable [13, p. 16].

Synthesizing scientific approaches, we define financial stability as the state of the financial system capable of resisting shock phenomena, the negative influence of endogenous and exogenous factors, resulting from the interaction of financial institutions, financial markets, and infrastructure, the entire totality of various financial relations in the real economy. Financial stability is critical from the perspective of fostering confidence in the financial system, which is vital for investments and economic growth. In such a state, the financial system can function efficiently and continuously over a prolonged period, fulfilling its fundamental roles, maintaining equilibrium, and preserving its structure. Close financial interconnections between various sectors of the macroeconomic system dictate that financial stability can only be ensured comprehensively for the entire macroeconomic system. A stable financial system supports economic growth by efficiently allocating resources, maintaining consumer and investor confidence, and facilitating trade and investment. Financial stability of the macroeconomic system must be ensured at three levels (Table 1.3).

Table 1.3. Levels of the macroeconomic system

Level	Essence
Microprudential	Sets a series of normative requirements for subjects of the financial sector, aimed at ensuring the reliability of each financial intermediary.
Mesoprudential	Eliminates systemic risk within the financial sector and encompasses its connections with firms and households.
Macroprudential	Eliminates systemic risk within the entire macroeconomic system, covers foreign sector, public sector, budgetary-fiscal and monetary policies of the government in an integrated manner.

Source: Developed by authors based on [14, p. 43]

In modern conditions, enhancing the substantiation level of management decisions by state authorities in the sphere of forming a financial paradigm is important and relevant in the context of its impact on economic growth dynamics and achieving financial stability. The adaptability of financial regulation involves the constant review and update of goals and tasks depending on the dynamic changes of endogenous and exogenous factors affecting the financial system, the cyclicity of economic development, structural transformations of the financial sector, and the transformation of the institutional environment [15, pp. 38, 41]. Endogenous and exogenous factors determine a country's financial stability, including:

- Exogenous – economic relations with other countries regarding export-import operations, technology exchange, volumes, and structure of foreign investments, integration into global economic systems, etc. The conjuncture of global financial markets plays a significant role, affecting a country's ability to borrow in international capital markets.
- Endogenous – forms of ownership, economy structure, state of economic development, organization of monetary circulation, stability of the monetary unit, development of financial technologies, social composition of the population, level of prosperity, intellectual level of the population, etc.

Considering these factors and the peculiarities of Ukraine's current economic state, the formulation and implementation of the state's financial policy occur, which is one of the main tools for societal development and regulation of socio-economic processes. In crisis periods, the impact of financial policy on the economy needs to be intensified by refining financial mechanisms and macroeconomic stabilization tools. Creating a financial system structure based on the interaction of state regulation of economic processes and self-regulation mechanisms is necessary. For economic growth, a system of effective management of state financial resources needs to be established, along with creating an institutional environment in economic, social, and legal aspects that will balance budgetary and tax processes [16, p. 150, 153].

The primary task of Ukraine's state regulation at this stage is developing effective fiscal and monetary policies through their harmonious coordination, optimizing the volume of resources involved, and enhancing the scientific

substantiation of financial policy. The priority directions should be the improvement of the institutional environment, enhancing the efficiency of financial regulation, increasing international reserves, gradual and measured growth of the monetization indicator, maintaining price stability, and curbing inflationary pressures. It is crucial to strengthen the interconnection of financial regulation with the cyclicity of economic development, support the development of digital technologies and innovations to increase competitiveness and economic efficiency, and ensure macroeconomic balance.

A key institution playing a decisive role in forming and executing financial policy in Ukraine, contributing to financial stability by helping the financial system to perform its functions effectively and remain resilient to crises, is the National Bank of Ukraine (NBU). To achieve financial stability, the NBU applies the following approaches [17]: conducting macroprudential policy; supporting banks as a lender of last resort; promoting financial stability of banks, especially systemically important ones; supervising banks, payment systems, and settlement systems; conducting stress testing of the banking system and the largest bank borrowers. The primary objective of the monetary policy is the achievement and maintenance of price stability [18]. The effective functioning of the economy necessarily demands the facilitation of financial stability, particularly in the realm of ensuring the resilience of the banking system, and the maintenance of stable rates of economic growth. The latter two aspects, namely ensuring financial stability in the banking sector and preserving stable rates of economic development, are identified as the second and third key priorities by the National Bank of Ukraine [17, 19].

A particularly significant role in the NBU's regulatory system is played by macroprudential policy – a modern toolset for avoiding systemic risks, preventing crises, and mitigating their losses. Characteristics of macroprudential regulation include the following [21, p. 340]:

- Aimed at overcoming the cyclicity of the financial sector, which can generate financial cycles and fluctuations;
- Operates within the entire financial sector and has a systemic effect, enhancing the internalization of social costs from instability in the financial

sector, and increases the impact of the financial sector on economic growth through ensuring its stable functioning;

- Aimed at increasing resilience through the formation of stabilization buffers and moderating the cycle by reducing the likelihood of systemic risk accumulation;
- Includes tools for additional capital and liquidity buffering, dynamic provisioning, credit norms, and measures for reducing concentration levels, spreading risks through the financial sector, and taking excessive risks by systemically important financial institutions;
- Forms part of macroeconomic policy and complements monetary, fiscal, and capital flow management policies.

The National Bank of Ukraine develops macroprudential policy, orienting towards advanced international practice, guided by the experience of the EU and recommendations of the Basel Committee on Banking Supervision [17]. Thus, the NBU reduces risks in the financial system by obligating banks to accumulate additional capital reserves during rapid credit growth periods; limits excessive credit growth in general or its specific types; has sufficient liquidity reserves in case of fund outflows; and meets additional requirements when a bank becomes systemically important.

The main task of monetary policy is to maintain price stability. At the time, of course, in the conditions of war, market principles of economy are influenced heavily, monetary transmission mechanisms do not function appropriately, and the role of state regulation increases. In these conditions central bank uses mechanisms of purchasing assets on the open market, buying of government obligations, and using the programs of refinancing [24].

A key publication of the National Bank of Ukraine is the Financial Stability Report. Its purpose is to inform about existing and potential risks that could threaten the stability of Ukraine's financial system. The report, approved by the Financial Stability Committee on June 27, 2023, focuses on risks to the financial sector and Ukraine's economy in conditions of a prolonged full-scale war. It also contains recommendations to authorities and financial institutions aimed at countering risks in

wartime, increasing the financial system's resilience to them, and preparing for post-war recovery. The report is primarily addressed to financial market participants and all interested in financial stability issues. Its publication increases transparency and predictability of macroprudential policy, helps to build public trust in it, thereby assisting the National Bank in managing systemic risks [26].

Equally important is the next component of state regulation – fiscal policy (Table 1.4), which the government implements through the Ministry of Finance of Ukraine. Fiscal policy is a critical component of state regulation, playing a vital role in managing a country's economic performance and social welfare. It encompasses the government's use of its revenue collection (primarily taxes) and expenditure (spending) to influence the economy. The different objectives of fiscal policy are to stimulate economic growth, maintain price stability, and reduce unemployment, thereby improving the standard of living for the population.

Fiscal policy plays a crucial role in ensuring macroeconomic stability through the implementation of key directions and instruments indicated in Table 1.4.

Table 1.4. Principal directions for the implementation of fiscal policy

Fiscal Policy Directions	Characteristics
Tax Policy	An effective tax policy aids in stabilizing the economy by ensuring a sufficient flow of revenue to the budget for financing state programs and reducing public debt.
Government Expenditure	State expenditures, including capital investments and social transfers, can serve as a vital stimulus for growth and stabilization of the economy, especially during recessions.
Debt Policy	Managing public debt enables the country to finance deficits without excessive growth in debt burden, which could lead to instability.
Countercyclical Measures	Fiscal policy can act as a tool for countercyclical regulation, where the government increases spending or decreases taxes during economic downturns to stimulate demand, and reduces them during booms to control the economy.
Stabilization Funds	The creation and utilization of stabilization funds allow the country to conserve financial resources during periods of economic growth for use during downturns.

Source: Compiled by the authors based on [7, 27, 28]

Fiscal policy, therefore, plays a vital role in managing an economy, influencing everything from short-term economic performance to long-term growth and stability. The effectiveness of fiscal policy, however, depends on timely and appropriate implementation, as well as coordination with monetary policy and other factors like global economic conditions.

Over the last few decades, many countries around the world have significantly modernized their approaches, tools, and operational design of financial policy with the aim of exerting a more effective influence on the economy. Broadly speaking, any state's economic policy is directed towards enhancing the standard of living and welfare of the population. The cyclical nature of the economy, typically around an ascending trend, provokes instability, which can be smoothed through well-founded and rational state policy. An equilibrium state of the economy, where current macroeconomic indicators align with the long-term trend, is possible; however, in practice, such a situation occurs infrequently, and periodically, state authorities have to smooth out cycles around the trend. The existence of economic cycles is driven by fluctuations in demand and supply for manufactured goods and provided services, determining the aggregate level of production, real income of the population, and employment. The state can regulate economic imbalances, consequences of crises, and situational market turbulence through monetary and fiscal policies. Fiscal policy ensures the redistribution of income among the population to achieve a minimum level of affluence for all citizens by regulating tax burdens, expenditures, pension sizes, and subsidies. Monetary policy, in turn, controls the cost of money in the economy with the goal of ensuring price stability, fostering economic growth, and orienting towards achieving a low level of unemployment.

Consequently, monetary and fiscal policies are essential instruments of state regulation in socio-economic processes. However, in the context of macroeconomic instability, the coordination and coherence of these financial policy directions assume particular importance. Monetary policy, focused on controlling the money supply and interest rates, and fiscal policy, which influences government spending and tax rates, must interact to ensure stable economic growth. The harmonization of these policies aids in avoiding economic imbalances, reducing inflation and unemployment, and

promoting efficient resource utilization. Consistent and coordinated policies reduce uncertainty in the economy, fostering a stable environment for investment and growth. It requires continuous communication, shared objectives, and sometimes, legislative frameworks that guide the coordination process. Such a coordinated approach facilitates the achievement of congruent objectives and stimulates economic recovery and development.

1.3. The role of state regulation in fostering sustainable economic growth

The issue of financial support for comprehensive economic, social, and ecological development has been at the forefront of global community attention for at least the last 20 years. Concurrently, the challenges of ensuring sustainable development are compounded by factors such as climate change, deteriorating economic and social dynamics, the repercussions of the COVID-19 pandemic, and Russia's war against Ukraine, which has already inflicted significant environmental damage.

According to estimates by the Bank for International Settlements, environmental challenges represent a source of systemic financial risks and could trigger the next global financial crisis. Hence, the sustainable development goals outlined in the UN Summit's outcome document "Transforming our world: the 2030 Agenda for Sustainable Development" [30] necessitate the intensification of actions by individual countries and the international community. In response to these challenges, a new concept has emerged – sustainable finance, which defines a novel approach to the allocation of financial resources and the consideration of environmental, social, and governance (ESG) factors in financial decision-making. To counter climate challenges and achieve a sustainable future, countries adhere to global agreements such as the United Nations Framework Convention on Climate Change [31] and the Paris Agreements [32]. In 2015, representatives from 195 countries in Paris approved the UN's Sustainable Development Agenda for 2030 and the Paris Agreement on climate change, which stipulates that one of the three ways to combat climate threats in the context of sustainable development is to ensure the

consistency of financial flows with a low-carbon and climate-resilient development path. Ukraine participates in key international agreements aimed at addressing problems caused by environmental challenges. Ensuring conditions for sustainable development and forming sustainable financing is a joint task for all state and private institutions.

The concept of "sustainable development" was first mentioned in 1987 in G. Bruntland's report "Our Common Future", where it was stated that among the main mechanisms for ensuring change are: creating prospects for improving the existence of the population and the environment, as well as solving problems development of industry, energy, regional and international relations. That is, we are talking about development that meets the needs of society in our time, but does not endanger the capability of people in future to provide for their own potential needs, namely, the minimization of the adverse consequences of the reduction of natural resources and environmental pollution as a result of the rapid socio-economic development of mankind for the sake of the future [32]. Sustainable economic growth is an integral part of the broader concept of sustainable development, which combines economic progress with environmental care and social inclusion. It's increasingly recognized as essential for long-term prosperity and well-being, moving away from the traditional focus on GDP growth as the sole indicator of economic success.

In November 2021, the National Bank of Ukraine (NBU) presented the "Policy for the Development of Sustainable Finance until 2025," offering a comprehensive view on the creation and further development of the sustainable finance sector in Ukraine. The main directions of this policy include [34]: integration of ESG criteria into financial services, crucial for ensuring prolonged economic prosperity less dependent on limited resources and environmental exploitation, more socially inclusive, and encompassing closely linked ecological, social, and economic aspects; management of environmental and social risks, integrating a system for managing these risks into the overall risk management system of financial institutions; assessment and selection of projects for financing based on their role in sustainable development, where financial institutions will be obliged to evaluate their

impact on the environment, economic resilience, and energy efficiency. The NBU's policy on sustainable financing is a comprehensive document that allows financial market participants to consider the NBU's vision in their plans for the coming years and prepare in advance for discussing regulatory changes and their implementation. Additionally, in December 2021, the National Securities and Stock Market Commission of Ukraine (NSSMC) developed an ESG addendum to the Corporate Governance Code. This addendum is part of an initiative to develop sustainable financing and includes: justification for the implementation of advanced ESG practices; description of necessary ESG information; description of operational and reporting standards for structuring sustainable corporate practices. These innovations and additions contribute to strengthening trust in companies and the implementation of the best global ESG practices, which are key to the sustainable development of the corporate sector in Ukraine. The addendum was developed in collaboration with the International Finance Corporation and the Ukrainian Academy of Corporate Governance [35]. Thus, Ukrainian financial market regulators actively incorporate the best international ESG support practices into their activities and create a new institutional environment for all market participants to ensure sustainable economic growth in Ukraine.

Additionally, the integration of budget planning for Sustainable Development Goals (SDGs) is one of the key priorities within the government's financial policy. During 2016-2017, a broad and comprehensive process of adapting the SDGs took place, considering the Ukrainian context. Each global goal was reviewed, taking into account the specifics of national development. In the summer of 2021, a national UNDP consultant conducted work on reflecting the SDGs in the budget using the best approaches of partner countries, involving multilateral participation at national and local governance levels, and deep analysis of budget programs to properly relate them to SDG tasks and indicators [36]. Currently, state and local Ukrainian budgets finance all 17 goals with corresponding tasks. However, the distribution of programs and their varying levels of effectiveness result in a lack of assessment of funding volumes for each SDG [38]. Of course, in the current conditions of Ukraine's economic development, the full implementation of SDGs in national budgets faces

several difficulties and challenges, such as limited financial resources, increased defense spending, macroeconomic instability, and social tension. However, in the post-war period, returning to the issue of budget planning for sustainable development goals will be one of the first priorities.

The National Bank of Ukraine, the Ministry of Finance of Ukraine, the National Securities and Stock Market Commission, and the Deposit Guarantee Fund for Individuals (DGF) have approved a new Strategy for the Development of Ukraine's Financial Sector. This strategy sets forth current priorities and objectives for the development of the financial sector, focused on resisting Russian aggression and the country's reconstruction. Its development is stipulated in the Memorandum of Economic and Financial Policy between Ukraine and the International Monetary Fund [39].

This strategy envisages that the combined actions of financial sector regulators, the Ministry of Finance, and the Deposit Guarantee Fund for Individuals will be directed towards achieving five strategic objectives: macroeconomic stability; financial stability; a financial system that works towards the country's recovery; modern financial services; and the institutional capability of regulators and the DGF. The measures envisaged by the Strategy are conditionally divided into short-term actions aimed at ensuring stability, preventing deterioration in the financial sector and the economy overall, and medium-term measures that will form the basis for future reconstruction and economic growth.

The development of the financial sector and ensuring its continuous operation, the gradual unwinding of extraordinary prudential measures, diagnostics of banking assets, monitoring and resolving the problem of non-performing loans, creating a comprehensive system for rehabilitation and removal of insolvent market participants, and implementing an early response system for the problematic nature of financial institutions are the immediate priorities defined by this strategy. Under favorable and stable macroeconomic conditions, a gradual liberalization of financial markets and a return to inflation targeting with a floating exchange rate are envisaged. Also justified is the need for the continued technological development of financial services as a necessary prerequisite for further expansion of financial

inclusion and ensuring cybersecurity. Important measures also include the restoration of financial infrastructure in de-occupied territories, ensuring the accessibility and inclusiveness of the financial sector.

The model of comprehensive macroeconomic architecture and post-war guidelines for ensuring the reconstruction of the economy and further sustainable growth are outlined in the report "Post-War Macroeconomic Architecture for Ukraine," developed by the Centre for Economic Policy Research (CEPR) PRESS. This report emphasizes that sound public finances, a balanced monetary policy, a predictable and fair regulatory base, and flexible labor markets are fundamental for the successful development of human capital, foreign direct investments, technological leaps, and many other elements of reconstruction [40].

Ukraine's financial policy is positioned at the crossroads of numerous challenges. On one side, the complex socio-economic situation arising from the onset of the full-scale invasion has led to increased external and internal risks, social and financial instability, migration of skilled labor, and a slowdown in economic growth, all of which define the challenges and tasks of contemporary macroeconomic regulation aimed at addressing the most pressing issues in the fiscal and monetary spheres. On the other side, in the context of changes in the global economic order and long-term planning necessary for reconstruction, Ukraine faces the task of adapting its financial policy to the demands of sustainable development. This encompasses ensuring macroeconomic stability, stimulating growth and innovation, and addressing socio-economic challenges.

State financial policy for sustainable development acts as a strategic economic management tool aimed at achieving balanced growth, social justice, and ecological resilience. It encompasses a comprehensive set of measures and strategies that regulate the mobilization, allocation, and utilization of state financial resources for forming a competitive national economy, ensuring socio-economic growth, enhancing population welfare, and strengthening the state's status in the global geopolitical arena amid rising external challenges and threats [41].

Ensuring sustainable economic development requires forming a comprehensive approach to financial policy aimed at achieving a balance between

economic growth, social justice, and ecological resilience. The systematization of sustainable development financial policy measures is presented in Figure 1.1.

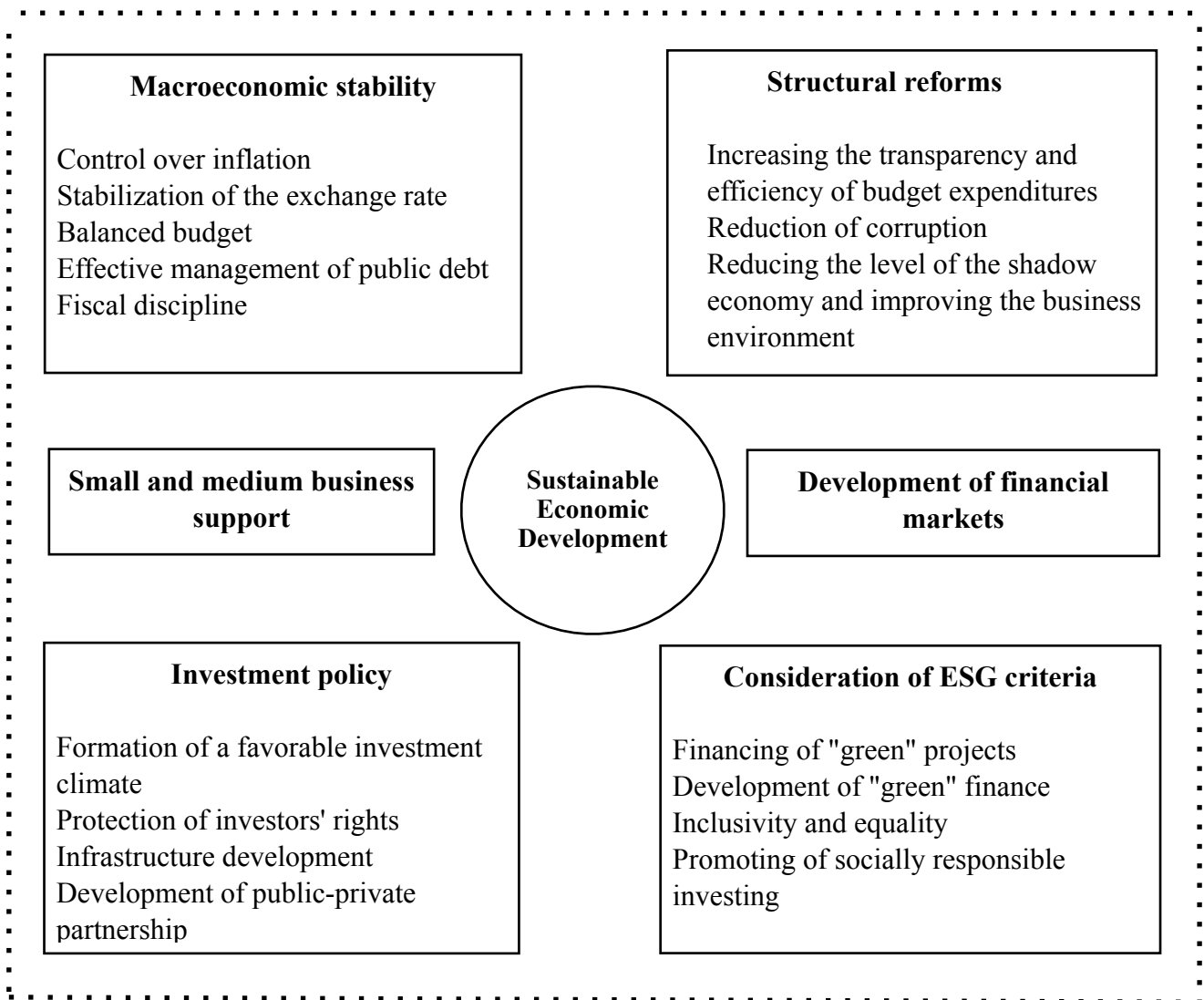


Figure 1.1. Comprehensive measures of financial policy for sustainable economic development

Source: Compiled by the authors

In recent years, the consideration of ESG factors in financial decision-making has gained particular relevance. Environmental resilience within financial policy requires a strategic approach to integrating environmental aspects into all areas of economic planning and management, including financing "green" projects and developing "green" finances. This involves developing and implementing policies that consider not only short-term economic interests but also promote long-term ecological stability and sustainable development. Equally important is the

development and implementation of socially responsible financial policies, ensuring social protection, inclusivity, equal opportunities, and countering discrimination in all areas.

As noted in previous sections, the foundation of sustainable development is macroeconomic stability, which includes controlling inflation, stabilizing the exchange rate, balancing the budget, effective management of public debt, and fiscal discipline. Stability is a necessary condition for creating an environment conducive to long-term investment decisions essential for sustainable development. This also necessitates structural reforms in public financial management, aimed at increasing transparency, reducing corruption, and improving the business environment, thereby enhancing the efficiency and transparency of economic processes.

The next direction is increasing the efficiency of investment policy to attract domestic and external investments. This involves forming a favorable investment climate, improving the system for protecting investors' rights, developing infrastructure, and fostering public-private partnerships, all essential conditions for capital attraction. Alongside this, developing financial markets and creating conditions for capital access, innovation stimulation, and support for small and medium-sized enterprises are crucial. The latter is a particularly important direction, as small and medium-sized businesses are vital drivers of economic development and job creation.

Ukraine's financial policy in the context of sustainable development requires a comprehensive approach, incorporating macroeconomic environment stabilization, structural reforms, investment stimulation, financial market development, and active support for small and medium-sized businesses. Implementing these directions requires coordinated efforts from the government, private sector, and international partners. Considering global economic trends and challenges, as well as adapting to the changing conditions of the world economy, are key to ensuring prolonged economic growth and welfare in Ukraine.

CONCLUSIONS TO CHAPTER 1

In the proposed study, the theoretical and methodological foundations of macroeconomic stability and its crucial component - financial stability - are examined. A list of endogenous and exogenous factors influencing financial stability is provided, parameters of macroeconomic and macro-financial stability are determined, and benchmarks for effective management of the national economy are substantiated. The study also explores the activities of the Financial Stability Council of Ukraine, the "Strategy for the Development of the Financial Sector of Ukraine," and the proposed "Post-War Macroeconomic Architecture for Ukraine."

It is considered that a state's financial policy plays a pivotal role in ensuring sustainable development, as it influences economic stability, social protection, investments in environmentally sustainable technologies, and other critical aspects of sustainability. Through fiscal policy, the government regulates expenditures and revenues to fund programs that promote sustainable development, such as ensuring quality education, supporting energy efficiency, and developing infrastructure. Proper management of public finances is key to ensuring efficient resource allocation, which contributes to sustainable economic growth and social well-being.

The National Bank of Ukraine and the National Securities and Stock Market Commission are actively working on implementing principles of sustainable development and sustainable financing in Ukraine. These institutions are focused on integrating environmental, social, and governance (ESG) criteria into financial services and corporate governance. The National Bank of Ukraine has presented the Sustainable Finance Development Policy up to 2025, which includes guiding principles and an action plan, while the National Securities and Stock Market Commission has developed an ESG appendix to the Corporate Governance Code. Consequently, Ukraine's financial market regulators are actively incorporating best international practices in support of ESG into their operations and creating a new institutional environment for all market participants to ensure sustainable economic growth in Ukraine.

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CHAPTER 2. ANALYSIS OF MONETARY POLICY AND INFLATION TARGETING IN UKRAINE UNDER MODERN CONDITIONS

2.1. Inflation targeting as the main tool of monetary policy

Inflation targeting (IT) is currently one of the most popular monetary policy frameworks in both advanced and emerging economies [1]. As of 2023, more than 70 central banks around the world [2] have adopted it in some form, including the US Federal Reserve System, the ECB, the Bank of Japan, and the Bank of England.

IMF defines the inflation targeting framework the following way: “[IT] involves the public announcement of medium-term numerical targets for inflation, with an institutional commitment by the monetary authority to achieve these targets” [3]. As can be observed from the definition, inflation-targeting has a simple and straightforward idea at its core: anchoring inflation to the publicly announced goal with the means accessible to the central bank. However, the simplicity of the definition leads to frequent debates about the de jure and de facto adoption of the inflation-targeting framework by a central bank. The commonly recognized features of inflation-targeting are the following [1; 4; 5]:

- public announcement of a quantitative inflation target;
- price stability is explicitly recognized as the main and overriding goal of monetary policy (there should be an official commitment);
- growth of communication with the civil society and institutions about the strategy and aim of central bank policy;
- inflation forecast is used as the main intermediate target

An official announcement of an unambiguous quantitative inflation target is required as such a target serves at least three goals. Firstly, it is meant to stabilize inflation expectations around a specific and commonly known figure. Secondly, it serves as a benchmark for the evaluation of the performance of the central bank’s actions. Lastly, it assists in refocusing of public’s attention on price level from other measures of national currency value, e.g. nominal exchange rate, which is particularly important for emerging countries adopting inflation-targeting.

An inflation target is usually announced for the medium-term time frame. This is done intentionally to avoid the necessity to achieve an inflation target all the time, i.e. even in the short-term period. The latter could be harmful to the sustained development of an economy, as quite often prices grow faster or slower due to unforeseeable demand- and supply-side shocks. Such shocks, which are inevitable in their nature, make the goal of achieving an inflation target all the time both unattainable (as monetary policy actions almost always affect prices with a lag), and counterproductive (as too frequent and abrupt changes in monetary policy may further destabilize actual inflation and inflation expectations). The length of “medium-term” is rarely defined quantitatively by central banks, though some authors assume that it encompasses a horizon of around 2-3 years [6]. But the idea is that in the medium term, the above-mentioned shocks are offset primarily by the structural changes in an economic system [7]. While the inflation rate approaches its target as a result of the sustained development of an economy assisted with appropriate monetary conditions.

An inflation target is most commonly set as a point with an interval of possible divergences [5]. The point serves as a specific measure of an average change in the value of national currency over a longer time period, while an interval forms a range of comfortable fluctuations of the inflation rate, i.e. the range where no monetary policy response actions are required.

Official recognition of price stability as the highest priority goal of monetary policy is crucial to the implementation of inflation targeting. Price stability is obtained “when economic agents no longer take account of the prospective change in the general price level in their economic decision making” [8]. Importantly, a central bank that chooses to conduct its monetary policy following an inflation-targeting framework needs not only to announce its formal commitment to achieving and sustaining the rate of inflation that agrees with the abovementioned definition of price stability but is also responsible for active actions of proving to the public that inflation target takes precedence in monetary policy decision-making. This is important as the success of inflation targeting depends heavily on the level of trust of the public and financial market players in the central bank.

Particularly for the aforementioned reason, inflation targeting requires expanded communication with the public and the markets about the aim and goals of monetary policy. Also, this increases awareness of the general public about price developments and their drivers. More importantly, increased communication makes the central bank's decisions more predictable, removing an additional source of uncertainty for economic agents.

Increased accountability of the central bank is meant to build the trust of the economic agents in a central bank's ability to achieve its announced goals. The declared numerical target for the inflation rate compared with the actual inflation serves as a simple way of evaluating monetary policy's successfulness which is transparent and comprehensible to any citizen. This is in contrast to another monetary policy framework, namely monetary aggregate targeting. The latter uses more complex concepts for targeting which hinders assessment of and therefore trust in monetary policy.

Svensson [9] and other authors in the last decades provided substantial arguments that “the best possible intermediate target is the current forecast of the goal itself”. That is why inflation forecast is commonly used by inflation-targeting central banks as an operational goal of monetary policy. Moreover, such forecasts provide a sense of the expected trajectory for inflation over the coming time periods and constitute an important part of a central bank's communication to the general public about the foreseeable future and its planned actions.

Historically, an inflation-targeting framework was first adopted by economies that had already been advanced and had sound financial systems and credible central banks [10]. And it was considered that such a framework had not been suited for emerging market countries due to numerous reasons [11; 12], the most important of which constitute four groups: institutional independence; technical infrastructure; financial system health; economic structure (Table 2.1).

Table 2.1. Prerequisites for successful implementation of inflation-targeting

Institutional independence
Monetary policy demands to be independent, especially from the executive branches of state power. This is needed in order to avoid the monetization of government debt and prevent statesmen who hold elective positions in the government from using their power to affect monetary policy and the business cycle in order to gain advantages during elections. The independence of a central bank is usually achieved by making it a separate institution with its own resources and legal authorities and excluding direct subordination of central bankers from any other body within the state.
Instrument independence: a central bank needs not only to be independent in making decisions about the current policy but in its choice of instruments used for achieving the announced goals.
Security of employment for a governor and/or members of a board of governors of a central bank. It is particularly important that the tenures of key central bank policymakers exceed the tenure of elected statesmen who often are authorized for appointing them.
Freedom from linkage to another nominal anchor, such as the exchange rate or wages. A central bank is highly unlikely to achieve several targets simultaneously, as it will most probably create antagonism in the operational design of monetary policy. If a central bank is committed to targeting inflation, it should be prohibited from targeting any other nominal indicator.
Technical infrastructure
A central bank has adequate forecasting capabilities and its staff is able to use them to make macroeconomic “forecasts conditional on different assumptions for the monetary policy instrument”. This is needed for two purposes: 1) to make reliable inflation forecasts that will serve as an operational target for monetary policy; 2) to link monetary policy instruments with its goals, to improve the understanding of the underlying mechanism of the monetary policy, build confidence in the central bank’s abilities to attain the announced goals, and most importantly make informed decisions.
A central bank has access to reliable and comprehensive data, needed for forecasting and substantiation of monetary policy decisions. And the lag in data collection is sufficiently small.
A central bank has “an operating procedure for adjusting monetary instruments” and is able to conduct macroeconomic forecasting on a regular basis.
Financial system health
A sound banking system: banks attract deposits from and provide loans to households and corporations, and have sufficient sources of own funding to sustain their operations.
Developed stock and bond markets: a fairly extensive volume of financial operations designed for the redistribution of financial resources within a state.
Economic structure
Low sensitivity of domestic prices and nominal exchange rate of a national currency to changes of commodity prices. This condition greatly simplifies the task of reaching an inflation target for a central bank.
Financial dollarization is minimized. A high level of financial dollarization imposes significant limitations on the efficacy of a central bank’s key instruments as economic agents choose to conduct their business in a currency other than a national one.
Minor exchange rate pass-through into prices. This condition is usually stated for a so-called “fear of floating”, i.e. reluctance of a central bank to allow significant exchange rate changes so as to prevent high volatility of inflation and output. If an economy is characterized by a lower exchange rate pass-through, its central bank would be more prone to let a national currency float freely and conduct “classical IT”.
Administered prices are either non-existent or their share in price indices is minimized. Inflation-targeting relies heavily on market forces in the attainment of its goals, which is why state-administered prices hinder its proper functioning.

Source: developed by authors based on [10-15]

Even though the above-mentioned prerequisites do help a central bank in the effective implementation of inflation targeting, most of them either could be achieved after the formal adoption of inflation targeting as a monetary policy framework. And there is a growing body of literature proving that the central bank's commitment to such a monetary framework speeds up structural and institutional changes in an economy so that it faster moves to the attainment of the aforementioned preconditions [10]. For example:

- exchange rate pass-through decreases after the adoption of IT [16], though some researchers argue that there is “little indication that inflation-targeting countries have lower pass-throughs” [17];
- high dollarization does not preclude the use of inflation-targeting as a policy rule [18], while inflation targeting has significant treatment effects on lowering actual financial dollarization [19];
- inflation targeting framework assists in a better macroeconomic performance of commodity-exporting economies [1; 20].

In 2015, the National Bank underwent a massive transformation by adopting an inflation-targeting framework for conducting its monetary policy. This transition was one of the most significant reforms that Ukraine has ever implemented. However, the adoption of inflation targeting was not without its challenges. Ukraine's economic conditions at the time of the transition were far more adverse than those faced by other countries that had already adopted this framework. Despite these obstacles, Ukraine successfully made the shift to inflation targeting, and it has continued to be a crucial element of its monetary policy ever since.

The fixed exchange regime kept inflation under control for an extended period until 2014, which marked a turning point for Ukraine [23]. The country faced several significant challenges, including an economic crisis, military conflict in the East, and the annexation of Crimea by Russia. As a result, the real GDP declined by 6.8% due to falling domestic and weak external demand. This led to a sharp increase in demand for foreign currency, coupled with a drop in exports, resulting in a rapid devaluation of the hryvnia [21]. In 2015, the IMF intervened to rescue Ukraine, and

one of the reforms implemented was the transformation of the NBU to an inflation-targeting regime.

In the Monetary Policy Fundamentals for 2015, the NBU prioritized achieving and maintaining price stability in the country. To ensure predictability in long-term economic planning and managerial decision-making, it is necessary to maintain low and stable inflation rates over three to five years. The NBU aimed to reduce inflation to 5% per year as a medium-term objective, with an acceptable deviation of one percentage point [21].

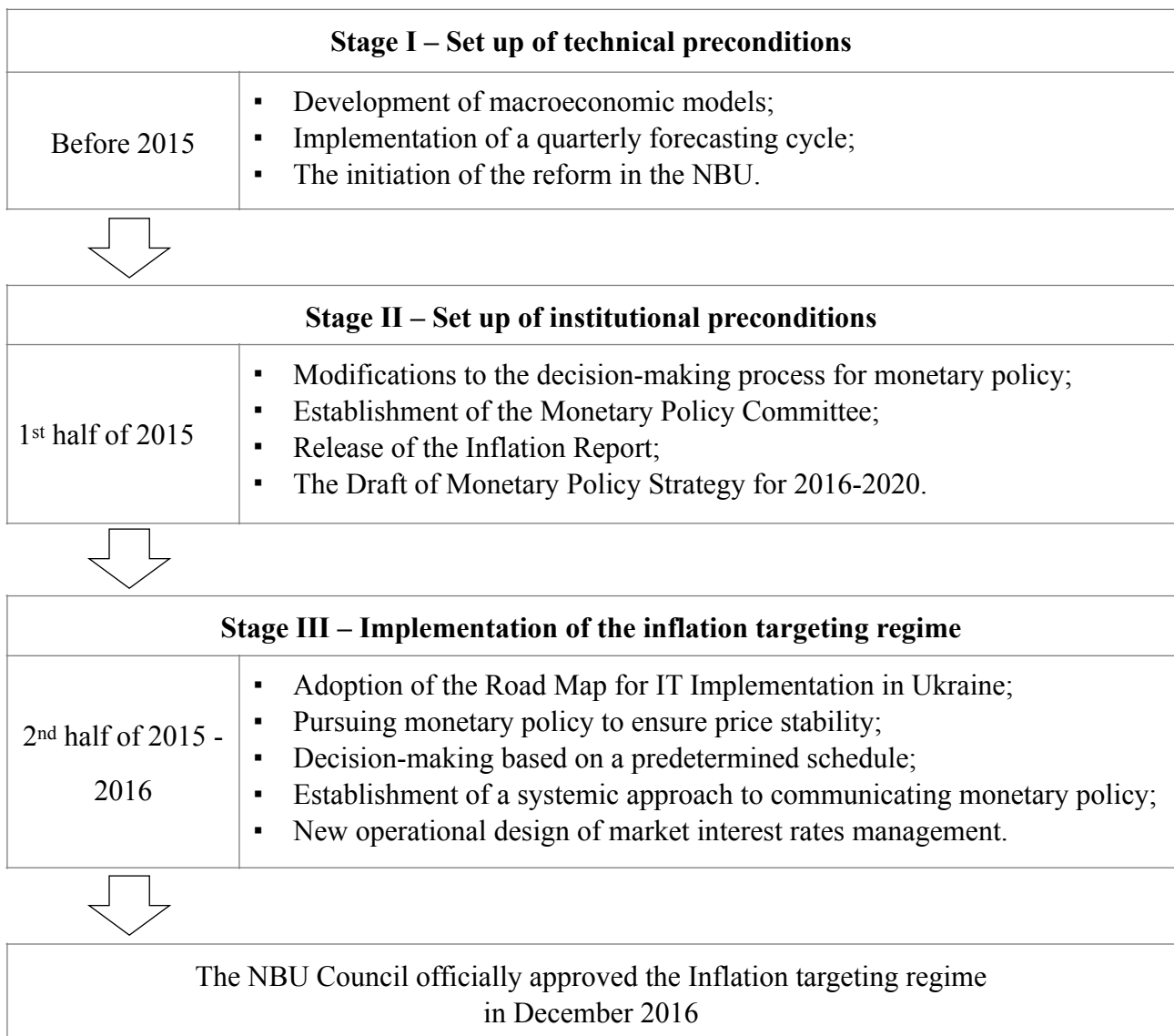


Figure 2.1. The timeline of inflation targeting regime adoption in Ukraine

Source: developed by authors based on [21, 22]

In March 2016, the NBU released a roadmap for implementing inflation targeting over the next 12-18 months. The Monetary Policy Guidelines established inflation targets for the consumer price index, starting at a 12% annual increase with a 3% deviation and ending at a 5% annual increase with a 1% deviation by the end of December 2019. The NBU emphasized that the inflation target is unchanging, unlike inflation forecasts which are subject to revision based on actual economic developments. The central bank would use monetary policy instruments to keep inflation projections on track.

The NBU has been working on implementing inflation targeting since 2015, focusing on building macroeconomic models, designing quarterly forecasts, and modifying monetary policy decision-making mechanisms. The third stage of reform, the implementation of inflation targeting, began in the second half of 2015. The NBU also affirmed its independence in selecting monetary policies to achieve price stability and ensured that there would be no fiscal dominance [22].

The NBU employs the key policy rate as its primary tool for controlling inflation. This rate is regularly reviewed, and decisions may involve leaving it unchanged, increasing it, or decreasing it [23]. The NBU adjusts the key policy rate to align with its inflation targets. Unlike the prevailing trend in inflation, the regulator uses inflation forecasts to determine the key policy rates for the next six weeks [24].

In addition to using the key policy rate to control inflation, the NBU applies foreign exchange (FX) market interventions as an extra monetary policy tool. These interventions aim to maintain international reserves at sufficient levels, reduce exchange rate volatility, and support key policy rate transmission. However, it is worth noting that FX interventions cannot guarantee a specific exchange rate due to the flexible exchange rate regime in Ukraine. The NBU may also use other methods, including banks' required reserves, repo, and swap transactions, and purchasing or selling government bonds, to achieve its goals [25].

The monetary transmission mechanism in Ukraine operates through several channels, with varying degrees of intensity [26]. Changes in the NBU's key policy rate impact interbank interest rates, which then affect aggregate demand and inflation, primarily through changes in household and business expectations. The transmission

process takes time, typically 9 to 18 months, which is why the regulator bases its policy decisions on future expectations rather than past events. To enhance monetary policy transmission, the NBU implements a consistent inflation-targeting policy that effectively manages expectations [23]. Figure 2.2 provides a summary of the information discussed, highlighting the functioning of monetary policy in Ukraine.

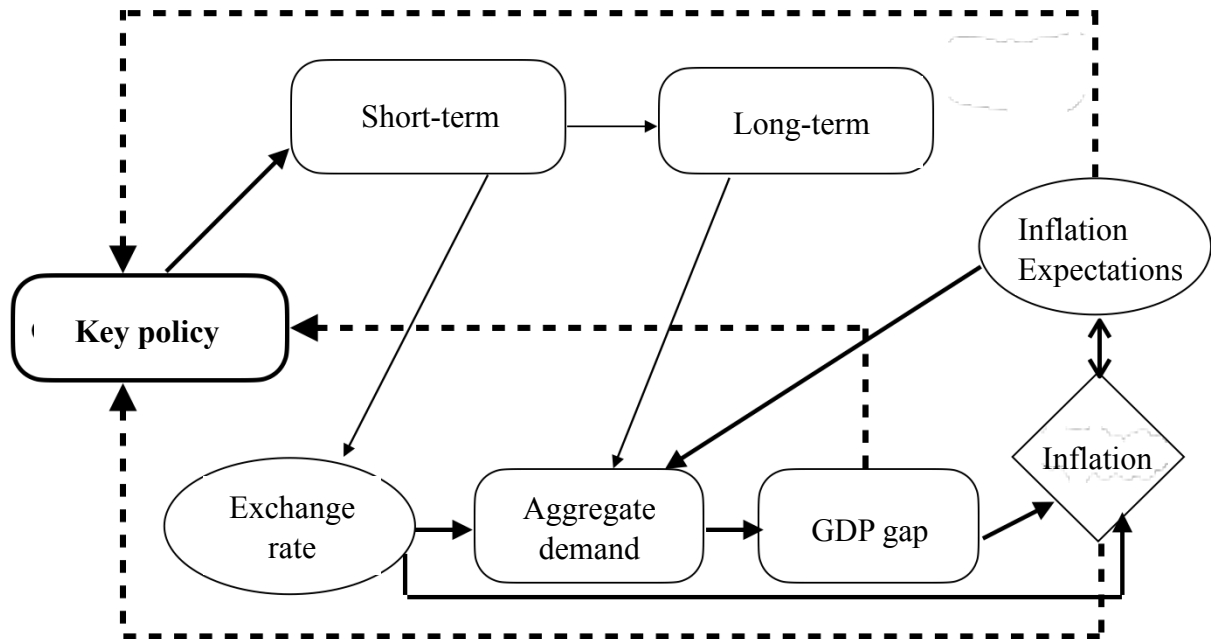


Figure 2.2. The transmission mechanism of the NBU's monetary policy

Source: developed by authors based on [21, 23]

As the interest rate is the primary tool of the central bank, we begin our analysis by focusing on the interest rate channel. The initial step of it is the impact of a modification in the key policy rate on short-term money market rates, specifically the interbank market. Central banks usually succeed in regulating short-term rates by managing bank liquidity. In the event of a liquidity surplus, they absorb excess liquidity. It is possible to achieve this by either selling the deposit certificates or government securities from the NBU's portfolio or carrying out reverse repo transactions. In case of a liquidity deficit, they inject funds into the banking system by providing loans to commercial banks and accepting liquid collateral. Furthermore, the NBU may also purchase government securities for its portfolio or engage in repo transactions [21, 23].

The NBU communicates its preferred rate level for achieving its monetary policy objectives by setting the key rate. It conducts its transactions based on this key rate to align market rates closer to the desired level. Specifically, when there is a liquidity surplus, the NBU's primary operation involves selling two-week certificates at the same rate as the key policy rate. Moreover, to mitigate market volatility, the NBU also utilizes standing facilities such as certificates of deposit and overnight loans (1 percentage point below/above the key policy rate).

Besides, the central bank can organize prompt and effective control over short-term interbank rates if it does not impose any additional limitations when attracting or issuing short-term facilities. Commercial banks can engage in transactions with either the NBU or with each other, causing short-term interbank rates to generally fall between the central bank's rates for deposit certificates and overnight loans and remain near the key rate [23].

Nevertheless, medium- and long-term interest rates play a crucial role in influencing economic processes by directing temporarily free funds to where they are needed within the banking system. These rates depend on various factors, including short-term interbank rates, competition within the banking system, inflation expectations, demand for loans, etc.

After the NBU adjusted the short-term rate management system in 2016–2017, the relationship between short-term interbank rates and rates on bank loans and deposits strengthened considerably, leading to decreased volatility of short-term rates, and providing banks with a reliable indicator of money value in the market [21, 23].

Besides, the change in interest rates on bank loans and deposits leads to a shift in economic agents' preferences for current consumption, investment, and savings. Rising interest rates tend to encourage savings and reduce investments, which could result in a slowdown of inflation and/or deflation due to a decrease in aggregate demand [26]. This has been supported by the experience of developed countries and developing economies, including a study of the MTM in the Czech Republic, Poland, and Hungary that points out the specifics of transitional economies that switched from a fixed exchange rate to inflation targeting [27].

Some methods can be used to assess the effect of changes in market rates on the components of aggregate demand. For example, the National Bank of Poland uses vector autoregression (VAR) models and semi-structural and structural models [28]. While most models show the existence of transmission, the quantitative results vary. Another way to study the effect of changes in market interest rates on their investment decisions is the usage of data from companies' balance sheets (this method is embraced by the Central Bank of Hungary [29]). In the case of Ukraine, it is worth assessing the effect of the monetary transmission mechanism using several models, including macro models and micro analyses of individual transmission chains. At the same time, the short data sample since the country's transition to inflation targeting complicates the use of econometric models, and the problem of a short data sample can be mitigated somewhat with assumptions for how the relationship between some variables had been changing after the launch of inflation targeting [26].

In addition to the information mentioned above, the short-term interest rates also impact long-term rates on the financial market, particularly yields on government securities, which are the safest debt instruments, and whose yields serve as a benchmark for investors to assess the return and risk of investing in other securities. The maturity of domestic government bonds varies from several months to years and yields on these bonds of different maturities form the yield curve, which illustrates the relationship between yield and investment term [23].

In the research of Oleksandr Zholud, Volodymyr Lepushynskiy, and Sergiy Nikolaychuk, "The Effectiveness of the Monetary Transmission Mechanism in Ukraine since the Transition to Inflation Targeting," there was a model that estimates the pass-through level of interest rate changes to short-term business loans in Ukraine. The authors of this paper discovered that there is a significant relationship between short-term business loan rates and overnight and key rates (0,92). Moreover, the model indicated a weekly pass-through level of 19%, while the expected long-term transmission should be 15%, suggesting that other factors also impact interest rates. When the researchers used only 2017 data, the model represented a more significant short-term effect, but with lower statistical significance for most

coefficients. Nevertheless, market interest rates still have a weak impact on aggregate demand and, therefore, on inflation in Ukraine considering such factors as lower financial depth and high volatility in nominal and real interest rates during a long period of high and volatile inflation [26].

If we look at the research conducted on monetary transmission in Poland via the interest rate channel, it has been discovered that the key policy rate fully transmitted to money market rates in all cases except short-term interbank rates, which were affected by the global financial crisis of 2008-2009. The further transmission of money market rates to interest rates on business and individual deposits indicated full long-term transmission for all except short-term deposits, which was also affected by the crisis. There was incomplete transmission to interest rates on property loans for individuals, while the transmission to loan interest rates for businesses was statistically higher than one [30].

Moreover, the paper “The Effectiveness of the Monetary Transmission Mechanism in Ukraine since the Transition to Inflation Targeting” emphasized the yield curve concept that lies at the intersection of the interest rate and expectations channels. In Ukraine, the NBU handles the short end of the yield curve, which includes overnight deposits and 14-day certificates of deposit, while the Finance Ministry handles the DGBs with maturities ranging from 6 months to several years [26].

While the government securities market has increased in volume and liquidity during last years, it remains relatively shallow. Therefore, the key interest rate is transmitted quickly and completely to government security yields. Despite this, there is still a significant gap between the yield on government securities and the interest rates on individual deposits due to the low level of engagement. In the future, there will no longer be any arbitrage opportunity for the DGB market as it grows.

International experience shows that the establishment of the first stage of monetary transmission and the adoption of inflation targeting both help increase the sensitivity of aggregate demand to interest rate changes. Gradual resumption of lending, further expansion of the DGB market, and lower dollarization are important

factors that can also help strengthen the effect of changes in market interest rates on aggregate demand and inflation.

The second monetary transmission channel is the key policy rate transmission via the exchange rate. In general, in economies with open capital flows, the exchange rate channel enables borrowing at lower interest rates in one country and investing in another with higher yields. If the key policy rate increases, it can attract foreign currency inflows, increase demand for domestic currency, and strengthen it. The issuance of government bonds with different yields in hryvnia and foreign currency in Ukraine means that rate changes can affect the balance between supply and demand for both types of bonds, as well as influence the choice between domestic and foreign currency deposits. This, in turn, can impact the exchange rate [23].

The CPI in Ukraine includes imported and domestically produced goods that compete with imports. When the hryvnia strengthens against the dollar, the cost of imported goods decreases, while local products become more expensive in dollar terms, making them less competitive on global markets. As a result, inflation may decrease, but the trade balance could worsen [23].

Even though no studies have been conducted on the effects of changing interest rates or foreign currency interventions on exchange rates in Ukraine, there seemed to be a strong correlation between monetary policy decisions and exchange rate trends, as was observed in the rate hike cycle in 2017-2018.

After exceeding the inflation targets for 2017 and 2018, the NBU began a cycle of tightening monetary policy by increasing the key rate in October 2017. As a result of the increase in the key rate, yields of domestic government bonds (DGBs) went up in early 2018. Before the rate increased in January-November 2017, DGBs with a one-year term accounted for less than 600 million UAH per month in average placements. During January-February 2018, DGB placements increased by more than ten times, with yields increasing by around 1.6 percentage points. Foreign currency inflows strengthened the Ukrainian currency's exchange rate between 1 January and 28 February [26].

Analyzing the second stage of this transmission channel, historically, the exchange rate and inflation have had the strongest correlations and fastest

transmissions in Ukraine. It is partly due to the country's long history of hard currency pegs that the public pays so much attention to exchange rates. In contrast, the Ukrainian economy is characterized by high levels of openness and dollarization, and it has also an impact on the existence of this strong correlation between inflation and changes in the value of Ukrainian hryvnia to USD [26].

As for inflation transmission, the study was conducted by Oleksandr Faryna, and the researcher used a panel autoregressive model with distributed lags to study the nonlinearity of transmission effects. The results of his study demonstrated that significant devaluations (more than 16% per quarter) lead to a high pass-through (0.2-0.3 during 12 months). Nevertheless, mild exchange rate fluctuations (between 3 and 16%) pointed out no significant impact on inflationary processes. At the same time, inflation was found to have very low elasticity under conditions of strengthening exchange rates [31].

In another research, the effects of anticipated and unanticipated changes in the exchange rate were compared. The industrial and agricultural sectors were observed, and there were found no reactions to expected changes in the nominal effective exchange rate (NEER) and unanticipated changes in NEER had a negative effect. The currency floating, as it has been in Ukraine before the full-scale invasion, also strengthens the impact of unanticipated changes in exchange rates [32].

A foreign currency's role in the assets and liabilities of economic agents is another important aspect of the exchange rate channel. As household and company assets and liabilities are mostly held in foreign currencies, primarily US dollars and Euros, exchange rate fluctuations impact balance sheets significantly [26].

During times of economic growth and crisis, the hryvnia's real exchange rate has been observed to strengthen and weaken, respectively. These trends are primarily driven by capital flows and foreign currency loans used for capital and production financing. When capital inflows increase, the hryvnia strengthens in real terms, reducing foreign-currency loan costs and increasing corporate assets. This balance sheet effect leads to increased investment and production activity, as well as lower costs for imported investment goods and increased household purchasing power. However, this strengthening weakens price competitiveness and reduces net exports,

resulting in a widening foreign trade deficit during periods of economic growth. Conversely, during crisis periods, the opposite trend occurs. Despite these fluctuations, the impact of exchange rate changes on economic activity in Ukraine is limited due to the offset effect of other channels.

Another monetary transmission channel, which plays a significant role in Ukraine, is the expectations channel. The transition to inflation targeting has resulted in a significant and rapid decline in inflation expectations after the crisis, with clear and irrevocable inflation targets declared in mid-2015. The NBU has still been viewed with low trust considering its history and the experiences of the most recent currency crisis in 2014-2015, and, as a result, inflation expectations remain much higher than its targets. Based on Coibion and Gorodnichenko's study, inflation expectations are significantly influenced by currency exchange rates [33].

Since mid-2016, inflation expectations have remained largely stagnant, despite a temporary but significant increase in actual inflation. To sum it up, if the public trusts the NBU's monetary policy, it is possible to anchor them at a lower level [26].

Interest rate hikes by the NBU in October 2017 - March 2018 increased trust in monetary policy and enhanced the capacity of the expectations channel, despite their unpopular nature. Another factor in the success of the NBU's communication strategy regarding monetary policy was its use of best communication practices. The following elements have been introduced since 2015 as standard features for inflation reduction:

- Public meetings by the NBU Board on monetary policy are held eight times a year since 2018;
- Announcing each monetary decision via a press release or press briefing featuring the regulator's members;
- Issuing of the Inflation Report along with the macroeconomic forecasts by the NBU;
- Release of Monetary Policy Committee discussion summaries [26].

In the research “The Effectiveness of the Monetary Transmission Mechanism in Ukraine since the Transition to Inflation Targeting”, to determine the rationality of economic agents in Ukraine, the following hypotheses were tested:

1. A central bank's key rate changing unanticipatedly harms long-term forward rates according to Rezessy [34]. When the regulator raises its key rate to respond to rising inflation, government securities' yield curves tend to slope upward. Consequently, central banks lower long-term forward yields by taming inflation in this manner.

The analysis of this hypothesis is based solely on obvious evidence due to the limited availability of data. A four-step increase in the key rate was carried out by the NBU in the period from October 2017 - March 2018. There were no expectations for the first two hikes among financial analysts. As a result, the market learned the National Bank is prepared to defend its inflation target, despite not expecting a tightening of policy in the past. This resulted in a rise in current yields on DGBs whilst forward rates remained flat or declined. The market considers the NBU's behavior when determining whether this channel is effective.

2. There is no consideration for current price trends in inflation expectations, or they are unbiased. To examine this hypothesis, the inflation expectations for the following year in the division of months were compared with actual values of inflation in 12 months. According to Ranchhod, bias might exist when forming expectations, as indicated by the mean error that considers the deviation sign [35].

Understatement of expectations is suggested by a negative error, which was observed for all respondent groups except firms, where it is positive but nearly zero. This tendency towards underestimating inflation was a consequence of unforeseen shocks that hastened inflation during the survey period, especially in 2015 and to a lesser extent in 2017. Despite this, the results were encouraging as the expectations had not been anchored at high levels of actual inflation and were expected to decrease. Those expectations can be anchored more closely to the inflation target as we gain experience with inflation targeting. Moreover, it was found that respondents consider factors other than current inflation when forming their expectations [26].

3. The inflation expectations are influenced by forward-looking inflation, not backward-looking. First of all, it is necessary to mention that some quantitative analyses suggest that inflation expectations are not rational not only in developed countries like Sweden but also in developing countries like India [36, 37].

The results of research show that there is a future-oriented component to the expectations of all economic agents. It is no surprise that financial analysts are highly future-oriented, as they associate future inflation expectations with future inflation rates. Their forecasting skills are better, and they already know the NBU's monetary policy goals. In contrast, current inflation indicators primarily determine other economic agents' expectations [26].

A thorough examination of the expectations channel would have been possible but isn't available right now due to the lack of detailed studies of Ukraine's wage and pricing mechanisms and the effects of monetary policy on them. Additionally, short survey periods (especially for inflation targeting periods) would permit accurate estimates of expectations.

Based on the available data on inflation expectations, Ukrainian researchers found that these expectations are a function of not only current and backward-looking inflation but also future inflation expectations. It is also necessary that economic agents are better at making predictions than simply using naïve forecasts. This mainly applies to skillful analysts, who already have a superior level of understanding of regulator goals and the way it conducts its monetary policy. Enterprises and households still have weak links to the NBU's inflation target in terms of their inflation expectations. It is due to the initial low level of trust, the short time of inflation targeting regime work in Ukraine, and considerable inflation shocks of recent years.

Maintaining a consistent monetary policy for a long time can lead to inflation expectations anchored near the NBU's inflation target, according to the study's results. A more comprehensive analysis would be possible with more data, especially for timeframes during which the NBU used inflation targeting as a basis for monetary policy.

Moreover, it is necessary to mention that there are two monetary transmission channels, which don't have such power in Ukraine as the three previous ones. They include credit and asset channels.

In general, the credit channel theory suggests that tighter monetary policy increases the premium for external financing due to imperfections in the credit market, such as the principal-agent problem and information asymmetry. Borrowers have a better understanding of their investment project's success chances than creditors, leading to a risk premium on all types of external financing. This results in adverse selection and moral hazard, causing a gap between the cost of external and internal funds. Therefore, an increase in the central bank's key rate decreases aggregate demand and loan supply.

A credit channel consists of two components: the lending channel and the balance sheet channel. They operate differently. In the lending channel, credit resources in the banking sector are reduced by tighter monetary policy. On the other hand, the balance sheet channel relies on the financial accelerator principle, where changes in interest rates have a direct impact on cash flows and collateral values. Hence, as interest rates increase, net worth decreases, and external financing premiums increase [21].

However, the credit channel's contribution to the monetary transmission mechanism in Ukraine is not outstanding, as evidenced by recent studies. Commercial banks prefer to finance reliable borrowers despite monetary conditions, particularly those affected by the armed conflict [38]. Additionally, institutional factors, such as poor creditor rights protection, restrict the fast resumption of lending. As well, large corporations can borrow from their parent companies and issue Eurobonds instead of borrowing from banks. Moreover, the corporate sector's dependence on bank lending has reduced in recent years, financing only 5.3% of investments in 2017 [21].

Another monetary transmission channel is the asset one. In theory, it works the following way: a central bank's key rate hike leads to a decline in asset prices, particularly bonds (yield increase), stocks, financial derivatives, and commodity futures. These prices serve as the foundation for consumer prices, collateral appraisal

(especially real estate), and real estate prices themselves. As a result, asset prices affect consumption through the wealth effect and liquidity of households [39].

However, the asset price channel works best in countries with developed stock and commodity markets, like the US, and has limited capacity in Ukraine. The main reason for it is that the stock market in Ukraine is still in an early stage, with stocks playing no significant role in household financial assets. Similarly, government securities account for only UAH 36,1 billion in the circulation of individuals and UAH 115,7 billion – legal entities as of May 1, 2023 [40].

The asset price channel's effect may be noticeable to some extent via substantial amounts of foreign currency held by households as savings. A tighter monetary policy that strengthens the hryvnia exchange rate reduces the real value of household savings in foreign currency. This may affect households' long-term consumer and investment decisions.

In summary, the NBU has been successful in implementing the inflation-targeting regime and resolving the banking system crisis since 2016. Research conducted by Ukrainian scholars has shown that the interest rate, exchange rate, and expectations channels have been effective. However, the credit channel remains ineffective, and the asset price channel is underdeveloped. The reasons for this include an underdeveloped financial system, low stock market development, and the limited role played by long-term investment institutions such as pension funds, as well as historical factors such as high and volatile inflation, low trust in the central bank, and structural changes.

2.2. The monetary policy experience during the war and post-war periods

During a crisis, the objectives of a monetary policy shift to address the unique challenges presented by a military economy. In such an economy, government expenditure rises, and the state's role in the economy becomes more prominent. Furthermore, economic decisions are dominated by security concerns, and the economic multiplier effect is limited due to the destruction caused by war [41].

If we look at the Federal Reserve System of the U.S. when World War II outbroke, the challenges for dealing with a considerable surge in the federal deficit due to increased war expenditures occurred even though the Treasury was depended more on taxes than it was during World War I and even with the rise in tax revenue due to the significant growth in industrial production [42].

To promote stable financial markets and reduce interest rates on financing large deficits, the FRS controlled government bond prices and established a maximum yield. The FRS's commitment to maintaining low yields resulted in the purchase of a significant volume of government securities, producing a substantial expansion of the Federal Reserve System's balance sheet and the monetary base (by 149% from August 1939 to August 1948). Moreover, the outbreak of war in Europe led to an acceleration of gold inflows as Britain and other allies paid for domestically produced war materials and supplies by shipping gold to the United States [43]. This, along with another contributing factor, resulted in a strong expansion of the monetary base and the money supply. As a result, inflation rose significantly during the war despite price and wage controls, and consumer credit controls were imposed to curb inflation.

For many years, reserve requirements were an important part of US monetary policy, but since the Treasury-Federal Reserve accord, more emphasis was placed on open market operations. Selective credit controls, except on stock exchange securities, were not a permanent part of monetary control. However, the US did not face the same reconstruction or payment difficulties as other countries, and its simple monetary policy techniques combined with budget surpluses facilitated steady economic growth and high employment. Although there had been no direct controls for most postwar years, the US experienced moderate price increases compared to other countries [44].

If we look deeper into the foreign experience of countries who took part in World War II, Belgium was one of those that returned the fastest to economic liberalism by using monetary policy, which was consistent with the country's prevalent liberal philosophy. Belgium undertook a monetary purge in October 1944 to reduce the money supply by blocking part of the currency and bank deposits.

Besides, the banking system's liquidity was attacked to avoid excessive expansion of bank credit. Banks were required to keep 50 to 65% of their demand deposits as cash or government securities, and this provision has remained in force with minor modifications. The use of the discount rate technique began in January 1945 when the rate was lowered from 2 to 1.5% to promote the revival of production and the replenishment of stocks. The rate was gradually raised as the economy recovered and lowered during an economic recession in 1949 [44]. The central bank also set up a system of certified bank acceptances for imports and exports, which had been developed considerably and become the basis for charging different discount rates for different types of bank paper.

Analyzing the Netherlands and its experience with monetary policy after World War II, the country faced latent inflation with a money supply four times larger than in 1938, and wholesale prices 80% higher than prewar levels in May 1945. The government tried to tackle the problem in September 1945 by withdrawing and blocking all currency and deposit money. The idea was to gradually deblock old accounts to provide means of payments for current contributions to production. However, the deblocking of old money and assets together with the creation of new money led to the re-emergence of latent inflation in the early postwar years. Control over bank credit was exercised, with banks not allowed to give credit to anyone still holding blocked accounts. The discount rate remained at the 1941 level of 2,5%, and banks were not subject to reserve requirements. The mainstay of credit control was direct quantitative control. By 1949, the ratio of the money supply to national income had been restored to the 1938 level, and the excess money supply had been influenced with the help of rising prices and import surpluses [44].

Looking back at Germany after World War II, Germany demonstrated economic achievements since the currency reform of 1948, attributing them to a combination of monetary policy and generous U.S. assistance. Employment in industries has increased by over 20% and industrial production has more than doubled since then, while real wages have increased along with productivity. Germany adopted a tight monetary policy to control inflation, which was a major issue of the post-war period due to the previous period of hyperinflation. The central

bank was committed to maintaining price stability. Germany achieved a small balance of payments surplus and a commanding cumulative surplus with EPU by 1952. Despite a remaining unemployment amount of 1.1 million people, the country's progress should be judged against the backdrop of a rise in employment and real wages and the influx of millions of refugees from Eastern Germany. The Bundesbank was established in 1957, known for its independence and commitment to price stability. This independence was critical for implementing effective monetary policies without political interference. The primary goal of the Bundesbank was to maintain price stability. This objective guided its monetary policy decisions, often leading to higher interest rates to combat inflationary pressures.

France pursued an active monetary policy since World War II but faced unique economic challenges including persistent budget deficits, political instability, and social tensions. To combat inflation, France implemented an elaborate system of quantitative and qualitative controls over credit. However, as inflationary pressures continue to be generated, massive wage and price increases become inevitable. French monetary policy was characterized by periodic attempts to patch up loopholes in existing credit controls while acknowledging the need to raise the limit on credit in response to inflation [44]. Also, France was a significant beneficiary of the Marshall Plan, an American initiative to aid Western Europe. This aid was crucial in rebuilding France's economy and stabilizing its currency. In the result, by the 1950s, France's economy began to experience significant growth. This period, known as the “Thirty Glorious Years”, characterized by rapid industrialization and economic expansion.

After World War II the United Kingdom's monetary policy changes represent a more complete return to monetary orthodoxy compared to other countries. The new monetary policy relied on controlling bank liquidity to restrict the availability of bank credit, without using statutory reserve requirements or keeping interest rates low. The fear of increasing the cost of government debt had been set aside for a flexible monetary policy. Besides, short-term government paper interest rates increased to encourage banks to hold short-term government investments. Qualitative credit controls were used along with indirect pressure on banks during refinancing operations.

It is common and effective to peg the exchange rate at the start of military activities to stabilize macro-financial conditions. For instance, in 2008, the Georgian central bank stabilized the foreign exchange market by fixing the lari to the USD during the summer and autumn months. However, to achieve this, they had to devalue the domestic currency by 16% and stabilize the exchange rate at a new level through foreign exchange market intervention [45]. Similarly, Israel used various forms of pegging the shekel with varying degrees of success since 1985 but only introduced a floating exchange rate in June 2005 [50]. However, keeping the exchange rate fixed for an extended period can result in accumulating macroeconomic imbalances, as the effect of stabilizing the exchange rate diminishes over time. This fact is exemplified by the negative experiences of Libya (2016-2020) and Lebanon (in 2020) [46]. It is also worth noting that foreign exchange crises can occur even in peacetime if the exchange rate remains fixed for too long, as was the case in Chile, Mexico, and Thailand.

It is important to consider the link between war financing and monetary policy. War can be financed through various means, including tax increases, borrowing from domestic and foreign markets, receiving financial aid from other countries, and borrowing from the banking system. However, when central banks finance a large portion of the budget deficit, it often results in hyperinflation, high levels of dollarization, and, in some cases, the loss of monetary sovereignty. This was demonstrated after the First World War in countries such as Germany (where inflation reached 29,500% month-over-month in October 1923), Austria (which experienced 129% month-over-month inflation in August 1922), Poland (with 275% month-over-month inflation in October 1923), and others. Similar experiences occurred after the Second World War in Japan, Hungary, and again in Germany and Austria. South Korea also experienced high inflation during the Korean War (213% year-over-year in 1951), and Israel experienced a surge in inflation after the Lebanon War (480% year-over-year in November 1984) [48].

To recover from wartime crises, many countries have found success in abandoning monetization and adopting a more independent monetary policy, fiscal consolidation, and market financing. Two examples of successful programs were

implemented in Israel and Croatia. Israel's program, for instance, significantly reduced annual inflation from 480% to 18% in the mid-1980s through a combination of fiscal consolidation (such as subsidies reduction, new tax introduction, and limiting civil servants), tight monetary policy, and structural reforms [2]. Similarly, Croatia introduced a comparable program in 1993 after annual inflation surpassed 1000%, implementing measures such as tight monetary policy, fiscal adjustments (such as increasing tax revenue and reducing state budget expenditures), and structural reforms (such as accelerating privatization and demonopolizing the economy) [52]. Both countries limited the central bank's financing of the government and, with the collaboration of the government and central bank, successfully controlled inflation and stabilized inflationary expectations.

International experience with monetary policy tools in the post-war period varies significantly across countries, reflecting different economic conditions, institutional frameworks, and policy objectives. International experience on monetary policy tools in the post-war period is considered in Table 2.2.

Table 2.2. The monetary policy tools of the countries in the post-war period

Country, Year	Monetary policy of Central Bank
The United States of America, 1946-1953	<ul style="list-style-type: none"> • The preferential discount rate was abolished, marking the first move towards flexible interest rates. • The discontinuation of the buying offer on Treasury bills in July 1947 led to an increase in the rates on new issues of Treasury bills and certificates, which narrowed the spread between short-term and long-term interest rates and affected the money market rates. • The legal maximum requirements for central reserve city banks were increased to avoid a situation of bank credit's excessive expansion. This step reduced potential bank credit expansion by about 12 bln USD. • Temporary controls were imposed on consumer credits to curb speculative purchases of securities made with borrowed money.
France, 1945-1953	<ul style="list-style-type: none"> • The discount rate was raised significantly (from 1,625% to 3,5%) together with the rate on advances against securities (from 2,75% to 4,5%). These moving-ups resulted in the cost of borrowing from banks and made government bonds more appealing. In early 1950s, the discount rate was lowered to 2,5% to ease the restrictions on loans. • The direct credit controls were initiated to give the power for the National Credit Council to grant authority to provide banks with instructions or recommendations on the types of loan they should promote or discourage. • The regulations on mandatory reserves were also updated (during 1945-1950 every month, in 1951 – on daily basis) and increased.

<i>Continuation of Table 2.2.</i>	
Country, Year	Monetary policy of Central Bank
Germany, 1948-1953	<ul style="list-style-type: none"> • Change from the old Reichs mark to a new Deutsche Mark. The conversion rate of RM 10 to DM 1 was used to convert most monetary claims under the currency reform, which also declared the entire internal debt of the old Reich worthless, resulting in a reduction in the money supply and liquid assets in the economy. • The minimum reserve requirements and the key policy rate were raised to restrict bank credit in 1948 and 1950. • Imports were made harder to finance by requiring a 50% cash deposit at the central bank for import permit grants or extensions. As a result, the balance of payments position improved.
The United Kingdom, 1945-1953	<ul style="list-style-type: none"> • The interest rates on short- and long-term government security rates were decreased to sell Treasury Bills held by government agencies to banks and purchase long-term securities from the public with the proceeds of the Treasury Bill sales (Ultra-cheap-money policy). • Qualitative control over bank credit was introduced, consisting mainly of instructions sent out to banks by the Bank of England regarding the priorities to be given to different uses in granting bank advances. • A substantial outflow of reserves, primarily due to the UK's balance of payments situation, occurred in 1951 amounting to \$1.5 billion over six months. To stop this drain, the key policy rate was raised several times step-by-step, the peg on the Treasury Bill rate was removed, and the direct or qualitative controls were further intensified.
Israel, 1985	<ul style="list-style-type: none"> • The Bank of Israel increased the reserve requirements and the real discount rate to restrict the growth of deregulated banking lending. • The minimum term for dollar-indexed deposits was raised to 1 year. • The new central bank law was introduced, prohibiting borrowing from the BoI to finance the budget deficit. • The tradability of government bonds was improved. • The exchange rate was devaluated, partially unified for importers and exporters, and the rate was fixed to the USD at NIS 1,5 per dollar.
Croatia, 1995-2000	<ul style="list-style-type: none"> • The Stabilisation Programme included the establishment of nominal exchange rate targeting framework as a crucial component. • The emergence of numerous new banks due to financial liberalization and low requirements has led to intense competition for deposits, resulting in the establishment of attractive deposit rates. • To prevent appreciation, the monetary policy facilitated capital inflows by buying foreign currency. • The excess liquidity was sterilized mainly through reserve requirement, but the CNB also issued voluntary and obligatory bills in kuna with high interest rates, which succeeded in lowering money market interest rates.

Source: developed by authors based on [42-50]

The effectiveness of these tools depends on various factors, including the state of the economy, the financial system's structure, and the central bank's credibility. In the post-war context, the focus often shifts towards rebuilding and stabilizing the economy, addressing inflation or deflation, and ensuring a smooth transition to peacetime economic conditions. International coordination and learning from global best practices also play a significant role in shaping post-war monetary policy.

2.3. Evaluation of the effectiveness of monetary policy in Ukraine

Throughout the war period, the NBU's monetary policy was adaptive, focusing on crisis management and the stabilization of the financial system while laying the groundwork for post-conflict economic recovery. The unique challenges posed by the war necessitated a departure from conventional monetary policy practices, emphasizing the need for flexibility and responsiveness in central banking during times of crisis. Based on the information provided above, Ukraine followed a similar path to other countries when the NBU chose to peg the exchange rate of hryvnia to USD during the onset of the invasion. This move was made by the regulator to maintain stability in economic agents' expectations and thereby ensure macro-financial stability during the war. In addition, the fixed exchange rate played a vital role in controlling inflation [21, 24].

Foreign exchange interventions have become the main monetary policy instrument in Ukraine during the war. By imposing foreign exchange restrictions and intervening in the interbank market to cover the remaining foreign exchange deficit, the NBU was able to fix the exchange rate. Also, certain restrictions were imposed on some foreign exchange transactions and capital movements. In such a way, NBU wanted to prevent nonproductive capital outflows, thereby limiting foreign exchange demand.

At the same time, in the first several months of the full-scale invasion, the regulator decided to postpone its decisions regarding the central bank rate and left it at 10% till the beginning of June 2022, when the Board of the NBU raised the key policy rate to 25% [21].

At the beginning of the extensive Russian aggression, the NBU chose not to make any significant decisions regarding the key policy rate. The reasoning behind this decision was the immense psychological pressure caused by the full-scale invasion. As a result, altering the key policy rate was unlikely to have a positive impact on stabilizing expectations and encouraging the retention of hryvnia assets, particularly in support of the fixed exchange rate. Instead, the NBU focused its

monetary policy efforts primarily on guaranteeing the uninterrupted functioning of the banking system and payments within the economy.

The situation with inflation was worsening, as it was accelerating from February to May (from 10,7% to 18% respectively) due to the disruption of production and logistics [21]. Moreover, the persistently high global energy prices exerted significant inflationary pressure on consumer inflation, both directly and indirectly, through increased production costs. Furthermore, global inflation rates also recorded high values, exceeding 8% in the United States and euro area countries, which was further fueling the rise of domestic prices. Despite the gradual economic recovery, the upward inflation trend was expected to persist in the upcoming months. This may have worsened inflation expectations, influencing depositors to convert their hryvnia savings into foreign currency. To mitigate these negative effects, the NBU returned to an active interest rate policy.

The NBU's governing board has opted to maintain the key policy rate at 25% while also raising the required reserves ratios for banks. These actions were expected to promote greater appeal for hryvnia-based assets, reinforce the stability of the exchange rate, and gradually mitigate inflationary pressures. Furthermore, the choice to maintain the key policy rate at its current level is motivated by the need to uphold exchange rate stability. Additionally, it creates suitable circumstances for the persistent reduction of inflation and the alleviation of the most oppressive foreign exchange constraints.

As the Ukrainian economy was gradually adapting and the psychological shock of the conflict subsided, there was a need to change the approach to monetary policy. With low yields on hryvnia assets, there was an increased risk of dollarization of the economy and the financial system losing valuable resources. The depreciation expectations of households and businesses were also vulnerable to changes in the war situation, especially those on the frontline and other situational factors. To address these issues, the NBU decided to intensify its interventions to sell foreign currency. However, the difference in the cash market exchange rate and the official exchange rate widened, exacerbating the negative effects on the economy caused by multiple

exchange rates and restrictions on foreign exchange transactions and cross-border transfers.

The NBU admitted that the fixation of the exchange rate at USD/UAH 29,25 had a restraining effect on the cost of goods and services and influenced inflation and exchange rate expectations. Economic agents were adapting to the war, and consumer imports recovered faster than exports due to restrictions on seaports that were till July. During that period, The U.S. dollar strengthened markedly against most currencies, including reserve currencies, and the fixed exchange rate caused more imbalance in the economy and high pressure on international reserves. As a result, the members of the Monetary Policy Committee agreed that maintaining the exchange rate at pre-war levels was unjustified and that improvements in export logistics and imports justified a policy change. However, returning to a floating exchange rate was seen as premature, so a one-time adjustment of 25% was made to fix the exchange rate at a new level of USD/UAH 36,56 per USD. This adjustment was expected to reduce demand for noncritical imports, improve the competitiveness of domestic production, and stimulate exports. External financing and the exchange rate adjustment allowed international reserves to be maintained at a sufficient level (as of May 1, 2023, Ukraine had reached its historical value of USD 35,9 billion in international reserves, covering 4,9 months of future imports), strengthening the NBU's ability to control the exchange rate and inflation trends [21, 23, 24].

According to the recent situation with inflation in Ukraine, it has been decreasing at a great pace than predicted for the third consecutive month (as of April 2023, the annual consumer inflation dropped to 17,9%, which was much lower than in December 2022 – 26,6%; the rates of price growth were also lower than the trajectory outlined in the NBU's Inflation Report published in January 2023). This decline is attributed to the significant supply of food, sufficient fuel reserves, and improvements in inflation and exchange rate expectations. The latter is mainly due to the NBU's consistent monetary policy that seeks to maintain exchange rate stability and increase the appeal of hryvnia savings.

The decrease in inflation is anticipated to persist, mainly because of the reduced expense of energy resources in the worldwide market, limited internal

demand, and the influence of the monetary policies implemented by the NBU. Considering the collective impact of these factors, alongside the significantly improved situation in the energy sector, the NBU has modified its inflation projection for 2023, lowering it from 18.7% to 14.8% [23].

At the same time, the notable decline in inflation every year is mainly due to the elevated reference point of the previous year, coupled with the mild winter climate that reinforced this pattern. Nevertheless, the strain on production expenses for businesses remains prominent, including the challenges of managing operations and adapting logistics networks amidst the ongoing conflict. As a result, the ongoing conflict remains a major source of uncertainty, which poses a significant risk to future inflation trends. That's why NBU highlights the necessity to keep the key policy rate at a high value to bolster the impact of previous measures by the regulator and facilitate additional growth in the investment appeal of hryvnia savings.

In addition to it, the NBU has taken steps to strengthen the monetary transmission and increase interest rates on hryvnia deposits, including tightening reserve requirements (RR) for current accounts and demand deposits. Moreover, starting from February 11, 2023, banks can use a wider range of domestic government debt securities to cover up to 50% of their total required reserves. The NBU implemented this measure to encourage banks to actively participate in auctions held by the Ministry of Finance and help revive the domestic debt market, thereby avoiding direct funding of the budget deficit by the NBU in 2023 [21]. At the same time, these measures taken to immobilize liquidity may not be sufficient due to constant inflows of foreign exchange and government debt securities returning to the banking system. So, the question arises of what additional tools to protect hryvnia retail and corporate deposits from inflation and optimize the operational design of monetary policy to make hryvnia assets more attractive could be implemented. The members of the MPC also believe that NBU's measures to stimulate hryvnia term deposits and stabilize the foreign exchange market should create conditions for easing foreign exchange market restrictions, which adversely affect business activity.

From September 15, 2023, the National Bank has taken decision to decrease the central bank rate from 22% to 20%. The decrease of inflation allowed to decline

further the central bank rate. Furthermore, from October 27, 2023, the key policy rate was set at 16% [21]. Moreover, the NBU sees the possibility of an additional reduction in the central bank rate at the next meeting. At the same time, the expected trajectory of inflation limit the scope for softening the interest rate policy next year. A return to the cycle of lowering the key policy rate in 2024 will be possible only in the event of a significant reduction in the risks to exchange rate stability and inflationary dynamics.

Since the beginning of the full-scale russian invasion, the NBU has been constantly communicating its commitment to inflation-targeting combined with some extra measures needed to stabilise the foreign exchange market and banking system. At the same time, the successfulness of inflation-targeting depends greatly on the strength of the links between monetary policy instruments and the real economy. The importance of these links for an adequate macroeconomic environment constitutes the relevance of this research topic. Next step is to evaluate whether current monetary policy and inflation-targeting has been more successful in decelerating and decreasing the volatility of inflation compared with fixed exchange rate.

The general approach for modeling the causal relationships in a national economy follows the design of "a semi-structural, forward-looking New-Keynesian model of a small open economy" [54] that the NBU uses for medium-term forecasting of key macroeconomic variables. Also, the research of David Wheat [57] on modeling macroeconomics with system dynamics tools was a great source of inspiration for the development of this model. There are 8 sectors in the model. Each represents a part of a national or a foreign economy.

In Figure 2.3, the first three sectors are displayed. We start with the assumptions concerning domestic interest rates. It is assumed that inflation expectations are the same for all economic agents in an economy (which is an obvious simplification, but this is a simple model of a national economy) and for foreign investors too. The sum of the expected inflation and the required real interest rate is the required nominal interest rate in the economy. The normal real interest rate is assumed to be equal to 3% per year as the NBU estimates that the neutral real interest rate in a steady state for Ukraine is 3% [54]. The neutral rate is the normal

rate because at such a level, the monetary conditions are neither tight nor accommodating [53, 55].

Additionally, it is assumed that the real interest rate changes only if a central bank changes its policy rate. And the policy rate of a central bank is a goal for real interest rate in the economy.

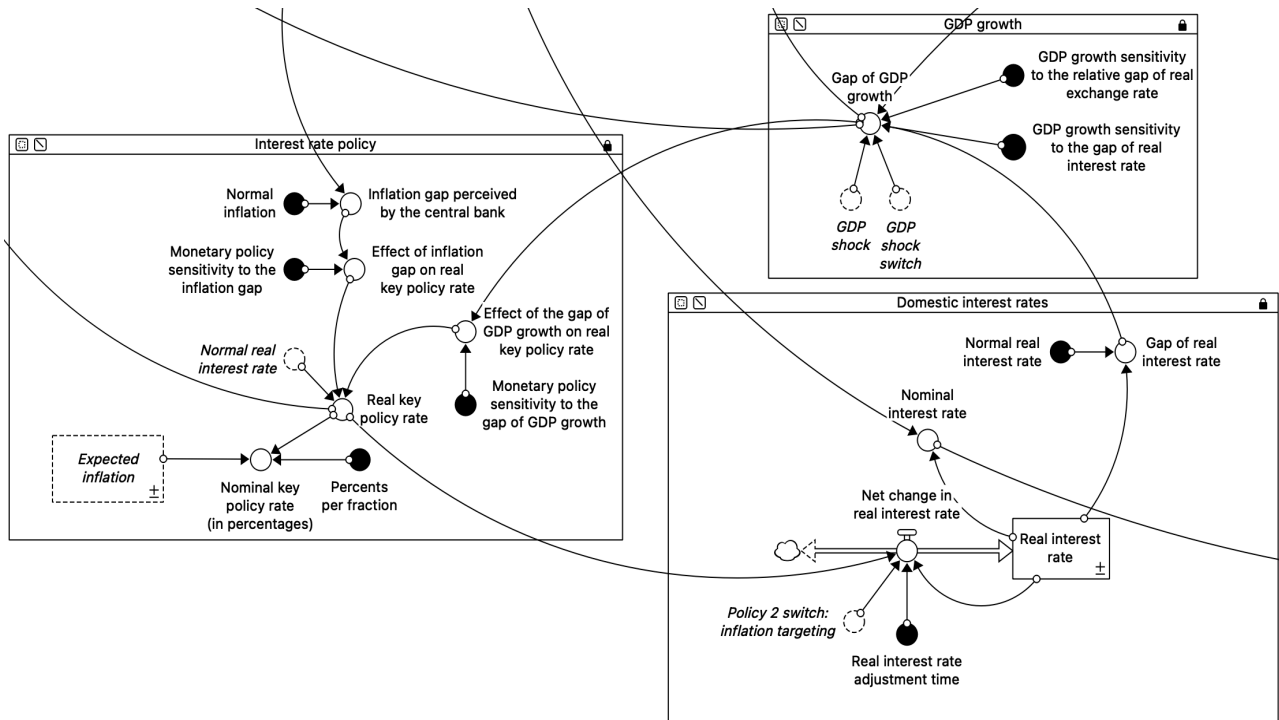


Figure 2.3. Interest rate policy, GDP growth and domestic interest rates sectors

Source: developed by authors in Stella Architect

In the GDP growth sector, real monetary conditions (real interest rate) and real conditions of international trade (real exchange rate gap) define the rate of change in GDP instantaneously. GDP growth sensitivities to the mentioned factors are assumed to be equal -0.035 and -0.065 , respectively [54].

The interest rate policy sector represents a decision rule of a central bank. Monetary policy sensitivity to the gap of GDP growth is assumed to be equal 0.4 . The lower bound for this parameter is equal to 0 , because usually, central banks are not willing to increase the interest rates to react to the positive gap of GDP growth as there are debates about whether the actual rate of GDP growth is higher or lower than the growth of the potential GDP. The upper bound for this parameter cannot be higher

than the lower bound for monetary policy sensitivity to the inflation gap because price stability is the overriding goal of monetary policy. Monetary policy sensitivity to the inflation gap is assumed to be equal to 2 [54]. This parameter cannot be less than 1, because in emerging economies, the financial depth of the country is low, and it requires quite significant changes in interest rates to affect the real production and inflation. Also, because of high volatility, various risk premiums, and high dependence of domestic businesses, particularly of banks, on loans in foreign currency, the transmission of the changes in the key policy rate into market interest rates could be incomplete, which will increase the need of higher sensitivity of monetary policy to the inflation gap. The upper bound is around 3 because too high sensitivity of monetary policy to the inflation gap in real world might significantly restrain economic development, which would lead to dissatisfaction of the population with the policy of a central bank, which will cause the change of management in the central bank and less sensitive monetary policy. Normal inflation for the period under consideration (2016-2022) is assumed to be equal 13% annually. This value is higher than the current medium-term inflation target because the targeted rate of inflation has been gradually decreased in 2016-2019.

In the domestic prices sector (Figure 2.4) it is assumed that inflation sensitivity to the changes in the nominal exchange rate is -0.05 as in the paper on the quarterly projection model for Ukraine [54] a respective parameter in the core inflation specification is calibrated to be equal -0.05. Similarly, the inflation sensitivity to the gap of GDP growth is equal to 0.18, while inflation sensitivity to the relative real exchange rate gap is assumed to be equal -0.06.

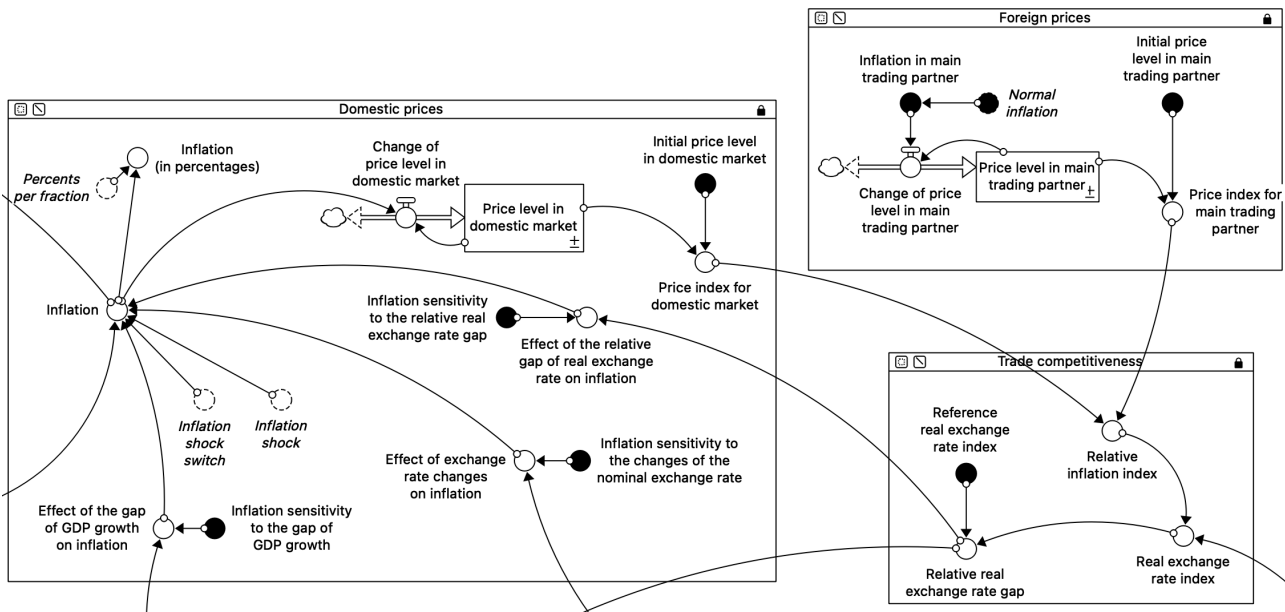


Figure 2.4. Domestic prices, foreign prices, trade competitiveness sectors

Source: developed by authors in Stella Architect

The most important component of the inflation formations sector (Figure 2.5) is the central bank credibility parameter. In the paper on the quarterly projection model for Ukraine [54], this parameter is assumed to be equal to 0.75. However, during the calibration, it was found that this value should be much lower, around 0.15. It makes more sense to assume that the central bank's credibility is closer to its lower bound as the central bank of Ukraine experienced a severe decrease in trust in 2014-2015 and there have been major changes in the regulations about the central bank and its mandate in Ukraine.

In the foreign exchange market (Figure 2.6) it is assumed that the nominal exchange rate sensitivity to the gap of nominal interest rate is around 0.25, because the effect of international flows of capital on the nominal exchange rate covers only one segment of the foreign exchange market and we are interested in the dynamics of this specific segment.

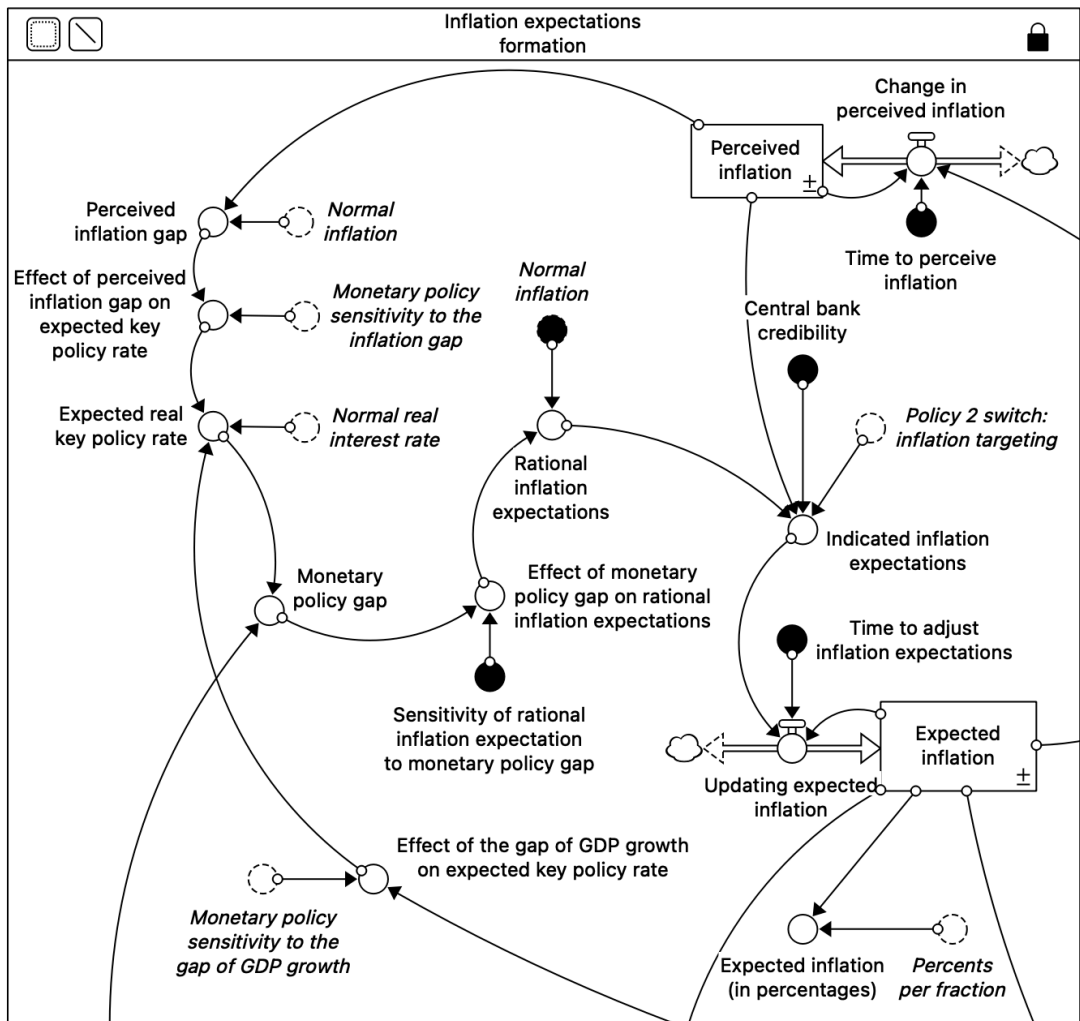


Figure 2.5. Inflation expectations formation sector

Source: developed by authors in Stella Architect

In this model the nominal exchange rate can change either because of international flows of capital or because of foreign exchange interventions by the central bank. This is a simplification, because there are other factors affecting nominal exchange rate like the revenues of exporters and the need for foreign currency to pay for imported goods. Because of the assumption that there are only 2 countries in the world of this model, the stock of the nominal exchange rate can also be considered a nominal effective exchange rate (NEER). The nominal exchange rate adjustment time is assumed to be equal to 1 year because Ukraine has a shallow financial market. Normal fraction for coverage of exchange rate volatility with foreign exchange interventions equals to 0.15 [54].

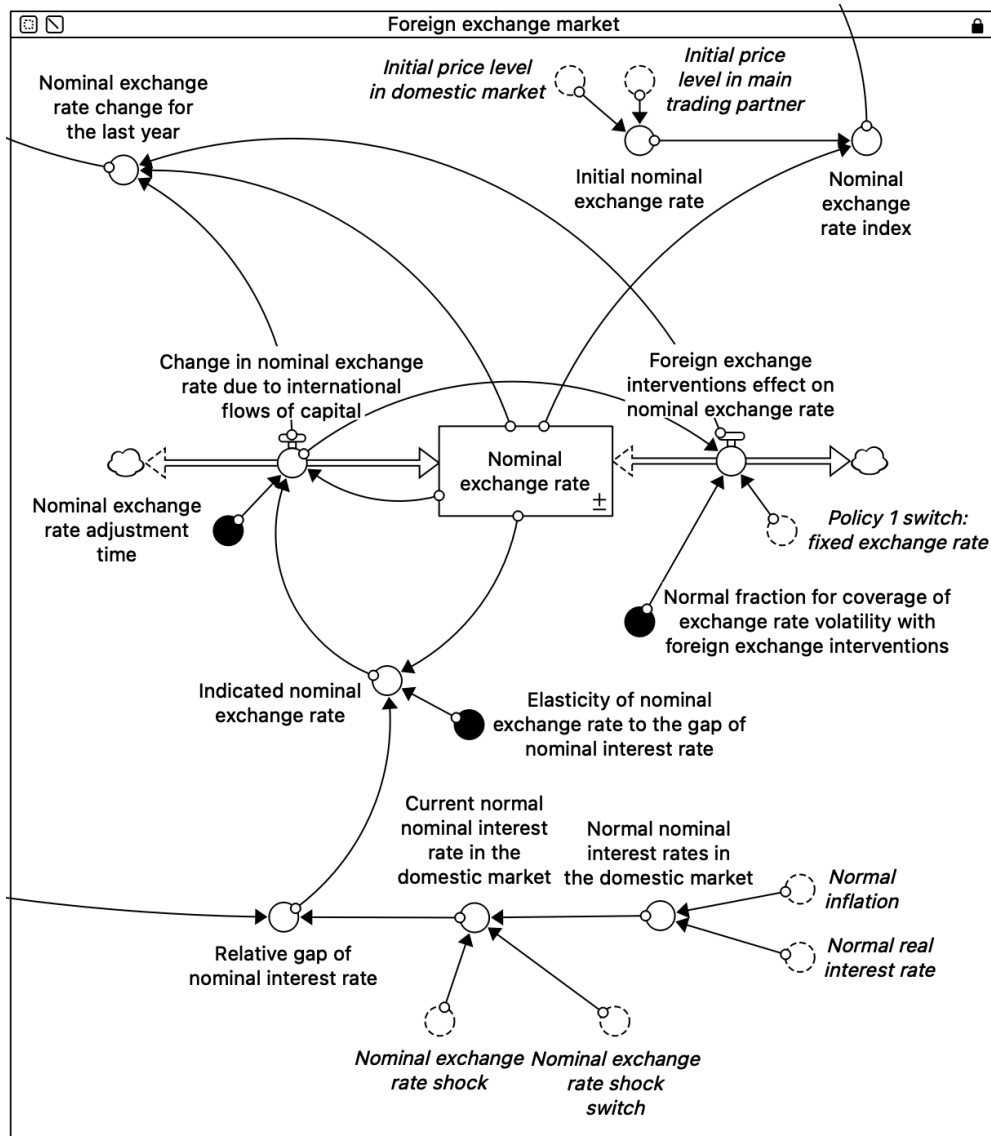


Figure 2.6. Foreign exchange market

Source: developed by authors in Stella Architect

Now that structure of the model is described, next step is to consider the dynamic hypothesis about the key structural relationships that drive the behaviour of our system. The most important feedback loops integrated in the model are summarised in the form of a causal loop diagram (Figure 2.7).

Self-fulfilling backward-looking expectations (R1). It is assumed that inflation expectations have persistent nature and are affected by the historical events which the population has seen. J. Sterman shows that expectations about prices tend to be primarily dependent on the past even when there is an abundance of complex methods for inflation forecasting [56]. At the same time, the actual price changes are

heavily dependent on inflation expectations, because manufacturers account for expectations when they set their prices.

Imported goods get relatively cheaper (B1). Ukraine is a relatively small economy, but at the same time it is extensively involved in international trade (the ratio of exports and imports to GDP has rarely fallen below 80% over the last few decades). Due to that, the inflation in the main trading partners of Ukraine affects the dynamics of prices in Ukraine through its effects on the relative trade competitiveness of foreign and domestic manufacturers. For example, if for a long period of time inflation stays higher in Ukraine than in the main trading partners, prices of goods and services of foreign firms will become very attractive for households in Ukraine. They will buy more imported goods and services and the general price level in the domestic economy will move towards the world price level.

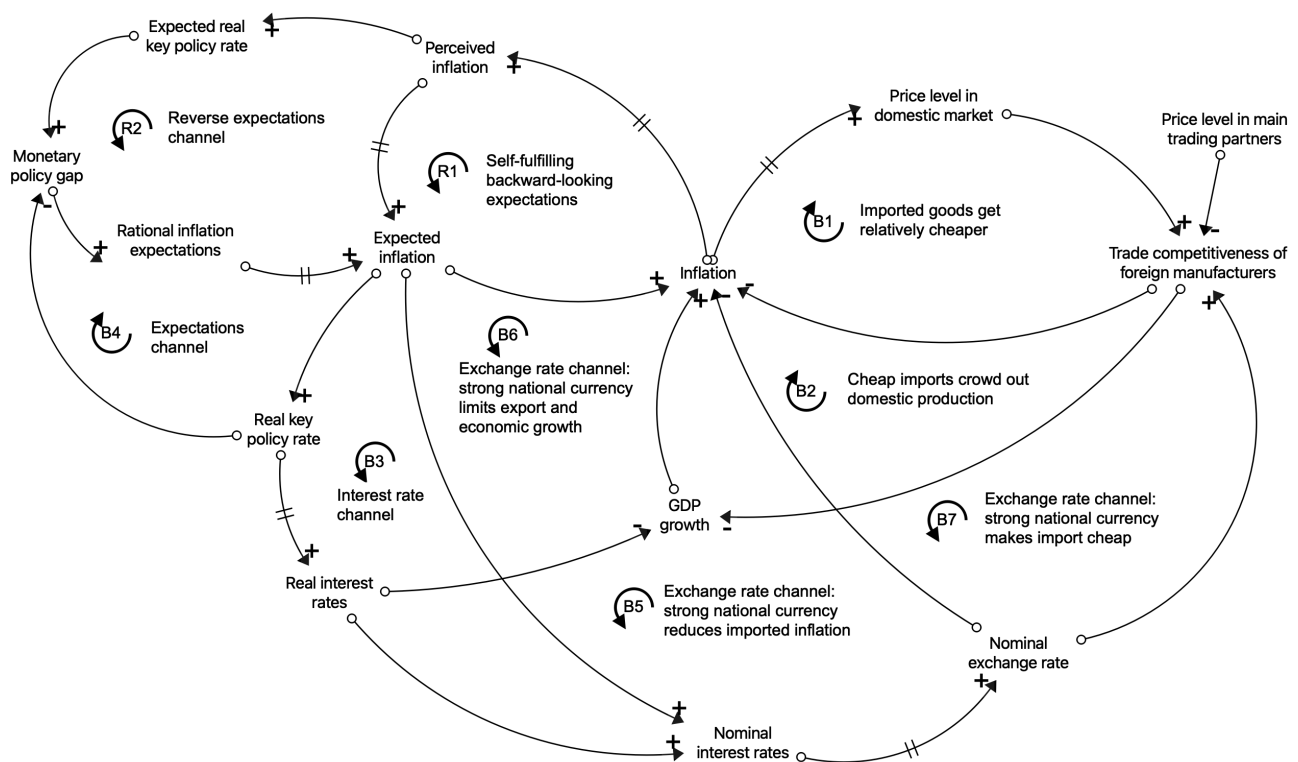


Figure 2.7. Causal Loop Diagram for key feedback mechanisms

Source: developed by authors in Stella Architect

Cheap imports crowd out domestic production (B2). This feedback loop is like B1, but here the influence of trade competitiveness on GDP growth is also considered. If we take the previously mentioned example of high persistent inflation in the domestic market, then we can also add that the increase in the demand for imported goods and services will decrease the demand for domestic ones. Also, exporters would not be able to sell as much as before in the foreign markets, because their prices became relatively high. As a result, GDP in the domestic economy will decrease and it will lead to a reduction in the demand-driven pressure on inflation.

Secondly, we need to discuss the feedback processes that are added when a central bank is using inflation-targeting monetary policy regime.

Interest rate channel (B3). When the forecasted inflation is higher than the inflation target, a central bank must increase its key policy rate. Real interest rates in the economy will increase as well because the key policy rate represents the cost of short-term borrowing for commercial banks. As a result, it will become more costly for firms to borrow money. Thus, investments will fall, and GDP growth will slow down. Slower GDP growth means less competition for resources in the domestic economy and smaller final demand, which would lead to a deceleration of inflation.

Expectations channel (B4). One of the key characteristics of inflation-targeting is public communication of the inflation target. A central bank is trying to convince the population that its actions will lead to the stabilization of inflation around the targeted rate in the medium term (1-2 years). And if a central bank is acting according to its vows, then the expected inflation will approach the inflation target.

Reverse expectations channel (R2). Conversely, if the actual actions of a central bank contradict the expected actions, inflation expectations will destabilize.

Exchange rate channel. It is assumed that higher interest rates in the domestic economy attract foreign investors, which is why the nominal exchange rate appreciates. This has a direct effect on inflation because the prices for imported goods become relatively lower (B5). At the same time, the appreciation of national currency increases the demand for foreign goods and services, which limits GDP growth (B6) and increases the proportion of relatively cheap imports in consumption (B7).

The structure of the model was developed as it was already mentioned based on the forecasting model that in its turn had been developed relying on modern mainstream macroeconomic thought. Rational inflation expectations were added to the sector of inflation expectations to make the expectations channel of the monetary transmission mechanism more explicit compared to the econometrics model. Most of the values for constant parameters in the model are taken from the quarterly projection model for Ukraine [54]. The values for other constant parameters are based either on assumptions or on the hand calibration of the model to historical data on inflation, inflation expectations, and the policy rate in Ukraine.

Next step is the model's sensitivity analysis, which is divided into 4 parts. The first three parts explore the sensitivity of key performance indicators to different values of individual parameters, and the parameters are separated into three groups because their involvement in the system behavior depends on the monetary policy regime that is used by a central bank. Also, policy sensitivity tests were conducted to explore the model sensitivity to constant parameters under different monetary policy regimes.

First parameters that are influencing the system independently of the monetary policy regime are considered. This group consists of constant parameters that stay active under each of the scenarios described in this article. That is why they were tested under all three scenarios to investigate the possible presence of leverage points that are independent of the monetary policy. Parameters were changed one at a time while other parameters remained the same for each of the tests in this part of the sensitivity analysis discussion. Stella's Model Analysis Tools were used with the following settings: Distribution – Uniform, Latin Hypercube sampling (Noise seed = 21), and 200 runs for each parameter under each scenario. The key results are presented in Table 2.3. The results indicate that the model is most sensitive to two variables: the adjustment time of inflation expectations and inflation sensitivity to the relative real exchange rate gap.

Table 2.3. Summary of results of the sensitivity tests for the parameters that are influencing the system independently of the monetary policy regime

Parameter [unit]	Range			Sensitivity	Uncertainty about the actual value
	Min	Used in the model	Max		
Time to perceive inflation [Year]	0.042	0.083	0.250	Numerical	Low
Time to adjust inflation expectations [Year]	1.000	2.000	4.000	High Numerical / Policy	High
GDP growth sensitivity to the relative gap of real exchange rate [(dmnl/Year)/(dmnl/Year)]	-0.400	-0.065	-0.010	Numerical	Average
Inflation sensitivity to the gap of GDP growth [(dmnl/Year)/(dmnl/Year)]	0.040	0.180	0.360	Numerical	Average
Inflation sensitivity to the relative real exchange rate gap [dmnl/Year]	-0.200	-0.060	-0.010	High Numerical / Policy	Average
Normal inflation [dmnl/Year]	0.010	0.130	0.250	Numerical	Average
Normal real interest rate [dmnl/Year]	0.015	0.030	0.060	Numerical	Average
Initial price level in domestic market [Units of national currency]	0.500	1.000	2.000	No	Low
Initial price level in main trading partner [Units of foreign currency]	0.500	1.000	2.000	No	Low

Source: calculated by authors in Stella Architect

The model shows both high numerical and policy sensitivity to the time to adjust inflation expectations parameter. This makes sense: if it takes longer to adjust inflation expectations then an ability of an exogenous shock to push inflation expectations higher would be limited (the reinforcing loop of self-fulfilling backward-looking expectation is weakened) and vice versa. Also, the results indicate that under inflation-targeting the development of inflation and inflation expectations

show enhanced oscillatory behaviour. This happens because the feedback loops that are added with inflation-targeting monetary policy regime force inflation to decelerate, while the actual monetary policy decisions are primarily dependent on the expected inflation which gets more volatile if there is a faster adjustment of the expectations. We could also see that under a combination of the monetary policy regimes (inflation-targeting and fixed exchange rate combined) oscillatory behavior is dampened. The reason for that is the fact that the fixed exchange rate makes the exchange rate channel of the monetary transmission mechanism inactive, which is why monetary policy becomes less effective in the deceleration of inflation. At the same time, it makes the deceleration of inflation smoother. There is also quite significant uncertainty about the real value of this parameter, which is why future research on this topic seems necessary.

The model shows both high numerical and policy sensitivity to the inflation sensitivity to the relative real exchange rate gap parameter. And similarly to the adjustment time of inflation expectations, under inflation-targeting monetary policy regime, the variation of this parameter affects the amplitude of oscillations of the key performance indicators. The reason for that is the dependency of the efficiency of the exchange rate channel of the monetary transmission mechanism on this parameter. A relatively large negative value of inflation sensitivity to the relative real exchange rate gap strengthens one of the balancing loops in the exchange rate channel, which is why monetary policy decisions affect inflation and inflation expectations faster.

Next step is to consider parameters that are introduced with inflation-targeting regime and stay active even if exchange rate is fixed (2 policy settings). This group consists of constant parameters that stay active either under a pure inflation-targeting monetary policy regime or under a combination of inflation-targeting with the fixed exchange rate regime. Parameters were changed one at a time while other parameters remained the same for each of the tests in this part of the sensitivity analysis discussion. Stella's Model Analysis Tools were used with the following settings: Distribution – Uniform, Latin Hypercube sampling (Noise seed = 21), and 200 runs for each parameter under each scenario. The key results are presented in Table 2.4.

Table 2.4. Summary of results of the sensitivity tests for the parameters that are introduced with inflation-targeting regime and stay active even if exchange rate is fixed

Parameter [unit]	Range			Sensitivity	Uncertainty about the actual value
	Min	Used in the model	Max		
Real interest rate adjustment time [Year]	0.250	0.500	1.500	Numerical	High
Monetary policy sensitivity to the gap of GDP growth [(dmnl/Year)/(dmnl/Year)]	0.000	0.400	1.000	Numerical	Average
Monetary policy sensitivity to the inflation gap [(dmnl/Year)/(dmnl/Year)]	1.000	2.000	4.000	High numerical / Policy	Average
GDP growth sensitivity to the gap of real interest rate [(dmnl/Year)/(dmnl/Year)]	-0.400	-0.035	-0.010	Numerical	Average
Sensitivity of rational inflation expectation to monetary policy gap [(dmnl/Year)/(dmnl/Year)]	0.500	1.000	2.000	Numerical	High
Central bank credibility [dmnl]	0.000	0.150	1.000	High numerical	High

Source: calculated by authors in Stella Architect

Also, here we extend the number of key policy indicators and include the nominal key policy rate because this rate is the most important instrument of a central bank that is targeting inflation. The model shows relatively high numerical sensitivity to the monetary policy sensitivity to the inflation gap parameter under pure inflation targeting monetary policy regime. This is expected because higher monetary policy sensitivity to the inflation gap strengthens the link from the expected inflation to the real key policy rate, which is why the nominal key policy rate takes higher values faster and its effects on inflation appear faster as well.

Under the combination of inflation-targeting and fixed exchange rate high numerical sensitivity is observable only for the nominal key policy rate, while inflation and inflation expectations do not change that much as under pure inflation-

targeting. This is due to the inactivity of the exchange rate channel of the monetary transmission mechanism when the exchange rate is kept constant. In other words, even though the nominal exchange rate has already increased a lot, it does not affect inflation and inflation expectations that much. As a result, the deceleration of inflation is caused primarily by the loops that are not dependent on monetary policy.

The model shows relatively high numerical sensitivity to the central bank credibility parameter under pure inflation-targeting. This happens because increased central bank credibility makes both B4 and R2 feedback loops stronger. On the one hand, higher central bank credibility makes it easier to decrease inflation expectations as the population has trust in its central bank. On the other hand, inflation expectations become much more sensitive to monetary policy decisions and react faster to the discrepancies between the expected key policy rate and the actual one.

Finally parameters that become inactive if exchange rate is fixed were considered. This group consists of constant parameters that stay active only if the nominal exchange rate is allowed by a central bank to float. Parameters were changed one at a time while other parameters remained the same for each of the tests in this part of the sensitivity analysis discussion. Stella's Model Analysis Tools were used with the following settings: Distribution – Uniform, Latin Hypercube sampling (Noise seed = 21), and 200 runs for each parameter under only one scenario – inflation-targeting. The key results are presented in Table 2.5.

The results indicate that the model is highly numerical and to some extent behaviorally sensitive to the parameter of inflation sensitivity to the changes in the nominal exchange rate. This is a result of high uncertainty about the actual value of this parameter, especially during times of high macroeconomic volatility. As we can see from the sensitivity test, if this parameter is set to be equal to a relatively large negative value (-0.7), the inflation rate decreases fast after the end of the exogenous shocks because of a sharp increase of the nominal exchange rates that attract foreign capital in Ukraine, which is why the national currency appreciates. As a result, imported inflation slow down, and headline inflation slow down as well.

Table 2.5. Summary of results of the sensitivity tests for the parameters that become inactive if the nominal exchange rate is fixed

Parameter [Unit]	Range			Sensitivity	Uncertainty about the actual value
	Min	Used in the model	Max		
Nominal exchange rate adjustment time [Year]	0.500	1.000	1.500	Numerical	Average
Elasticity of nominal exchange rate to the gap of nominal interest rate [dmnl]	0.125	0.250	0.500	Numerical	High
Inflation sensitivity to the changes of the nominal exchange rate [(dmnl/Year)/(dmnl/Year)]	-0.700	-0.050	-0.010	High numerical / Behavioral	High
Normal fraction for coverage of exchange rate volatility with foreign exchange interventions [dmnl]	0.075	0.150	0.300	Numerical	Low

Source: calculated by authors in Stella Architect

Next step is to evaluate macroeconomic resilience under three monetary policy regimes: inflation-targeting, fixed exchange rate, a combination of inflation-targeting and fixed exchange rate.

The first simulation scenario represents the actual monetary policy used in 2015-2021. The graphs in Figure 6. show the comparison of the historical behaviour of the key performance indicators with the results of the simulation. Accounting for the role of exogenous inflationary shock in 2015, the model was able to reproduce the historical trends relatively well. But the simulated development of the nominal key policy rate shows higher ranges of fluctuations. It can be explained by the fact that, in reality, the central bank of Ukraine is not willing to increase its key policy rate above the range of 25-30% as the productive influence of such changes on inflation degrades on such levels of interest rates, which is why the central bank is forced to use its other instruments to affect prices.

In the first year of the simulation, we observe that in addition to exogenous shocks inflation also accelerates due to self-fulfilling backward-looking inflation

expectations, while it takes a long time for inflation to affect trade competitiveness and international trade, which is why B1 and B2 have small effects amid the crisis. At the same time, the nominal key policy rate is growing sharply as the central bank is trying to counteract the reinforcing loop of inflation expectations and deal with the aftermath of the exogenous inflationary shock for inflation expectations.

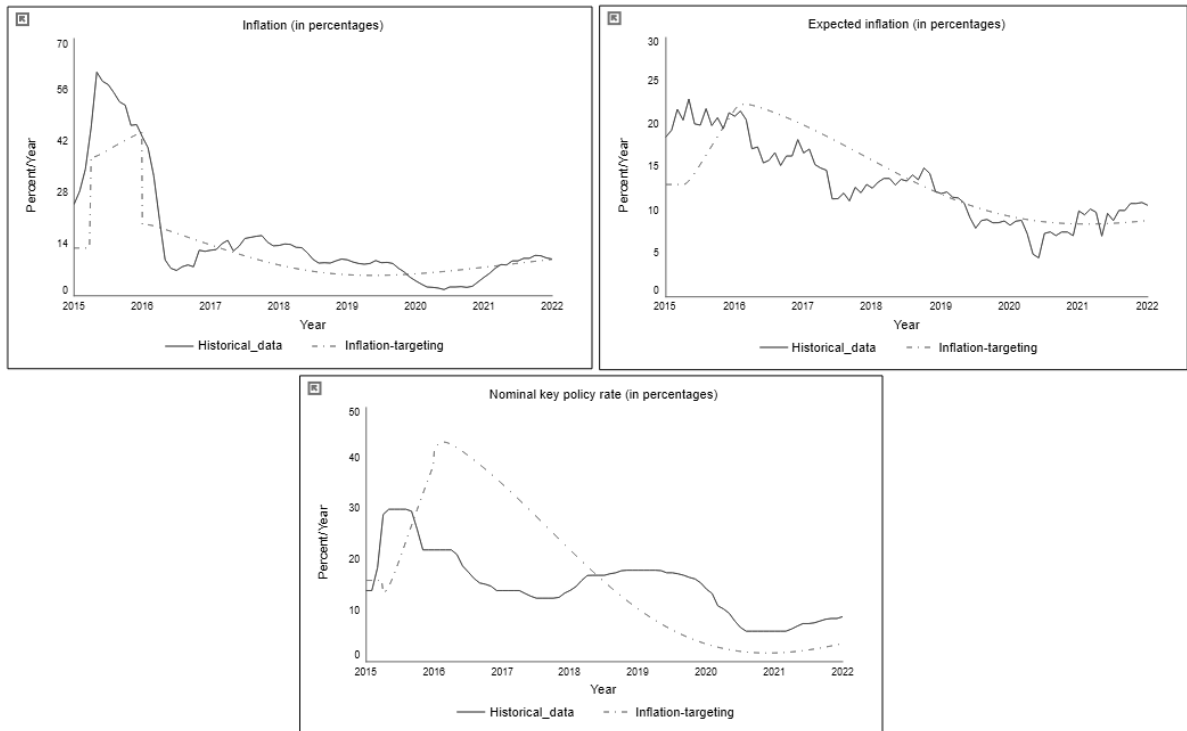


Figure 2.8. Behaviour of key performance indicators under inflation-targeting
Source: developed by authors in Stella Architect

After the exogenous shock is gone, the monetary transmission channels and the major balancing loops that are independent of the monetary policy start to decelerate inflation. But their effects have unequal delays, which is why in 2017 inflation is already lower than the initial normal level (13%) and still decelerating. It reaches the range of 5-6% in 2019 and starts to accelerate again as the monetary policy becomes expansionary. It should be noted that in the model the monetary policy has two goals: 1) stabilisation of inflation around its normal level (i.e., inflation target); 2) promotion of sustained economic growth when this goal does not contradict the first one. The same is observed in the real world. That is why, after inflation has been significantly decelerated, the second goal starts to grow in

importance for the central bank and the nominal key policy rate becomes even lower to stimulate the growth of GDP. As a result, by the end of the simulation inflation is around 10% per year and is close to its anchor i.e., inflation expectations (around 9%).

The role of the expectations channel is ambiguous. People judge the actions of the central bank by looking at the current inflation rate, while the central bank does not care and should not care that much about the currently perceived inflation rate which represents the past events, but about the future inflation as its policy is always future-oriented. In the model, this difference in anchors is captured by assuming that the central bank sets its key policy rate by looking at the inflation expectations which is a dynamic anchor for actual inflation, while the population judges the appropriateness of the nominal key policy rate by looking at the perceived inflation. As a result, during the simulation, the perceived (by the population) difference between the required key policy rate and the actual one (monetary policy gap) is very high in 2015: the central bank increases its key policy rate after it observes that inflation expectations get out of control, but such actions are viewed by the population as too weak and too delayed. On the other hand, in 2016-2020 the monetary policy is perceived to be too contractionary, which is why the future-oriented component of inflation expectations falls significantly.

Secondly, fixed exchange rate monetary policy regime scenario was simulated. If we consider the hypothetical situation in which in 2015 the central bank of Ukraine decided to adhere to its conventional policy of the fixed exchange rate, the development of key performance indicators would be different (Figure 2.9), though not too problematic. The graph of the key policy rate is not shown here as under the policy of fixed exchange rate a central bank is not trying to affect the interest rates in the economy, which is why the key policy rate becomes useless. It should also be mentioned that the key advantage of the fixed exchange rate monetary policy regime is the relative security it provides for the economic agents who hold assets nominated in the national currency. This is especially true during times of significant macroeconomic instability when there is a great risk of capital outflow from the country.

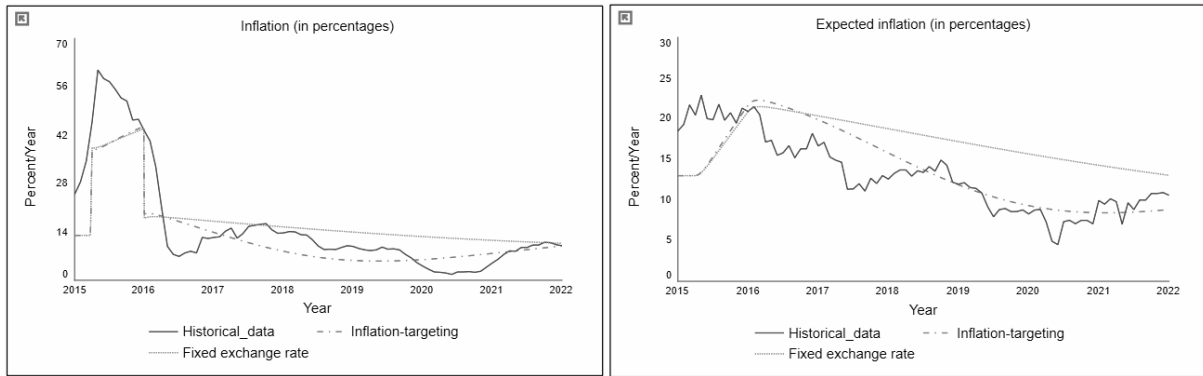


Figure 2.9. Behaviour of the key performance indicators under fixed exchange rate monetary policy regime

Source: developed by authors in Stella Architect

As can be seen, inflation and inflation expectations still converge to normal levels relatively fast. Even though all feedback loops that are added by inflation-targeting are turned off in this scenario, the influence of the accumulated over the crisis period gap of trade competitiveness forces the growth rate of domestic prices to slow down (B1 and B2 have a significant influence). Such results suggest that even though the chosen monetary policy regime was relatively efficient in the short and medium term, in the long-run active monetary policy has a relatively small effect on the overall price level. This is consistent with New Keynesian thought in macroeconomics.

Final step is to explore scenario of a combination of inflation-targeting and fixed exchange rate. This is an especially important scenario as currently (2023) NBU operates in a monetary policy setting that corresponds to this scenario. As it can be seen, the deceleration of inflation and the decrease of inflation expectations happen a little slower than under pure inflation-targeting. The reason for this is that the fixed exchange rate makes exchange rate channel (B5, B6, B7) of the monetary transmission mechanism inactive which is why the increased inflow of foreign capital into the domestic economy that follows the increase of the interest rates in the economy is not affecting the nominal exchange rate and does not help to slow down inflation in short and medium-term.

Interestingly, the key policy rate does not decrease as much by the end of the simulation as it did under pure inflation-targeting. This happens because due to the inactivity of the exchange rate channel the trade competitiveness of domestic manufacturers in the international market has not been worsened additionally to the effects of the exogenous shocks (inactive B6), which is why the GDP growth has been higher. Higher GDP growth prevented the central bank from further decreasing its key policy rate when expected inflation reached its normal range. Such results reveal a peculiar advantage of a combination of the fixed exchange rate with inflation-targeting: if a central bank of a small open economy is not willing to sacrifice economic growth for faster deceleration of inflation, it might use the fixation of the nominal exchange rate to “steal” some economic growth from the main trading partners by making the domestic manufacturers relatively more competitive in the international market.

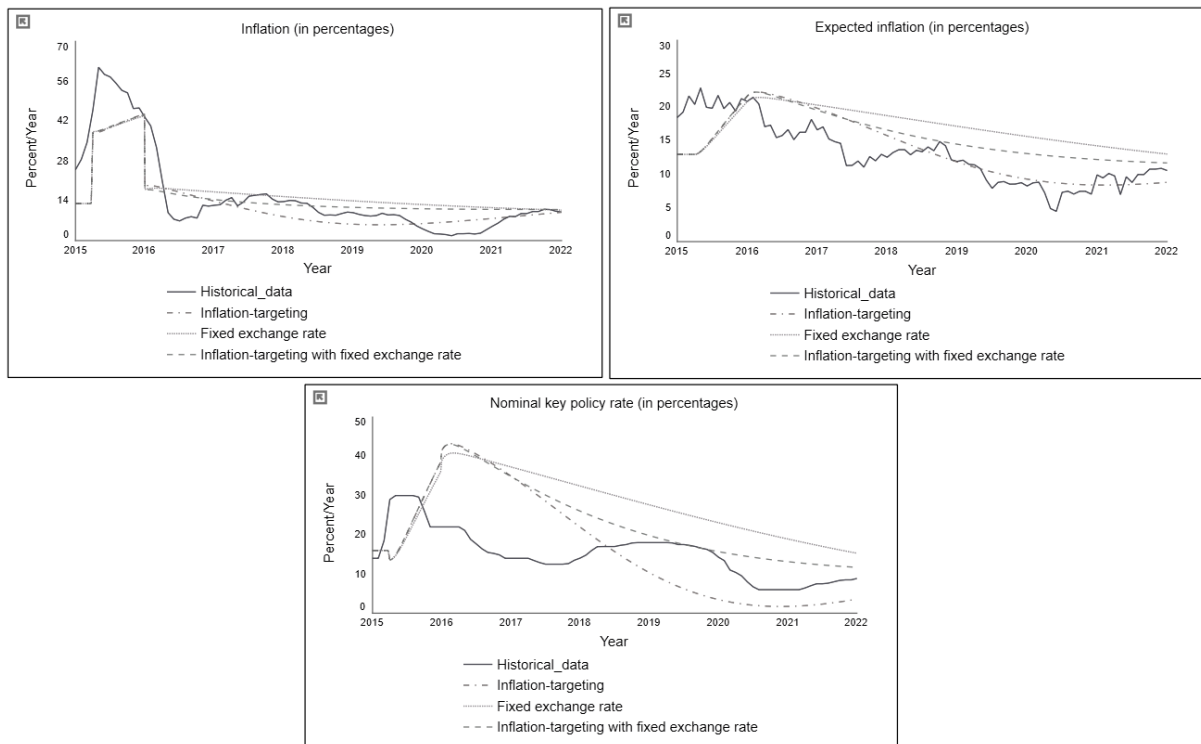


Figure 2.10. Behavior of key performance indicators under inflation-targeting with fixed exchange rate

Source: developed by authors in Stella Architect

Also, the results of the sensitivity analysis indicate that there is significant numerical sensitivity of the key performance indicators to the changes in inflation sensitivity to the relative real exchange rate gap under all three settings of the monetary policy. This parameter represents the degree of involvement of an economy in international trade and defines the speed of influence of foreign prices on domestic ones. Essentially, during the simulations, a high absolute value of this parameter helps inflation rates in domestic and foreign economies to converge to their normal value faster. That is why, even if there is no central bank in an economy, inflation could still be not very volatile if there are no barriers to international trade.

Model analysis revealed that under classical inflation-targeting (no fixed exchange rate) inflation and inflation expectation decrease the fastest. At the same time, the effect of monetary policy of any type on inflation deceleration has been found to be relatively insignificant in the medium- and long-term as it is the competition in the international trade that forces the prices in different economies to converge in the model. On the one hand, this conclusion stresses the importance of liberalization of international flows of goods, services, labor, and capital. On the other, it shows that model leaves outside of its boundary significant factors that should be accounted for to make a more comprehensive policy recommendation. In particular, the model does not consider technology and labor productivity differences between trading partners, and the positive structural changes in an economy that are triggered by a more transparent monetary policy (savings in the national currency become more popular, financial market develops faster due to a more predictable interest rate policy). Thus, further research aimed at the incorporation of these factors into the model seems necessary.

The main outcome recommendation is to return to the classical inflation-targeting without a fixed foreign exchange rate as soon as Ukraine wins the war. Also, it is crucial to develop the infrastructure and improve the regulatory conditions for the stock, bond, and mortgage markets to strengthen the monetary transmission mechanism.

2.4. Recommendations for enhancing monetary policy interventions to achieve macroeconomic stability in Ukraine over the medium term

Monetary policy constitutes a pivotal instrument of economic governance, enabling the regulation of inflation levels, ensuring the stability of the financial system, and supporting sustainable economic growth. However, the implementation of monetary policy amidst macroeconomic instability presents unique characteristics and poses a complex task for central banks and other state authorities. A notable challenge is that macroeconomic instability diminishes the effectiveness of monetary policy. For instance, in a recessionary context, increasing the discount rate does not yield the anticipated effect of reducing inflation and diminishing investment activity. Furthermore, a higher policy key rate can augment the risk of insolvency for households and businesses.

Military conflicts represent one of the most serious threats to a country's economic stability and development. In the context of the Russo-Ukrainian War, conducting monetary policy becomes a considerably more complicated task, as risks and challenges are significantly heightened. One of the primary issues is the escalation of inflation, as military actions lead to restricted access to resources and a decrease in production volumes, resulting in rising prices for goods and services. Consequently, additional economic difficulties emerge, including reduced demand and a downturn in economic activity. Another problem is the reduced efficacy of monetary policy during wartime, particularly as the state's fiscal deficit limits the government's ability to conduct currency interventions in financial markets. In the Ukrainian context, maintaining the temporarily fixed exchange rate by the National Bank of Ukraine (NBU) is feasible only through financial support from the IMF and other partners. Moreover, the uncertainty and instability in wartime conditions diminish the effectiveness of communication between the central bank and the market, weakening the impact of monetary transmission.

The primary risks associated with conducting monetary policy under macroeconomic instability are linked to changes in fundamental economic factors, such as increased budget deficits, low investment inflows, production decline, and

rising unemployment. In such conditions, challenges for monetary policy escalate, and the influence of monetary instruments on the real sector and prices may be limited. The key risks can be categorized into four groups: financial, economic, political, and inflationary (Figure 2.11).



Figure 2.11. Key risks associated with the conduct of monetary policy in conditions of macroeconomic instability

Source: developed by authors based on [21, 58, 60, 61]

In contemporary conditions, economic and inflationary risks are the most significant, as the former are associated with a reduction in production volumes, increasing unemployment, and a general economic downturn, while the latter signify threats of uncontrollable inflation rates by the central bank. Furthermore, averting risks related to the disruption of the country's financial system stability is a crucial component of overall macroeconomic equilibrium in the market. Complications in clients' access to their bank accounts, carrying out transactions for payments, transfers, and receiving funds block economic activity, and also cause panic moods and inflated inflationary-devaluation expectations among economic agents. Political

risks are associated with reputational losses of the state, particularly the decline of credit and investment ratings.

The realization of each of these risks leads to a series of negative consequences, complicating monetary and state regulation in general. In this context, there arises the need to develop a risk map for conducting monetary policy under conditions of macroeconomic instability, especially considering the current military-crisis conditions. Table 2.6 presents the developed risk map. The main destabilizing factors, considering the Russo-Ukrainian war, are identified as changes in the volumes of financing from the IMF, the EU, the USA, and other countries providing assistance to Ukraine to cover the budget deficit and support financial stability, the prolonged duration of military actions as a factor deepening crisis phenomena due to further destruction of infrastructure, as well as a global recession that will slow down the recovery of the national economy after the war.

Testing scenarios related to changes in financial assistance based on a simulation model involves changing two main factors - the main means in the economy and the volumes of international reserves. A reduction in financial support from partner countries will most significantly affect the exchange rate of the hryvnia to the dollar (devaluation of more than 10%), as the inflows, particularly from the IMF, are directed at ensuring financial stability. In case of reduced financing, devaluation expectations of the population and business will grow, moreover, financial support is important from the point of view of facilitating economic recovery and growth in the context of the major reconstruction after the victory over Russian invaders. Due to the effect of transferring exchange rate volatility to inflation, internal prices will also rise with less international aid than Ukraine needs, accordingly, the discount rate will increase in order to return the consumer price index to the target range, and GDP risks continuing to shrink due to insufficient resources for increasing production to pre-war volumes. The reverse situation, namely - more significant financial support from the EU, the USA, and other countries will instead facilitate the implementation of a softer monetary policy, strengthening the exchange rate, and increasing economic activity.

Table 2.6. Risk map for conducting monetary policy in conditions of macroeconomic destabilization and military actions

Destabilizing factors	Direction of change (deviation)	Monetary and macroeconomic indicators																			
		Consumer price index, %				Key rate, p.p.				GDP, in million hrn				The level of the shadow economy,				Exchange rate. UAH/USD			
		+10%	+5%	-5%	-10%	+10%	+5%	-5%	-10%	+10%	+5%	-5%	-10%	+10%	+5%	-5%	-10%	+10%	+5%	-5%	-10%
Changes in the amount of financing from the IMF, the EU and others	-10%	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	+10%	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Longer duration of the war	+ 1 p.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	+ 2 p.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Recession of the world economy	-10%	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	-5%	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Low probability of scenario implementation										High probability of scenario implementation											

Source: developed by authors

The continuation of active hostilities in Ukraine, widespread attacks on energy facilities, and further damage to infrastructure will lead to risks of GDP loss and deterioration of macroeconomic indicators. The destruction of logistical routes leads to an increase in prices for goods and services, and, as a result, to the implementation of a restrictive monetary policy. Furthermore, businesses are either going bankrupt or moving their operations underground in order to stay afloat in the market while minimizing costs, which increases the level of shadow economy in Ukraine. Each additional month, quarter, or year of the Russo-Ukrainian war exacerbates the crisis phenomena in Ukraine, slows down the recovery of economic activity, and intensifies the migration of skilled labor abroad. A longer duration of the war, according to the analysis of destabilizing factors, significantly affects macroeconomic and monetary indicators, with each of them worsening by 10% or more when testing scenarios that

predict high unemployment, deepening GDP gap, decline in exports, and increase in foreign debt.

In addition to internal problems associated with the attack by Russian aggressors and insufficient funding to cover the country's current needs, there are significant risks of destabilization due to a possible global recession. The scenario is based on changes in indicators such as the weighted consumer price index of Ukraine's trade partner countries, the weighted average exchange rate of the Polish zloty and the German mark to the US dollar, and the real neutral rate of the US. The global economic slowdown will primarily negatively affect monetary indicators, necessitating the implementation of an expansionist monetary policy to support economic growth. For Ukraine, as an exporting country, prices for products abroad are critically important, as they determine the volume of revenue received. Accordingly, the balance between demand and supply (created by the sale of foreign currency earnings by exporters) in the foreign exchange market is a driving factor in forming the exchange rate of the hryvnia to the dollar. In case of a significant decrease in prices for Ukrainian export goods (grains, oilseeds, metallurgy, etc.), there are significant risks of devaluation of the national currency by more than 10%. Devaluation of the hryvnia will lead to the exacerbation of internal problems in the country, in particular provoking price increases due to higher import costs and slowing down production growth due to unfavorable market conditions.

Based on the developed risk map, significant effects of destabilizing factors on monetary and macroeconomic indicators have been identified, in particular, delay or reduction of financial aid from partner countries, global recession, and a longer Russo-Ukrainian war lead to a deterioration of the analyzed indicators by more than 10%. The realization of risks mostly necessitates the implementation of a stringent monetary policy to curb price increases. At the same time, under the conditions of positive factors, particularly sufficient financial support from the EU, the USA, the IMF, and others, the chances of returning to economic growth with relative price stability increase. The risk map of monetary policy implementation under macroeconomic instability is convenient for identifying the most negative development scenarios, as well as choosing favorable ones. A thorough understanding

of the consequences of the realization of various risks will allow for well-informed management decisions regarding the application of relevant combinations of monetary instruments in a particular situation.

The sensitivity analysis of macroeconomic and monetary indicators to the realization of risks caused by both economic destabilization and military actions on Ukrainian territory revealed the need to develop an approximate scheme of measures aimed at post-war recovery and enhancing the effectiveness of monetary transmission. Achieving the goal, namely the quickest possible return to economic growth after victory, is impossible without the implementation of prompt monetary and institutional measures. Monetary regulation is carried out by the National Bank of Ukraine, while institutional regulation is the prerogative of the government, parliament, local authorities, the National Securities and Stock Market Commission, etc. A generalized scheme of monetary and institutional measures for conducting effective monetary policy during and after the war is presented in Figure 2.12.

The NBU's monetary policy under martial law differs significantly compared to the classic regime of inflation targeting. Under such conditions, the main goal of monetary policy becomes not only ensuring price stability but also ensuring the stability of the financial system and the economy in general. In particular, during the war, the risk of financial instability increases, not least due to rising inflation and currency instability.

Under such circumstances, the National Bank must ensure the stability of the banking system and reduce risks associated with the increase in insolvent banks. Additionally, the monetary policy of the central bank during the period of war should maintain the stimulation of the economy and enterprise activity, increase the bank loans amount.

During martial law, it is also essential to ensure the effectiveness of institutional control and supervision over financial institutions to mitigate risks of corruption and dishonest activities in the banking system.

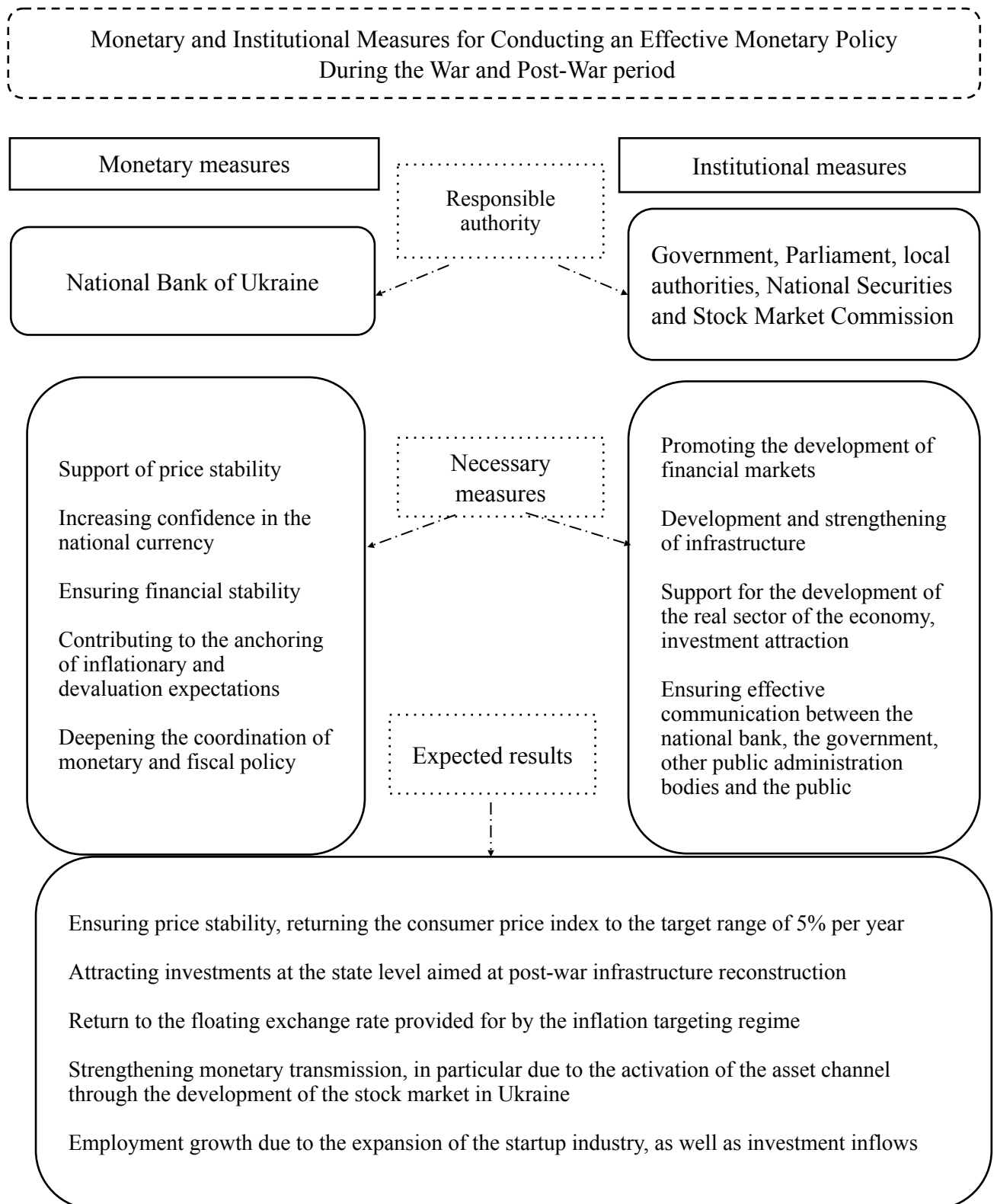


Figure 2.12. Conceptual scheme of monetary and institutional measures to stabilize the macroeconomic situation

Source: developed by the authors

In response to the specific needs of the economy following the onset of the Russian invasion, the Board of the National Bank of Ukraine approved the "Main Principles of Monetary and Credit Policy during the Period of Martial Law" in Ukraine [62]. Implementing monetary policy in the format of inflation targeting is untimely, as the efficacy and efficiency of the monetary transmission mechanism channels are significantly reduced due to administrative restrictions on capital and foreign exchange movements. Consequently, the NBU cannot fully rely on the discount rate as the primary tool of monetary policy affecting the cost of money in the economy and is compelled to apply administrative measures to curb price growth. However, the central bank is committed to ensuring the functioning of the payment system and avoiding losses for financial institutions under martial law. It was also determined that in case of emergencies threatening the country's financial stability, the central bank has the right to impose temporary restrictions on foreign currency and other financial operations. Additionally, the NBU increased liquidity for banks operating in temporarily occupied territories and reduced loan repayment terms. Overall, the NBU's primary approach is to ensure the stability of the financial system under martial law and minimize adverse effects on the country's economy. Even providing support to the state budget by purchasing government-issued securities on the primary market is permissible. Each of these measures aims to preserve price and financial stability and mitigate GDP losses in the face of widespread infrastructure destruction. In time, after Ukraine's victory over the Russian invaders and the lifting of martial law, the NBU commits to returning to the fundamental postulates of inflation targeting with a floating exchange rate and no government fiscal dominance [62].

Equally important is the implementation of institutional measures aimed at effective conduct of monetary and state policy to ensure macroeconomic stability. In the case of Ukraine, a key task is the development of financial markets, which play a significant role in determining interest rates and credit conditions, impacting the size of investments, expenses of enterprises and citizens, and overall economic development of the country. The development of financial markets includes creating effective financial instruments like stocks, bonds, derivatives, etc., which allow

attracting more capital and creating favorable conditions for business in Ukraine. Additionally, the creation of financial instruments will reduce the risk to investors and enable the raising of funds for long-term investments in Ukraine. Directions for the development of financial markets include the evolution of the banking system, securities market, stock market, insurance market, pension market, and derivatives market. Successful development of financial markets in Ukraine can increase the effectiveness of monetary policy and positively impact the development of the real sector of the economy.

As mentioned in previous sections, trust and dialogue with the regulator play a significant role in forming inflationary expectations. Therefore, communication by the NBU with various target audiences is essential for stabilizing these processes. Considering that the regulator uses its official website as the primary communication channel, most information presented there is mainly of interest to the academic community for working with statistical data and reviewing reports for scientific research, as well as stakeholders in public policy. However, ordinary citizens and users of financial services who are not directly involved in monetary policy get news related to the current actions of the NBU from external sources, including the media. Hence, the regulator should focus on alternative communication channels most used by Ukrainian citizens, where the current macroeconomic situation in the country can be explained in a simplified and interactive format. The NBU can collaborate with banks in Ukraine, which have online applications, and agree to duplicate information posted on the NBU website in the news section, but in a simplified format understandable to the citizens. Communication by the NBU's Head and his constant presence in various media, social networks, and conducting press conferences for reporting on the regulator's work and conveying decisions to the public is essential. Such a strategy by the NBU is necessary to consolidate expectations and increase trust in the regulator. Thus, the NBU's communication policy is a fundamental element of macroeconomic management and stability, contributing to ensuring transparency, predictability, and effectiveness of monetary policy.

CONCLUSIONS TO CHAPTER 2

It has been determined that in case of favorable and stable macroeconomic conditions, a moderate liberalization of financial markets and return to an inflation targeting regime and a floating exchange rate are important. The necessity of continuing technological development of financial services as a prerequisite for further expansion of financial inclusion and ensuring cybersecurity is also substantiated. Important measures also include the restoration of financial infrastructure in de-occupied territories, ensuring accessibility and inclusiveness of the financial sector. Additionally, for Ukraine, the development of financial markets is a crucial task, as they play a significant role in determining the level of interest rates and credit conditions, which affects the size of investments, expenditures of enterprises and citizens, and overall economic development of the country. The development of financial markets entails creating effective financial instruments, such as stocks, bonds, derivatives, and others, allowing for the attraction of more capital and creating favorable conditions for doing business in Ukraine. Furthermore, the creation of financial instruments will help reduce risk for investors and enable the attraction of funds for long-term investments in Ukraine. Directions for the development of financial markets include the advancement of the banking system, securities market, stock market, insurance market, pension market, and derivatives market. Successful development of financial markets in Ukraine can enhance the effectiveness of monetary policy and positively impact the development of the real sector of the economy.

Modeling has demonstrated that under classic inflation targeting (without a fixed exchange rate), inflation and inflationary expectations decrease most rapidly. Accordingly, as the functioning of the economy normalizes and the financial system of Ukraine stabilizes, a return to inflation targeting with a managed floating exchange rate should occur in the sphere of monetary regulation. Furthermore, the analysis of the impact of inflationary expectations underscores the importance of the National Bank of Ukraine's communication with economic entities at various levels. The regulator must pay significant attention to communication, as it is through effective

communication with various target audiences, including the public, consumers of financial services, the academic community, subjects of state policy (media, economic and financial organizations, and experts, both domestic and international), and international organizations and other external partners, that the NBU can achieve success. The importance of not only ensuring price stability during periods of macroeconomic destabilization but also supporting the uninterrupted functioning of the financial system and the economy as a whole is substantiated. We also want to mention that there is necessity to return to the inflation targeting system, which showed good results before war, as well as maintaining the floating exchange rate.

Monetary and fiscal policy are important instruments of state regulation of socio-economic processes. In conditions of macroeconomic instability, the issue of coordination and consistency of these financial policy directions acquires particular significance. Monetary policy, focused on the control of the money supply and interest rates, and fiscal policy, which affects government spending and tax rates, must interact to ensure stable economic growth. The harmonization of these policies helps to avoid economic imbalances, reduces inflation and unemployment, and promotes efficient resource utilization. Such a coordinated approach aids in achieving common goals and stimulates economic recovery and development.

It has been determined that trust and dialogue with the regulator play a significant role in shaping inflationary expectations. Accordingly, for the stabilization of these processes, communication from the National Bank of Ukraine with various target audiences is important. Thus, the NBU's communication policy is a fundamental element of macroeconomic management and stability, contributing to ensuring transparency, predictability, and effectiveness of monetary policy.

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CHAPTER 3. ANALYSIS OF CURRENCY POLICY AND ITS INFLUENCE ON NATIONAL COMPETITIVENESS

3.1. The essence and classification of the exchange rate regimes

The exchange rate plays a crucial role in the system of national settlements. In Ukraine, the exchange rate is formed on the interbank market. The Central bank can influence the demand and supply of foreign currency through interventions.

According to the definition from the Corporate Finance Institute, an exchange rate is a amount at which one currency can be exchanged for another between countries or economic zones[1]. This rate is important to define trade and capital dynamics of the flow and the values of currencies to each other. This rate influences trade conditions and movement of the capital between the countries-trading partners [2].

Each country chooses its own exchange rate system according to its decisions and strategic financial goals. There are four main regimes: fixed, flexible (freely floated), managed float and pegged. However, these regimes can be modified and form new derived types such as dollarization, monetary union regime, and others.

A *fixed regime* maintains the exchange rate stable or with minor fluctuations in narrow boundaries. The *freely floated* exchange rate is formed by the influence of supply and demand on the market without any interventions from authorities or regulators. This regime might have significant fluctuations at any point in time. The *managed float* exchange rate is also defined by the market forces, but with the influence of the regulators to smooth the movements. Pegged exchange rate consists in “pegging” the value of the currency to other foreign currency or to a unit such as gold. Each regime comes with its own set of conditions and implications for a country's monetary policy, economic stability, and integration with the global economy. All comparisons are depicted in Table 3.1.

Table 3.1. Comparative table of pros and cons of regimes of the exchange rate

Exchange rate regime	Advantages	Disadvantages
Fixed	-the constant basis for investment, trade, planning; -restraining devaluation of the currency and inflation; -less risk of price fluctuations -lack of monetary policy discipline.	-hard to define whether the fixed exchange rate is sustainable; -the risk of the significant appreciation of the exchange rate, which also causes the decrease of competitiveness of national goods on foreign markets; -large expenditure of the reserves.
Free floated	-effective allocation of financial resources; -representation of all external and internal shocks; -balancing of demand and supply in the market.	-distortions of resources allocation -difficulties in planning and forecasting for businesses; -overshooting of exchange rate; -abuse of the domestic monetary policy.
Managed float	-protection of investors against sharp fluctuations; -provide a predictable and stable business environment; -protects the economy from big fluctuations.	-manipulation from the government due to lack of transparency; -conflict of interest between exchange rate policy and monetary policy.
Pegged	-mitigation of the impact of domestic price changes; -contributes to the stabilization of export-import prices; -the devaluation of the currency to a big shock.	-the looseness of the monetary independence by the central bank; -the negative impact of the country to which the national currency was pegged; -targets for speculations.

Sources: compiled by authors based on the [3]

The choice of an exchange rate regime is a critical decision for any country, reflecting a complex interplay of economic, financial, and institutional factors. This choice fundamentally hinges on the trade-off between the stability provided by fixed regimes and the flexibility afforded by floating regimes. The choice between stability and flexibility is not static. As a country's economic, financial, and institutional landscape evolves, so might its optimal exchange rate regime. For instance, an emerging market economy may initially adopt a fixed regime to establish credibility and control inflation but may shift to a more flexible regime as its financial markets mature and its institutional capacity strengthens.

At the same time nowadays there are more detailed classifications of the exchange rate regimes. The IMF plays an important role in the evaluation of the exchange rate regimes and provides its classifications. This role is part of its broader mandate to oversee the international monetary and financial system and ensure its stability. The classifications and consultations also help member countries in making informed decisions about their exchange rate policies in the context of their broader economic strategies. The IMF publications define the detailed classification of the exchange rate regimes (Table 3.2). Based on its assessments, the IMF provides policy advice to countries on their exchange rate regimes. It may recommend changes or adjustments to support economic stability, reduce vulnerability to external shocks, or achieve other macroeconomic objectives.

Table 3.2. Classification of the exchange rate regimes according to IMF publications

Exchange Rate Regimes	Characteristic
<i>Exchange Arrangements with No Separate Legal Tender</i>	There is usage of foreign currency as the separate legal tender (it can be dollarization), also country can be a member of monetary union. Country loses independent control in monetary policy
<i>Currency Board Arrangements</i>	Commitment to exchange national currency to foreign one with a fixed exchange rate. National currency is backed by foreign assets with limited possibility of usage the monetary policy.
<i>Other Conventional Fixed Peg Arrangements</i>	Central bank is pegging national currency to foreign or the basket of currencies. Exchange rate can change in the amount less than ± 1 percent above or below a central rate. Central bank maintains fixed rate via direct or indirect interventions. Direct interventions include sale or purchase of currency on the market. Indirect interventions consist of strict interest rate policy, foreign exchange regulations, interventions of other institutions etc. At the same time flexibility of central bank policy is wider if to compare to the exchange rate regime with no separate tender.
<i>Pegged Exchange Rates within Horizontal Bands</i>	Fluctuations of exchange rate is at least ± 1 percent around a fixed exchange rate.
<i>Crawling Pegs</i>	The exchange rate is regulated by small amounts at the fixed rate. Monetary policy is limited as in case of fixed peg system
<i>Exchange Rates within Crawling Bands</i>	The exchange rate is controlled in certain change of at least ± 1 percent.

<i>Continuation of Table 3.2.</i>	
Exchange Rate Regimes	Characteristic
<i>Managed Floating with No Predetermined Path for the Exchange Rate</i>	The central bank maintains the exchange rate without specific path or target. Indicators to limiting the rate can be different: balance of payment, international reserves. Direct or indirect interventions can be used
<i>Independently Floating</i>	The exchange rate is defined and influenced by market fluctuations

Source: developed by authors based on [4]

Carmen M. Reinhart and Kenneth S. Rogoff have made a detailed classification of the exchange rate regimes:

- Without separate legal tender or currency union
- Pre announced peg
- Pre announced horizontal range (+/-2%)
- Actual peg
- Pre announced crawling peg;
- Moving band (+/-1%)
- Pre announced crawling band (+/-2%)
- Actual crawling peg
- Actual crawling band (+/-2%)
- Pre announced crawling band that is larger or equal to +/-2%
- Actual crawling band (+/-5%)
- Moving band (+/-2%)
- Actual moving band +/-5%/ Managed floating
- Freely floating
- Freely falling
- Dual market when no data on parallel markets are available [5].

This classification is the most detailed and structured and is widely used in the literature.

David Burton and Martin G. Oilman described the examples of the exchange rate regimes [6]. In the case of *peg to a single currency* country can link its national

currency to the foreign one- quite often US dollar – and do not change it often. Around a half of developing countries used this exchange rate regime.

Peg with the currency basket composites by the currencies of the countries-trading partners, which makes the exchange rate more stable. Currency changes can be influenced by trade of capital flows.

Limited flexibility includes changing the value of currency with several margins of the peg.

If the *exchange rate is adjusted to indicator*, it includes linking it to changes of different indicators, such as real effective exchange rate.

Managed floating is more flexible than using of band. The central bank maintains the rate, and it can impact it. It is influenced by the amount of international reserves, exchange market changes, real effective exchange rate.

Independent floating includes market- based changes of the exchange rate. The amount of countries, which have the floating rate is increasing last decades [6].

The exchange rate regimes are maintained together with central bank policy framework. According to *exchange rate anchor* regime the exchange rate performs as the nominal anchor. This system involves exchange rate with no separate legal tender, fixed pegs, and also crawling pegs.

The Monetary Aggregate Anchor includes usage of instruments of monetary policy to achieve a growth rate for aggregates M1 or M2 and this aggregate becomes an anchor for the monetary policy

In the case of *Inflation Targeting Framework* there are central bank announcements of inflation targets and policy to achieve the target.

Fund-Supported Programs include usage of monetary and exchange rate instruments [4].

According to so called macroeconomic trilemma it can be achieved two of the following: fixed exchange rate, free movement of capital and independent policy of the central bank. Casiraghi, Habermeier, and Harjes (2022) noted that in the free float the nominal anchor as inflation target is needed, usage of peg allows exchange rate to be a nominal anchor [7]. Managed floating, they indicated, is influenced actively via interventions. Authors specified that between late 1990s and Financial Crisis of

2007-2008 it was popular the bipolar opinion of usage free floats or hard pegs. But the last decade changed the opinion about the intermediate regimes, it was discovered that there are the benefits of floating and fixed rates combined, limiting the changes of exchange rate. Casiraghi, Habermeier, and Harjes indicated that choosing the fixed exchange rate demands the fiscal policy to implement countercyclical measures as far as monetary policy cannot fully stabilize macroeconomic conditions in the fixed rate regime. At the same time, they noted that diversification of export makes the country less vulnerable to shocks and it makes less necessarily to use the flexible exchange rate. In the case of trade integration there is increased possibility of peg or common currency. It is interesting that according to their investigation the less flexible the markets of labour, the stronger possibility of flexible exchange rates. Also, authors revealed that high dollarization influences the adoption of flexible exchange rates. To decrease the dollarization, it is needed a policy of low inflation and regulatory policies try to decline the usage of foreign currency. They noted, that countries with big resources base can suffer from the “Dutch disease”, in the case of growth of commodity prices on the global market there is appreciation of the real exchange rate, which negatively affects other export industries and diversification of the economy [7].

In general, there are different researches regarding the exchange rate regimes. Scientists reveal the benefits of fixed and floating exchange rates. Bleaney and Tian (2020) highlighted that fixed exchange rate helps to decrease trading costs, they are simple to operate and can be good choice for small open economies. They revealed that floating exchange rate has higher trading costs, it requires nominal anchor such as inflation target and can be a shock absorber.

David Burton and Martin G. Oilman has noted that both the fixed and floating exchange rates have their advantages in different conditions. Since 1970s the countries were moving to the greater flexibility of the exchange rate. Currency pegs were used in 85% of countries in 1975, and only 66% in 1990s. Their great usage of exchange rate regimes also influenced the diversification of schemes. Many of them preferred “managed” floating. Other popular mechanism of floating regimes was independent floats, used by Japan and the USA, when the exchange rate was caused

by market fluctuations, and was changed only by small extent by central bank interventions. According to the opinion of David Burton and Martin G. Oilman, pegged exchange rate can be good tool of exchange rate regimes in the case, when it is important to decrease the inflation. In the case when international reserves are exhausted, there arises the necessity to use the floating exchange rate [6].

In 2017 Ethan Ilzetzki, Carmen M. Reinhart, Kenneth S. Rogoff highlighted that around 80% of all countries at that moment used less flexible exchange rate. They investigated the growth in adoption of intermediate regimes, for example, it has increased the number of managed floating regimes especially among the larger emerging markets [5]. It is more flexible exchange rate regime and does not assign an anchor currency.

In 2017 Ethan Ilzetzki, Carmen M. Reinhart, Kenneth S. Rogoff also noted that 60 to 70 % of the researched countries had dollar as the anchor, and US dollar remained its positions of reserve currency in the world [5].

Rupa Duttgupta, Gilda Fernandez and Cem Karacadag researched that countries with fixed exchange rates are vulnerable to currency and banking crises. Flexible exchange rates protect better from external shocks and provide more independent monetary policy [9].

In the case of fixed exchange rate and higher inflation in the country, in comparison to its trading partners, the real exchange rate becomes overvalued, which causes the current account deficit. And adoption of the more flexible exchange rate, as free float or crawling peg may be an option. Authors indicate that for transition to floating exchange rate several factors are needed: liquid foreign exchange market, practice of central bank interventions, alternative anchor instead of fixed exchange rate, monitoring of exposure of private and public entities to the exchange rate risk [9].

Rupa Duttgupta, Gilda Fernandez, and Cem Karacadag noted that interventions of the central bank of Australia and Sweden can be good examples as giving the information in advance. The central bank of United Kingdom reveals the information about interventions in a monthly press release, the European Central Bank also discloses it in the monthly bulletin, the US Federal Reserve System give

the information at the same time, when interventions happen [9]. Significant element of central bank policy is control of monetary liquidity or supply. When country moves to the more flexible exchange rate regime, function of managing money supply is transferred to such market instruments, as open market operations, repurchase agreements. While moving to floating exchange rate countries concentrate on inflation targeting.

Changing of exchange rate regimes can be different. If the country has strong macroeconomic policy, it can change the regime faster, which helps to control interventions and protect international reserves.

Graduate change of exchange rates regime can be used in the case of lack of foreign exchange market or ability to evaluate the exchange rate risk. In the case of rapid change such a country can face the exchange rate volatility [9].

The International Monetary Fund plays its particular role in the exchange rate regimes. It ensures that countries-members cooperate with it and promotes a stable system of exchange rates [6].

Countries-members of the International Monetary Fund should notify it about the choice of the exchange rate regime. Exchange rates are discussed on the IMF Executive Board meeting and in the World Economic Outlook.

Currency interventions are an essential tool to affect the fluctuation of the exchange market. There are several types of currency regulation regimes. Each of them has its advantages and disadvantages. When choosing one of the currency regimes, the country must consider the specifics of the internal financial market, the country's development, economic growth, etc. During crisis events such as war, the optimal solution was to fix the exchange rate.

Foreign exchange intervention is one of the key instruments by means of which the Central bank provides its monetary policy to stabilize the exchange rate, strengthen the national currency, and support the economy during crisis events. The main source of interventions is the central bank international reserves. Simultaneously, the size of interventions depends not only on the available reserves but also on the degree of economic shock, the stage of the country's development, and others.

The key purpose of currency interventions is achieving price stability in accordance with the goals of the Central Bank of Ukraine. Based on this, it is necessary to form three main tasks for interventions.

1. At the expense of interventions, it is possible to smooth out the volatility of the exchange rate at a certain level. Sharp and significant exchange rate turbulence occurs during crisis periods. In the case of active panic of the population, the negative consequences of the shock are intensified. It is during such a period that the central bank acts as an active participant in the interbank market and helps to avoid significant exchange rate turbulence by interventions. After the stabilization of the economy in the post-shock period, the involvement of the central bank decreased.
2. Another task is the accumulation of international reserves. It is important for the central bank to maintain the volume of reserves at the generally accepted adequacy criteria, which determine that the volume of reserves should be sufficient to cover three months of future imports of goods and services.
3. The interventions of the central bank should be aimed at maintaining the transmission mechanism, in the event of a decrease in the effectiveness of the interest rate as the main instrument of monetary policy.

Thus, the currency intervention strategy should correspond with the goals of inflation targeting, the current regime of the exchange rate (floating or fixed). Moreover, during the absence of a significant shock and gradual stable development of the economy, the central bank minimizes its influence on exchange rate and guides the improvement of the currency market. The reverse situation persists during the crisis. Then the central bank becomes an active participant in the interbank market, adjusting significant fluctuations through interventions.

During currency interventions, the central bank is guided by the principles of appropriate transparency. This means that information about the criteria for the participation of market subjects, and the results of the implementation of interventions on the market are open and publicly available. However, sensitive parameters and the main motives, and tactics for interventions are not public for the sake of the effectiveness of exchange rate monetary policy.

3.2. Exchange rate of Ukraine: tendencies and problems

In this section, the main dynamics of the exchange rate of the Ukrainian national currency, the hryvnia, will be considered. From 1996 to 2014 the exchange rate regime in Ukraine was fixed, from 2014 to March 2022 - floating, and after the start of a full-scale war (24.02.2022) since March 2022 to October 2023 - fixed. In October 2023 National Bank of Ukraine announced change of the exchange rate to the managed floating.

As we mentioned, up to and including 2014, the exchange rate regime was fixed, and since 2015 – managed float. Fixation of the exchange rate caused many problems, including reduction of international reserves, loss of competitiveness of domestic producers, devaluation of the national currency, high level of inflation, etc. In fact, the exchange rate fixation reflected the illusion of stability. Therefore, in August 2015, the inflation targeting regime was de facto approved in the Monetary Policy Strategies for 2016-2020, and in December 2016, it was de jure, approved by the Council of the NBU in the Basic Principles of Monetary Policy for 2017 and the medium-term perspective.

The flexible exchange rate regime in Ukraine was maintained until the start of a full-scale war.

After February 24, 2022, the NBU fixed the hryvnia-to-dollar rate at UAH 29,2549; and the hryvnia-to-euro rate at UAH 33,1707. Such actions of the central bank were forced to ensure exchange rate and macro-financial stability, uninterrupted operation of the financial system, balancing the current market situation, fixing the expectations of the population, and maintaining control over the dynamics of inflation. The exchange rate policy of the Central Bank during the war would be considered further in more detail.

There are two main changes in the value of the domestic currency – reduction and increase. If the value of the national currency decreases under demand-supply forces with a flexible exchange rate regime, then the value depreciates. If the price of domestic currency declines, but under a fixed exchange rate regime, then the

currency devaluates. A similar logic in terms is used when the value of the currency increases. The revaluation occurs under the fixed exchange rate regime, and appreciation under the flexible exchange rate system. The dynamic of the exchange rate of the hryvnia (UAH) from 1997 to 2022 is depicted in Figure 3.1.



Figure 3.1. The dynamic of the exchange rate UAH/USD

Source: developed by authors based on the data [10]

In 1997, it was observed that the National Bank pursued a policy of restraining the excessive revaluation of the hryvnia, which occurred due to the inflow of foreign exchange funds. The largest fluctuations in the value of exchange rate occurred in 1998-1999, 2008-2009, 2014-2015, 2019-2020, and 2021-2022.

The first devaluation of the hryvnia took place in 1998-1999. The main reasons were the impact of the Asian financial crisis, the fall in GDP, the trade balance deficit, and the growth of foreign debt. Additionally, the expansionary fiscal and monetary policies of the government had a negative impact on the economy. That led to instability that created uncertainty for investors and influenced the exchange rate. Simultaneously, the devaluation stimulated the export of goods producers, which caused the surge in the volume of sales of foreign currency and supply on the market. As a result, the amount of foreign currency reserves of the NBU increased.

From 2000-2004 Ukraine achieved macroeconomic stability. During that period it was observed a sharp economic growth, and low rates of inflation. At the same time, political instability played an important role during that time. There were tensions between the president and parliament, which put downward pressure on the hryvnia. Additional uncertainty was created by the transition to a market-based economy. This was also facilitated by the fact that the position of the dollar in the domestic market was somewhat weakened by its devaluation in international markets [11].

In 2008-2009, the dynamics of the hryvnia exchange rate experienced significant fluctuations. The main factors of currency devaluation:

- global financial crisis and its negative impact on the inflow of foreign funds from abroad to the banking system;
- drop in world metal prices in August 2008 by 15-20%. As a result the export revenue significantly decreased, while the import value grew;
- intensification of the capital outflow due to negative expectations about the devaluation of the national currency.

In general, the dynamics of the hryvnia exchange rate reflected the conjuncture of international markets, where the depreciation of the US dollar was observed. In 2009 the decline of the official exchange rate of the hryvnia was 3.7 % in comparison with 52.5% in 2008.

In terms of exchange rate policy, since 2014, the national currency of Ukraine has been significantly undervalued. This was caused by three simultaneous crises: economic – caused by the annexation of Crimea and the war in Donbas; currency - because the fixed exchange rate had to be abandoned due to the deterioration of the foreign trade balance and the growth of the budget deficit, and banking - because the oligarchic banking system led to an increase in overdue debts and a panicked outflow of deposits. Instead, towards the end of the period (2019-2021), the gradual growth of the exchange rate to the equilibrium is observed.

The key positive and negative consequences for the economy during the float-managed exchange rate regime:

1. The floating regime has allowed the Ukrainian national currency to adjust the market changes and, in that way, make the export more competitive.
2. This regime has contributed to an improvement in the investment climate in Ukraine due to relative stability in the foreign exchange market.
3. As the Central bank smoothed the high fluctuations due to interventions in the interbank exchange market, this put pressure on foreign reserves.
4. There was inflationary pressure as the price of imported goods and services increased due to the depreciation of the currency. This led to a decrease in the purchasing power of consumers.

To conclude, the managed-float exchange regime had a mixed impact on the economy. On one side, this allows to improve the investment climate and external competitiveness. On the other hand, this had a negative impact on foreign exchange reserves and inflation.

The exchange rate policy of the Central bank during the 2022 year will be considered separately. However, before that, it is worth noting that currency devaluation cannot always be viewed from the negative side.

For instance, countries can deliberately maintain a low exchange rate in order to protect the domestic market from foreign competition. Such a policy was observed in China and Japan, at the end of the XX century accumulated foreign currency reserves and pursued a protectionist policy.

For countries with a low or medium level of development, the devaluation of the national currency has a mostly negative effect on the economic development of market relations. This happens because for developing countries, due to the insufficient development of their own production capacities, export is mainly presented by cheap raw materials, and import - technologically and resource-intensive goods. Therefore, during devaluation, it is extremely unprofitable for underdeveloped countries to import labor-intensive goods that are in demand in the domestic market due to high prices. At the same time, prices for export goods will rise.

The strengthening of the hryvnia exchange rate against foreign currencies can be observed due to the preponderance of foreign direct investment inflows over their

outflows. According to McKinnon's research, such an inflow has a positive effect not only on the exchange rate of the national currency but also on the activities of entrepreneurs and the commodity market as a whole [12]. During the strengthening of the national currency, the volume of export-oriented goods decreases. After all, the products of domestic manufacturers are becoming more expensive compared to foreign analogs. Such a situation is inherent in short-term changes in the exchange rate. With long-term planning and anticipation of the revaluation of the national currency, domestic exporting producers begin to improve their own production processes, modernize equipment, improve management processes, etc. Thus, in the long term, the volumes of export-oriented products will grow. This shows that the revaluation has a positive effect on the level of innovative investments.

Therefore, for the Ukrainian national commodity market, the devaluation of the national currency was an unprofitable direction of exchange rate policy. After all, under such conditions, the country remained a raw material exporter for developed partner countries. Instead, the strengthening of the exchange rate will direct entrepreneurs to the production of technological products for final consumption.

At the beginning of the war in Ukraine the central bank fixed the exchange rate at the level of 29,25 UAH per 1 USD and then has moved the value up to 36.57 on July 21, 2022. A fixed currency regime has its advantages and disadvantages, one of which is the high cost of usage foreign exchange reserves. However, such a policy of the central bank was a forced and necessary step to maintain nominal stability in the conditions of war. The fixed exchange rate policy was complemented by high-interest rates and currency restrictions.

Another important indicator of the exchange market is the real effective exchange rate (REER) and nominal effective exchange rate (NEER), the dynamics of which are depicted in Figure 2.2. The importance of these indexes lies in determining the competitive positions of domestic producers, identifying whether the national currency is undervalued or overvalued, and isolating destabilizing shocks to the economic macro system. These indexes reflect the change in the exchange rate adjusted for the level of inflation in Ukraine and the main trading partners. A fluctuation of +/-11% in a 3-year period is considered optimal [13].



Figure 3.2. The dynamic of the REER and NEER (12.1999-10.2023)

Source: developed by authors based on the [14]

The dynamics of the two indices are synchronous. Since the real effective exchange rate differs from the nominal effective exchange rate it is adjusted for the level of price changes. The highest increases in the REER were in 2008 and 2022. This means that the competitiveness of domestic goods decreases both in the domestic and world markets. The causes are the excess of inflation in the country over the inflation of trading partners, as well as the devaluation of the exchange rate of the national currency, and external and internal shocks. The reverse is the situation with a decrease in the REER index (the end of 2008 and 2015), in which the competitive positions of product manufacturers are strengthened. The main reasons for that were low rates of inflation and graduate recovery of the economy.

Maintaining of fixed exchange rate of hryvnia to US dollars till the beginning of October 2023 influenced the increase of NEER in the 3d quarter of 2023, that mostly totally levered its high decrease in 2022. Despite this, REER decreased as a result of decrease of prices in Ukraine in comparison with the more stable inflation in the countries-partners. Such dynamics is expected till the end of 2023. According to the prognoses of the National Bank of Ukraine, in the next years the stable deficit of the current account and increase of interest to risk assets will influence the

devaluation of dollar and appreciation of the currencies of trade partners of Ukraine. According to this condition the REER will weaken. It will influence the gradual improvement of foreign trade balance of Ukraine. Thought, despite the weakening, REER will remain stronger than its equilibrium level, which will contribute to disinflation [15].

Let's return to the exchange rate policy of the NBU during the 2022 year. As was mentioned before, since the beginning of the full-scale war in Ukraine on February 24, 2022, the NBU fixed the exchange rate. This currency regime was maintained until October next year. Let's consider the consequences for the economy of fixing the exchange rate and whether it should have been kept fixed in the future.

The positive consequences included the restoration of public confidence and the anchoring of expectations, the appearance of macro stability.

However, the reverse side of such a fixation also insinuates. For example, great pressure on foreign exchange reserves, deterioration of competitiveness, and a larger gap between the official and cash exchange rates. Since the main trading partners are the countries of the European Union, the depreciation of the euro against the dollar leads to even greater losses for exporters.

So, it is obvious that fixing the exchange rate had more advantages at the beginning of the war as a tool for stabilizing expectations and financial activity, but in the long run, the country would have suffered more and more losses. For example, the biggest losses are the reduction of international reserves. In addition, economic imbalances (price level, drop in production) will gradually increase, which will not be reflected due to a change in the dynamics of the exchange rate. Therefore, it was worth considering a potential solution.

To do this, we will consider examples of exchange rate policies of other countries during the war.

In many countries which faced with the fixing of limiting of the exchange rate have proved its effectiveness as temporary anti-crisis instrument to control the inflation and maintain the macroeconomic stability.

It can be considered the example of Israel, which fixed the national currency in 1985 for three years, firstly to dollar than to the basket of currencies with the band of

+3%. It influenced the decrease of inflation from three-digit to two-digit numbers. In 1989-2004 Central bank of Israel was experimenting with different variants of linking the national currency. As inflation has decreased from 20% to 7% central bank increased the measure of fluctuations of the exchange rate from $\pm 15\%$ to $\pm 26\%$. In 2003 inflation has achieved its goal: maintaining in the level of 1%-3% for 12 months. In 2005 central bank moved to the floating exchange rate regime.

In Croatia in 1991-1993 national currency was linked to deutsche mark. After the introducing of the new currency in 1994 central bank implemented managed floating, and influenced heavily the fluctuating of the exchange rate by currency interventions. During the year 1994-1996 the exchange rate of national currency remained stable with the average fluctuation of $\pm 1,6\%$ for a year. Together with other stabilization measures it helped to improve inflation and exchange rate expectations, and also decrease inflation from 1903 % in October 1993 to 3% in December 1994.

In Georgia till 2008 it maintained the floating exchange rate regime. After the Russian invasion central bank of Georgia temporary fixed the national currency to the US dollar to avoid the panic on the market and keeping the stable situation of the currency market. But it influenced negatively the international reserves of the central bank. It influenced the decision to adjust the lari exchange rate to the US dollar as a intermediated step to the floating exchange rate. The exchange rate has devaluated in two steps for 15%. The next days after devaluation of national currency the central bank made active interventions for the stabilization of the exchange rate on the new level and renewing trust to the national currency. The Central Bank further decreased the amount of interventions and in January 2009 moved to inflation targeting [15].

The currency interventions remained in all the cases the main monetary instrument. So, the targeting the exchange rate of Croatian currency in 1994-1998 was followed by active interventions on the currency market. Transfer to the higher flexibility of the exchange rate was graduate, long-term and careful. In 2009 it was used the managed floating regime, in 2010-2015 de facto of the crawling peg, and in 2016-2019 – low band $\pm 2\%$.

Interest rate policy is the additional instrument in maintaining the exchange rate stability. The central banks of Croatia, Israel and other countries used the central bank rate as additional instrument for the decrease of pressure on the international reserves and maintaining the stability of market of currency. At the same time, internal and external facts also influenced the decrease of inflation during the war or in the after-war period. At the same time the premature decrease of the interest rate with the high risks of security and devaluation can influence negatively the exchange rate stability, as it was in the case of Georgia. When the inflation started to decrease in September 2008 the central bank started to decline the central bank rate with the aim to stimulate economic growth. But in the conditions of devaluation of the national currency it effected negatively the trust to it. And as a consequence, it caused dollarization of the economy, and was one of the reasons of speeding up the inflation in 2010. As a result, the central bank of Georgia was forced to increase the interest rate [15].

For Ukraine, in our opinion, a free-floating exchange rate is not a solution, as the high sensitivity of inflationary expectations leads to excessive macroeconomic volatility. A vivid example is the hryvnia exchange rate fluctuations during the first invasion of the Russians in 2014.

In the post-war period, Ukraine will return to a flexible exchange rate, inflation targeting, and restore the transmission mechanism. Ukrainian and American professor Yuriy Gorodnichenko noted, that during martial law the exchange rate should be flexible, the daily fluctuations of which are limited to a narrow range [16].

Thus, the exchange rate will change (rise or fall) under the influence of market forces, but within the corridor and at a rate determined by the central bank. Such a policy was already applied during the COVID-19 pandemic, and in some countries even earlier. This policy made it possible to slow down the pace of exchange rate appreciation and gradually introduce a flexible exchange rate.

Other positive aspects of the proposed exchange rate are the institutional independence of the central bank. It will also prepare for a smooth and safer transition to a flexible exchange rate, reduce pressure on currency reserves, and minimize post-war fluctuations.

When the war started the National Bank of Ukraine fixed the exchange rate with the aim to stabilize the situation of the market and introduced the range of temporary administrative restrictions regarding the currency operations. On the July 2022 central bank of Ukraine changed the exchange rate for 25%. It helped to decrease the pressure on the international reserves and increase the competitiveness of Ukrainian producers. National bank of Ukraine was maintaining active currency interventions. At the same time based on national and international experience, National Bank of Ukraine took into account, that the long-term fixation of the exchange rate can influence the macroeconomic disbalances, which can cause the financial crisis.

National Bank in its Strategy indicated that fixed exchange rate has its advantages and disadvantages, but in the long-term perspective, the disadvantages may be bigger, than advantages, for example, the currency restrictions may lose its effectiveness, there can increase the market deformations, grow the shadow economy, deepen the external disbalances. In the aim to transfer to a more flexible exchange rate in October 2023 it was announces a managed floating. The graduate transfer to a more flexible exchange rate will be maintained with the constant evaluation of macroeconomic and financial conditions. In October 2023 National Bank of Ukraine moved to the managed floating rate based on the stable progress of decreasing the inflation, maintaining the high level of international reserves and keeping the high level of attractiveness of hryvnia instruments. The movement to the managed floating was a controlled process. The currency market stabilized on the third day, and the amount of interventions decreased to the September level. Graduate improvement of the exchange rate flexibility, to the opinion of the National Bank of Ukraine, will increase the stability of Ukrainian economy and the currency market, influence its adaptivity to external and internal shocks and decrease the risks of currency disbalances. At the same time National Bank of Ukraine announced that it will play the key role on the market of currency and compensate the demand for the foreign currency. The exchange rate will fluctuate in both sides influenced by the market factors. On the early stages of the transit to the more flexible exchange rate the central bank rate will continue to maintain the role of additional instrument of the

stability of exchange rate regime and defense of international reserves. National Bank of Ukraine will maintain strict monetary policy, which will influence the profitability of assets - investments in national currency with the aim to avoid the uncontrolled pressure on the currency market, on the exchange rate and international reserves [17].

According to the announcement of the National Bank of Ukraine, managed floating rate will provide better adaptation to the external and internal shocks and decrease the risks of accumulation the currency disbalances [15].

At the same time the National Bank of Ukraine will limit the exchange rate fluctuations with the help of currency interventions, preventing the high depreciation and appreciation of the currency. The central bank rate policy also will be used to maintain the exchange rate stability.

According to the Strategy of easing the FX restrictions the main stabilization tool of decreasing the inflation and providing the adaptation of economy to the conditions of full-scale war will be maintaining the exchange rate stability.

Beside the maintaining the exchange rate with interventions, National Bank of Ukraine has implemented measures for the increase of the supply of foreign currency and eased restrictions in the non-cash foreign currency. That influenced the increase of operations in August- September 2023 and influenced the decrease of demand on foreign cash. At the same time it were eased other currency restrictions. In the conditions of new regime of exchange rate National Bank of Ukraine will take measures to maintain exchange rate stability and compensate the structural deficit of foreign currency and limit the exchange rate fluctuations with the help of currency interventions [15].

In the current conditions the usage of the central bank rate differs from the classical inflation targeting. Main determinant for the central bank rate is not only the inflation, but also the attractiveness of national currency as the store of value. As a result, people use to convert less amount of their savings into foreign currency. This causes the decrease of pressure on the market of currency and international reserves, and the exchange rate stability increases. That restrains the growth of costs of goods and services, in particular due to low import costs and decreases the pressure on the inflation and exchange rate expectations of citizens and business. To maintain price

and financial stability the National Bank of Ukraine in June 2022 increased the central bank rate to 25%. Improvement of the inflation expectations, prognoses of further decrease of inflation and stable situation of the currency market influenced the process of decreasing the central bank rate in July 2023 [15].

Currency interventions are the influence of the central bank of the country on the currency exchange rate by selling and buying foreign currency. In that way, the financial institution regulates the demand and supply of foreign currency and defines the desired level of the exchange rate. NBU can sell or buy the currency on the interbank exchange rate market. During the buying the NBU releases the hryvnia into circulation and vice versa when the central bank sells the currency, it withdraws the hryvnia from circulation. Figure 3.3 shows the dynamics of the interventions.

The main aims of the interventions are to balance the supply and demand for foreign currency and to maintain the stable exchange rate of hryvnia. This strategy was followed until 2014. In the case of the exchange rate the aims of intervention can be a little different, although monetary authorities can also use them with the goal to avoid unnatural deviations in the exchange rate, normalizing the situation on the market, and accumulating currency reserves [19]. So, from 2014-2016, the National Bank of Ukraine carried out currency interventions with the goal to avoid high fluctuations in the exchange rate and accumulate foreign reserves.

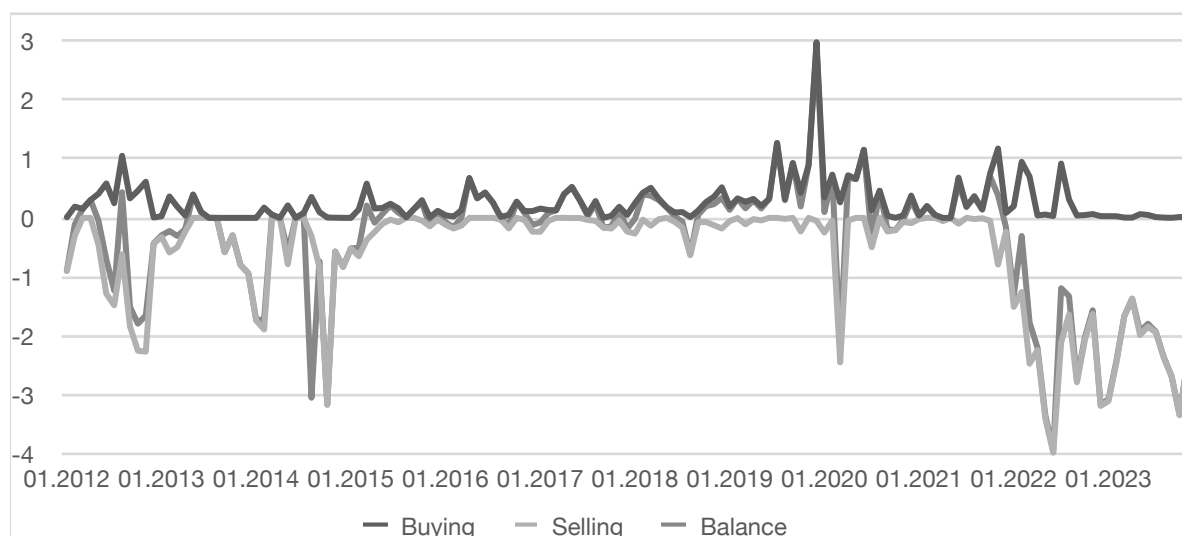


Figure 3.3. The dynamic of the foreign interventions

Source: developed by authors based on the [18]

On September 6, 2016, the board of the NBU presented the "On the approval of the Strategy of currency interventions of the National Bank of Ukraine for 2016-2020" [20], in which were described the main principles of the currency interventions in accordance with inflation targeting. The purpose was not only to accumulate foreign reserves and smooth the excessive fluctuations, but also maintenance of the transmission of the policy rate.

In 2016-2020, in accordance with the currency intervention strategy, the National Bank of Ukraine did not buy currency during the period of fluctuations in the direction of devaluation of the hryvnia but replenished international reserves only under favorable conditions on the foreign exchange market. At the same time, starting in April 2018, to increase the transparency of monetary policy, the NBU constantly announces the volume of foreign currency purchases to replenish international reserves [21].

Since the beginning of 2020, foreign exchange interventions have been carried out using interventions at the best rate, foreign exchange auctions, and interventions at a single rate. Some of the biggest sales of the currency are observed at the end of 2022. For comparison, in December 2022, the number of sales increased 13 times, compared to December of the previous year. It is worth noting that with the beginning of the full-scale war in 2022, the volume of currency sales fluctuated between 2-3 billion US dollars. At the end of the 2022 year, the value reached 3,19 billion US dollars. However, the highest was in June – 3,99 billion US dollars.

This adjustment of the exchange rate was caused by significant gaps in the balance of payments and the non-rhythmic inflow of international aid. This has a significant impact on the foreign reserves, the dynamics of which will be analysed further (Figure 3.4).

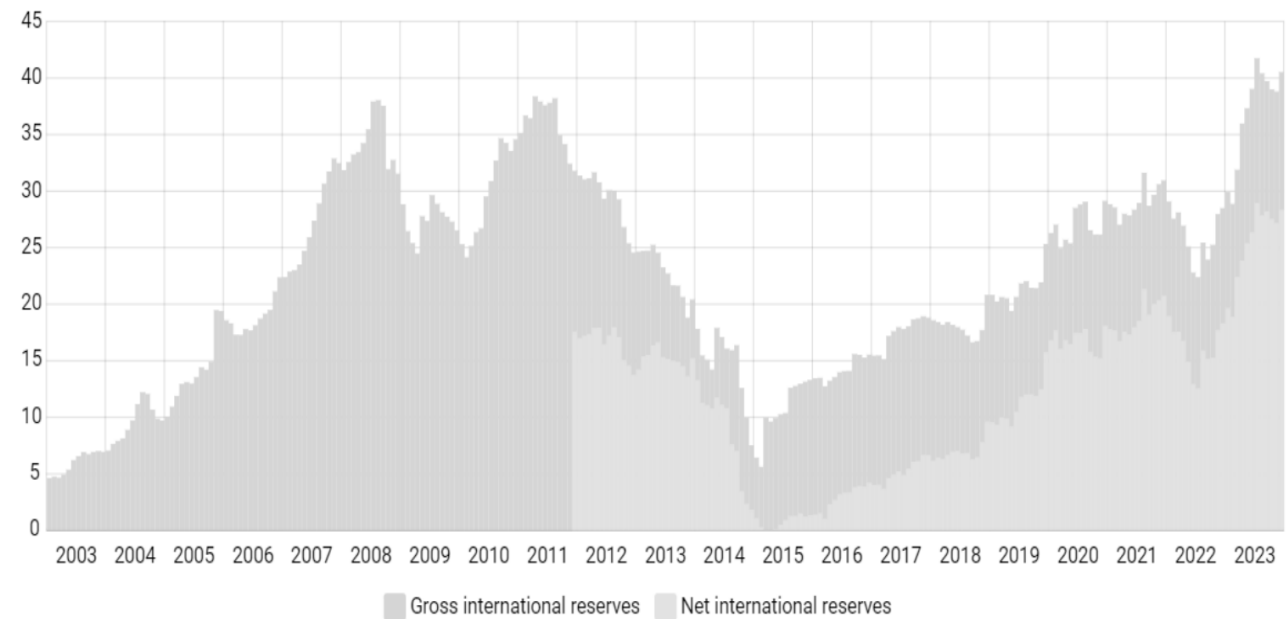


Figure 3.4. The dynamic of the international reserves, USD billion, in equivalent

Source: developed by authors based on the data [22]

International reserves consist of liquid financial assets with the help of which the country's regulators can achieve the defined monetary goals. They are primarily used to manage the currency's value, stabilize the financial system, and meet international payment obligations. Understanding the distinction between gross and net international reserves is essential for assessing a country's financial health and its ability to respond to economic challenges. The difference between gross and net currency reserves lies in that net reserves do not include funds borrowed from the IMF. By excluding borrowed funds, net reserves provide a clearer picture of a country's own reserve assets. This measure is often seen as a more accurate indicator of a country's reserve strength because it reflects the resources that are readily available and under the country's control.

The figure shows that the largest decline in reserves occurred at the end of 2014 and at the beginning of 2015 when the decision was made to switch from a fixed to a floating exchange rate. Then, there was a gradual increase in the number of reserves. Regular monitoring of these reserves helps a country's monetary authorities to make informed decisions about monetary policy, exchange rate management, and

other aspects of economic governance. It also provides critical information for international investors, rating agencies, and global economic observers regarding the country's economic resilience and stability.

The role of international financial aid from abroad during the crisis period is essential for any country. Such financial support ensures the solvency of the country, and its ability to fulfill obligations on time, and compensates part of the economic losses incurred due to different shocks that led to the crisis. Since the beginning of the full-scale war in Ukraine, many countries, and regions provided significant financial, humanitarian, and military aid, without which Ukraine could not conduct defensive action, carry about citizens, and maintain the economy.

It is prognosed that the general amount of financial support in the form of grants and loans in 2023 will amount to 45 billion dollars. This resources will be the main source of covering the budget deficit, which will maintain at 29% of GDP in 2023. International help allows to finance the big budget deficit and to maintain the high level of international reserves for the central bank and balance the currency market [15].

It is rather important to understand, that international aid influences the amount of the international reserves, budget deficit. It has a high influence on the governmental policy in the country and macroeconomic stability.

3.3. Exploring the relationship between exchange rate dynamics and trade competitiveness of Ukraine

The main relationship between exchange rate dynamics and trade competitiveness of Ukraine is represented by Vector Autoregressive model (VAR). This model is based on the reproduction of the dynamics of the time series based on its historical values, and long-term memory of series. Thus, a feature of these models is a high empirical level.

Since it was important to investigate the short-term forecast and analyze the relationships between the variables, therefore, the VAR model was chosen. Let's move on to the first stage of building the model - data selection and preparation.

Variables that were included in the model:

- Real effective exchange rate (REER) that shows the competitiveness of national products and services relative to foreign ones. Unit – dimensionless (index);
- Net export (NET_EXP) is the difference between the export volume of the country and its import. Previously, the time series were seasonally adjusted and the data growth rate was taken. Unit – dimensionless;
- Policy rate (POLICY_RATE) is the key rate of the Central Bank that represents the impact of monetary policy on trade in the model. Unit - percentage;
- Consumer price index (CPI) that reflects the annual percentage change in prices of goods and services. Unit - percentage;
- Exchange rate (EX_RATE) is important to include because that affects the relative price of goods between countries and plays an essential role in trade. Unit – UAH/USD;
- Industry index (INDEX_IND), which describes the change in the volume of manufactured products relative to the base period. Unit – dimensionless (index);
- Reserves (RESERVES), the amount of gross international reserves of the Central Bank of Ukraine. Unit – billion USD.

The 7-time series mentioned above were chosen to build the model. The sources for them are the official statistics from the National Bank of Ukraine [23] and the State Statistics Services of Ukraine [24]. The sample research period is from the first month of 2010 to the 12th month of 2022 (2010M01 2022M12). The number of observations is 156 for each time series.

Previously, the all-time series was checked for seasonality. For this, the ACF and PACF correlogram was considered. Sinusoidal oscillations are one of the signs of seasonality. In addition, 12, 24, and 36 lags were statistically significant for certain time series. Therefore, taking into account the presence of seasonality in such time series as net exports, a seasonal adjustment was used.

The next step is to test all time series for stationarity. Since only stationary series can be applied to the VAR model. To do this, it is necessary to check the Dickey-Fuller test and perform Unit root Test in the EViews (Figure 3.5).

Null Hypothesis: Unit root (individual unit root process)
 Series: REER, CPI, EX_RATE, NET_EXP, INDEX_IND, POLICY_RATE,
 RESERVES
 Date: 04/08/23 Time: 12:47
 Sample: 2010M01 2022M12
 Exogenous variables: Individual effects
 Automatic selection of maximum lags
 Automatic lag length selection based on SIC: 0 to 1
 Total number of observations: 1084
 Cross-sections included: 7

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-5.73978	0.0000

** Probabilities are computed assuming asymptotic normality

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
REER	-2.0984	0.2457	-1.532	0.735	0	13	155
CPI	-5.9326	0.0000	-1.532	0.735	0	13	155
EX_RATE	-0.0014	0.9563	-1.532	0.735	0	13	155
NET_EXP	-12.793	0.0000	-1.532	0.735	0	13	155
INDEX_IND	-0.1698	0.9384	-1.532	0.735	0	13	155
POLICY_RATE	-1.7012	0.4287	-1.530	0.745	1	13	154
RESERVES	-1.0581	0.7314	-1.532	0.735	0	13	155
Average	-3.3934		-1.532	0.736			

Figure 3.5. Dickey-Fuller test in Level

Source: developed by authors

According to the obtained results, it can be concluded that only two time series are stationary in levels - Net export (NET_EXP) and Inflation (CPI). Since the probability of the series < 0.05 . The rest of the time series is not stationary in levels. Therefore, we further perform this test in the first differences, which are presented in Figure 3.6.

As a result, in the first differences in values probability, all other previous series (REER, POLICY_RATE, EX_RATE, INDEX_IND, RESERVES) are stationary. Therefore, the CPI and NT_EXPORT time series are stationary in levels ($d = 0$), and the other time series are stationary in first differences ($d = 1$).

Null Hypothesis: Unit root (individual unit root process)
Series: REER, CPI, EX_RATE, NET_EXP, INDEX_IND, POLICY_RATE,
RESERVES
Date: 04/08/23 Time: 12:47
Sample: 2010M01 2022M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Total number of observations: 1070
Cross-sections included: 7

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-28.2891	0.0000

** Probabilities are computed assuming asymptotic normality

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
D(REER)	-11.103	0.0000	-1.530	0.745	1	13	153
D(CPI)	-9.9470	0.0000	-1.512	0.761	3	13	151
D(EX_RATE)	-11.233	0.0000	-1.532	0.735	0	13	154
D(NET_EXP)	-10.357	0.0000	-1.495	0.771	4	13	150
D(INDEX_IND)	-11.783	0.0000	-1.532	0.735	0	13	154
D(POLICY_R...)	-10.145	0.0000	-1.532	0.735	0	13	154
D(RESERVES)	-10.712	0.0000	-1.532	0.735	0	13	154
Average	-10.754		-1.524	0.745			

Figure 3.6. Dickey-Fuller test in First Difference

Source: developed by authors

Cointegration occurs when two or more variables have long-term relationships. The main prerequisites for availability cointegration relationship – non-stationarity of time series and is the same order of integration. Since a cointegration relationship cannot arise between time series of a different order of integration, the next step is the specification of a VAR model.

Firstly, it was necessary to determine the optimal number of lags to include in the model. For this, the Lag Exclusion Tests and the Lag Length Criteria test were used. It is important to correctly set the maximum number of lags, which is 10% percent of all observations. In our case, it is 15 (out of 153 observations). The obtained results are shown in Figure 3.7.

VAR Lag Order Selection Criteria
 Endogenous variables: D(REER) CPI NET_EXP D(POLICY_RATE) D(RESERVES)
 Exogenous variables: C D(INDEX_IND)
 Date: 04/08/23 Time: 12:52
 Sample: 2010M01 2022M12
 Included observations: 140

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-957.7224	NA	0.694357	13.82461	14.03472	13.90999
1	-890.1775	128.3353	0.378270	13.21682	13.95223*	13.51567
2	-855.5179	63.37762	0.330070	13.07883	14.33953	13.59114
3	-823.2898	56.62933	0.298856	12.97557	14.76157	13.70134
4	-800.0768	39.13049	0.308770	13.00110	15.31239	13.94034
5	-772.9557	43.78120	0.302967	12.97080	15.80738	14.12350
6	-756.2525	25.77063	0.346816	13.08932	16.45120	14.45549
7	-730.5267	37.85372	0.351275	13.07895	16.96612	14.65858
8	-623.0276	150.4988	0.111493	11.90039	16.31286	13.69349
9	-546.6028	101.5357	0.055675*	11.16575	16.10351	13.17231*
10	-529.4912	21.51168	0.065583	11.27845	16.74150	13.49847
11	-500.7415	34.08898	0.066263	11.22488	17.21322	13.65836
12	-459.2684	46.21288*	0.056664	10.98955*	17.50319	13.63650
13	-439.8337	20.26758	0.067559	11.06905	18.10798	13.92946
14	-425.7907	13.64179	0.088809	11.22558	18.78981	14.29946
15	-397.2054	25.72675	0.097178	11.17436	19.26388	14.46170

Figure 3.7. Lag Order Selection Criteria

Source: developed by authors

The optimal length of the lags is determined at the same time for 5 information criteria – LR (sequential modified LR test statistic), FPE (Final prediction error), AIC (Akaike information criterion), SC (Schwarz information criterion), HQ (Hannan-Quinn information criterion). According to two criteria (FPE and HQ), the optimal number of lags is 9, respectively the other two (LR and AIC) have a maximum length of 12, while SC has a maximum length of 2. In this case, we will include all 12 lags, and then apply the exclusion test lags - Lag Exclusion Tests.

The main indicator of the lag exclusion test is Prob Joint. In the testing process, not all lag with p-value could be included in the model. The final result is presented in Figure 3.8.

VAR Lag Exclusion Wald Tests
 Date: 04/08/23 Time: 12:53
 Sample (adjusted): 2010M11 2022M12
 Included observations: 146 after adjustments

Chi-squared test statistics for lag exclusion:
 Numbers in [] are p-values

	D(REER)	CPI	NET_EXP	D(POLICY_...	D(RESERVES)	Joint
Lag 1	15.83063 [0.0073]	113.2013 [0.0000]	22.05920 [0.0005]	17.92749 [0.0030]	7.262169 [0.2019]	184.9613 [0.0000]
Lag 2	9.583968 [0.0879]	16.27622 [0.0061]	10.92789 [0.0528]	10.84307 [0.0546]	10.39725 [0.0647]	68.50767 [0.0000]
Lag 3	12.00253 [0.0348]	23.01072 [0.0003]	3.993919 [0.5503]	12.81845 [0.0251]	6.507668 [0.2599]	58.48068 [0.0002]
Lag 6	10.60516 [0.0598]	5.802659 [0.3259]	33.22948 [0.0000]	6.817974 [0.2345]	10.50497 [0.0621]	65.78080 [0.0000]
Lag 7	18.64598 [0.0022]	14.65936 [0.0119]	22.64574 [0.0004]	3.702903 [0.5929]	9.012021 [0.1086]	85.81123 [0.0000]
Lag 8	10.91723 [0.0530]	20.65143 [0.0009]	42.15989 [0.0000]	8.267995 [0.1421]	20.33487 [0.0011]	101.8758 [0.0000]
Lag 9	8.534415 [0.1291]	9.915246 [0.0777]	94.95189 [0.0000]	23.41611 [0.0003]	16.26373 [0.0061]	163.1180 [0.0000]
df	5	5	5	5	5	25

Figure 3.8. Lag Exclusion Wald Tests

Source: developed by authors

As we can observe from the figure that lags 4 and 5 were not included in the model. Since the Joint value for other lags is less than 0.05 or absolute zero, there is no need to discard the lags. At the same time we want to pay attention that for some variables the lag probability is greater than 0.05. However, the overall p-value allows such lags to be included in the model. The next phase was the definition of exogenous and endogenous variables.

A Granger test was performed to determine which of the variables could be exogenous. The test results are shown in Appendix A. Only one variable becomes an exogenous – Index Industry. The probability value was more than 0.05. The theoretical explanation is that the industry does not affect the REER directly. The greater impact has macro indicators such as the exchange rate or policy rate. Other variables remained in the endogenous block. Thus, the final specification is shown in Table 3.3.

Table 3.3. VAR Specification

<i>Parameters</i>	<i>Value</i>
VAR type	Standard VAR
Estimation sample	2010M01 2022M12
Endogenous variables	d(reer) cpi net_exp d(policy rate) d(reserves)
Lag Intervals for Endogenous	1 3 6 9
Exogenous variables	c d(index_ind)

Source: developed by authors

It can be seen from the figure that the number of lags is 7 (except 4th and 5th), the index industry is exogenous variables and others are endogenous, and the type of model is Standard VAR.

An important stage for determining the adequacy of the constructed VAR model is checking the residuals for white noise, as well as the normality of the distribution and for the presence of serial correlation. Let's start with the Dickey-Fuller test for residuals models that are tested exclusively in levels. The results is depicted in the Figure 3.9.

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-29.2157	0.0000
Im, Pesaran and Shin t-bar	-12.7335	
T-bar critical values ***:	1% level	-2.40000
	5% level	-2.15000
	10% level	-2.01000

** Probabilities are computed assuming asymptotic normality
*** Critical values from original paper

Intermediate ADF test results

Series	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
RESID01	-12.550	0.0000	-1.532	0.735	0	13	145
RESID02	-13.454	0.0000	-1.532	0.735	0	13	145
RESID03	-12.568	0.0000	-1.532	0.735	0	13	145
RESID04	-12.548	0.0000	-1.532	0.735	0	13	145
RESID05	-12.548	0.0000	-1.532	0.735	0	13	145
Average	-12.733		-1.532	0.735			

Figure 3.9. Dickey-Fuller test for residuals

Source: developed by authors

According to the test results, it can be seen that there are residuals of each separate equation stationary because Prob <0.05. Also, overall Prob value < 0.05. Therefore, the residuals of the constructed VAR model are white noise.

An important indicator of checking the distribution of residuals is when the roots of the characteristic polynomial lie within the boundaries of the unit circle (Figure 3.10).

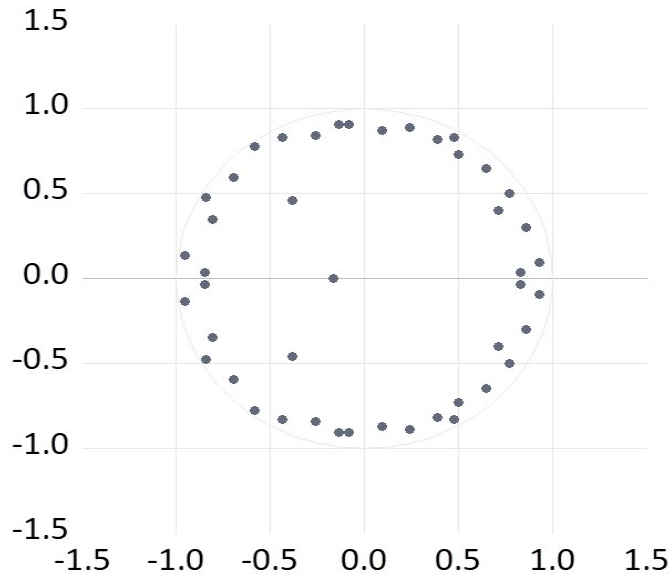


Figure 3.10. AR Characteristic Polynomial

Source: developed by authors

The graph illustrates no root lies outside the unit circle. So, VAR satisfies the stability condition. A serial correlation test showed (Figure 3.11) that it was absent.

Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	18.96494	25	0.7988	0.754130	(25, 354.4)	0.7991
2	24.29179	25	0.5026	0.973076	(25, 354.4)	0.5031
3	43.10366	25	0.0136	1.772297	(25, 354.4)	0.0137
4	29.98357	25	0.2249	1.210571	(25, 354.4)	0.2254
5	25.14050	25	0.4545	1.008255	(25, 354.4)	0.4550
6	16.72227	25	0.8916	0.662901	(25, 354.4)	0.8918
7	17.27576	25	0.8715	0.685364	(25, 354.4)	0.8718
8	22.66704	25	0.5970	0.905957	(25, 354.4)	0.5975
9	16.47058	25	0.9001	0.652697	(25, 354.4)	0.9003

Figure 3.11. Dickey-Fuller test for residuals

Source: developed by authors

Based on the results of residual evaluation tests, we can say that the built VAR model is adequate and therefore we can move to the next stage - construction of the impulse response function and dispersion decomposition.

Impulse response functions (Figure 3.12) examine the sensitivity of model indicators on the effect of shocks. For example, how and how much one variable will change under the influence of another change.

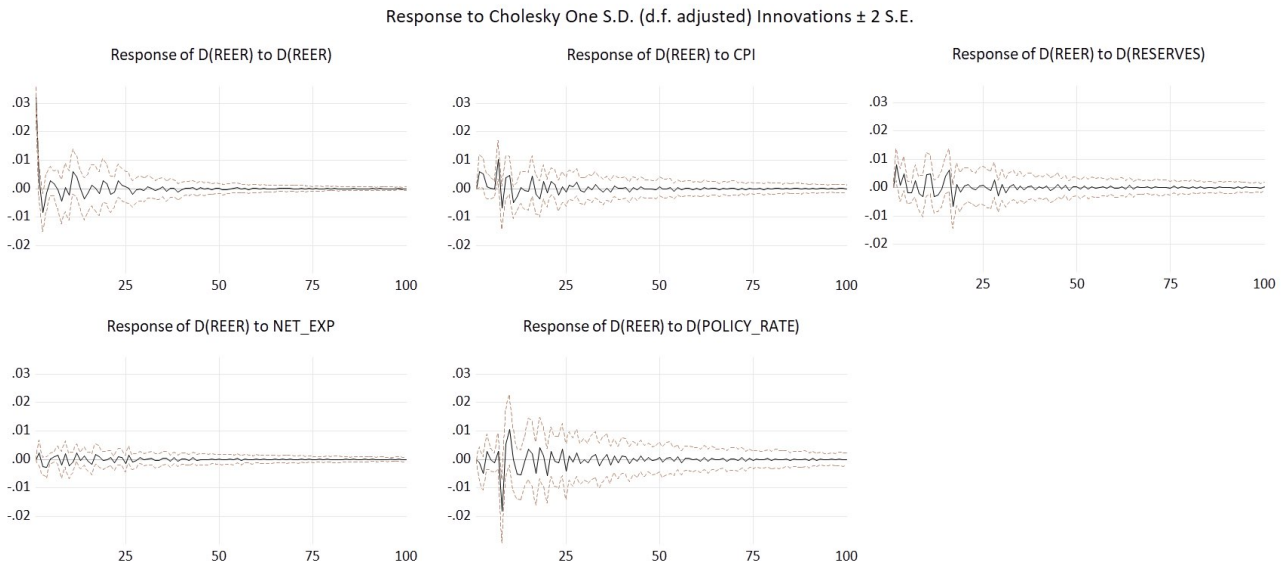


Figure 3.12. Impulse Response to Cholesky One S.D. (d.f. adjusted) Innovations

Source: developed by authors

In this research, we will consider the sensitivity of the REER, which determines the competitive positions of domestic manufacturers in response to a change, and the presence of a shock in the main indicators of the model. Firstly, it is worth noting that the impulse response function has a downward damping effect. The model constructed in this way is stable and adequate. However, it is also worth paying attention to the fact that attenuation occurs in the long term. That is, the effect of shocks has a long-term effect on destabilizing the equilibrium. Let us consider in more detail the behavior of the REER on the response of included variables.

The biggest deviation from equilibrium causes its own shock in the REER. In addition, the effect is the highest. However, attenuation is the fastest. Hence, the self-shock causes the largest deflection and at the same time the fastest decay.

The shock in inflation (CPI) does not cause significant deviations. However, the dynamics of influence are quite volatile and long-lasting. The net export (NET_EXP) variable has the smallest impact. Deviations in the model from equilibrium are insignificant. One important variable is the policy rate.

A shock in the rate initially has a smaller effect on REER, but subsequently increases, disturbing the state of equilibrium. Accordingly, attenuation is more long-lasting. This situation can be explained by the fact that the policy rate does not have a direct impact on the REER but has an impact through other macro-instruments such as the exchange rate, capital investments, and others. For example, with an increase in the policy rate, the attractiveness of investments in the national currency increases, as foreigners can get a higher return on their own investments, and the demand for the national currency increases accordingly. In this way, the appreciation of the currency takes place in accordance with other currencies, and competitiveness increases. However, such a mechanism operates with a certain time lag, which is why the greatest deviation does not occur in the first periods.

A shock in reserves does not lead to significant fluctuations. However, the impact is also long-lasting. The volume of reserves provides a certain buffer, and increased volumes raise confidence in the currency by reducing the risk of default. As a result, this leads to an appreciation of the REER.

To conclude, the largest deviation of the system from the equilibrium state causes a shock in the REER, and the least - net export. One important variable is the impact of the policy rate in addition to such variables as reserves.

The next stage of model building is the modeling of the variance decomposition. When constructing the decomposition, similar to the impulse response function, the order of the variables is essential. Since different combinations can produce different results, it is important to understand the theoretical rationale for modeling. The decomposition results are presented in Figure 3.13.

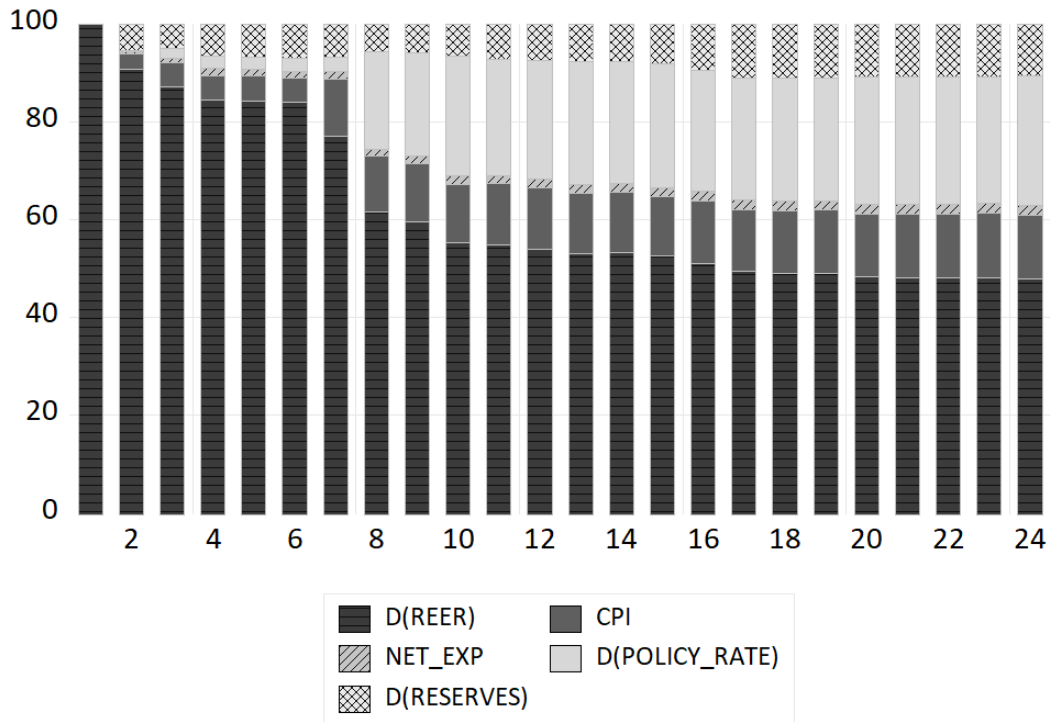


Figure 3.13. Variance Decomposition of REER

Source: developed by authors

From the dynamics of the influence of the variables included in the model (recall that the index industry is an exogenous variable), we can observe that at the end of the period, the policy rate has the greatest influence - 26%, followed by inflation - 13% and reserves - 11%. The influence of net exports is the smallest - 2%. Data dynamics variables increased over time, significant changes occurred in the 8th period. This behavior can be explained by different exchange rate regimes and the corresponding policy rate of the central bank. Thus, when the exchange rate was fixed, the effect of the policy rate on the competitiveness of goods was insignificant. However, under floating exchange rates, the role of the rate has increased.

Firstly, we briefly note why a flexible exchange rate is beneficial for the competitiveness of goods. Under the conditions of such an exchange rate regime, currency devaluation or strengthening can maintain trade competitiveness. For example, under conditions of a trade deficit, a decrease in the exchange rate of the national currency can make exports more attractive and vice versa. Secondly, under the conditions of a flexible exchange rate, the policy rate can influence such macro indicators as inflation, investments, etc., which in turn can strengthen the exchange

rate and increase competitiveness. Instead, a fixed exchange rate uses the policy rate to maintain the peg. Therefore, the impact of the policy rate, which is also confirmed by the results of impulse functions, has a significant impact on the competitiveness of national producers and their international position.

3.4 Influence of the exchange rate policy on trade competitiveness of the country

It is worth starting with the fact that, according to the authors, in the post-war period, the optimal exchange rate policy is to return to a floating currency regime in future. At the beginning of the full-scale invasion in February 2022, the National Bank was forced to fix the course in order to avoid panic and support the economy and financial activity of the country. Such actions had a positive result in the first months of the war. However, in the long term, fixing the exchange rate will lead to deepening of the country's economic problems. Thus, the exchange rate of the dollar is an indicator of the purchasing power of the population, the level of competitiveness of goods of national producers, inflationary expectations, etc. In the conditions of a fixed foreign currency regime, there is an accumulation of economic imbalances that are not reflected in the dynamics of the exchange rate.

One example of such imbalances is the deterioration of the real exchange rate due to the high level of inflation in Ukraine compared to its trading partners. This leads to the reducing of the competitive advantages of Ukrainian exporters. In addition, there is a lot of pressure on foreign exchange reserves, which are constantly shrinking. Thus, the proposed option is to switch to a free-floating exchange rate within defined corridors to correct significant deviations.

According to the simulation results, the exchange rate will gradually increase, and the level of competitiveness will decrease. However, in the long run, there will be improvement. In general, the REER indicator is not a valid tool capable of influencing the dynamics of external macro indicators or the country's trading position. Such a conclusion can be drawn based on the correlations tables and the results of econometric modelling. However, this indicator is a powerful analytical

tool that reflects the level of competitiveness of domestic producers and can be used as an indicator of changes in the positions of producers on the market.

The real sector of the economy and export-import opportunities suffered major infrastructural, logistical, and industrial destruction as a result of the full-scale Russian invasion of Ukraine. In addition, the situation is complicated by the temporary occupation of territories, interruptions in the supply of electricity, disruption of logistics sales channels, and labour migration. That is why the primary task in the post-war period is the restoration and reconstruction of sectors of the economy, and the increase of production capacities. The Ukrainian strategic plan should already be developed for the long term. And one of the key elements of such a plan should be a focus on the development of the real sector of the economy and investments in technology. At the same time, it should be emphasized that industries should focus on the production of goods for final consumption, and not on the recourse production and export.

An example of a strategic plan for the recovery of Ukraine is the plan that was presented in Lugano in July 2022. It is designed for gradual reconstruction over 10 years (2023-2032) and is estimated at \$750 billion U.S. dollars. The plan covers 15 programs. According to the amount of funding [25], the main directions are:

- restoration of housing and infrastructure (150-250 billion dollars);
- integration of logistics with the EU (USD 120-160 billion dollars);
- energy independence and "green" course (130 billion dollars);
- macrofinancial stability (USD 60-80 billion dollars);
- ensuring competitive access to capital (USD 75 billion dollars);
- development of the defense and economic sectors (50 billion dollars).

From the distribution of funding, it can be seen that the development of the real sector of the economy, the development of manufacturing enterprises is not a priority direction. The reconstruction of housing, infrastructure and logistics are priority sectors in the post-war period. However, in our opinion, the restoration of the real sector should also be one of the priority tasks. This will ensure the creation of new jobs, satisfaction of domestic demand with products of domestic production, reduce the share of imported goods, support national producers, and increase their

competitiveness in the market and, as a result, will contribute to the growth of GDP. Therefore, the reconstruction of enterprises that create final consumption products should be one of the priority directions of economic reconstruction.

Promising niche sectors of the real economy that have potential and can become drivers of development are presented below [26]:

- ✓ Military-industrial complex
- ✓ Heavy engineering.
- ✓ Production of electronics.
- ✓ Automobile industry.
- ✓ Aerospace industry.
- ✓ Infrastructure.
- ✓ Agro-processing industry.
- ✓ Furniture industry.
- ✓ Mining industry.
- ✓ Pharmaceuticals.

The main goal of the strategic reconstruction of the real sector of the economy should be reorientation from raw materials to the production of goods with high added value and final consumption goods.

In turn, the exchange rate policy should be aimed at strengthening the national currency. It is the appreciation that will contribute to the increase in production. The strengthening of the currency has a positive effect on import volumes. Imported goods are becoming cheaper on the market and, accordingly, more attractive compared to domestically produced goods. Therefore, national manufacturers are interested in investing in technologies and innovations that will optimize manufacturing. Thus, domestically produced goods will become more competitive, which will also positively affect the strength of the national currency.

CONCLUSIONS TO CHAPTER 3

Any crisis has a negative impact on the strength of the national currency. Therefore, a balanced exchange rate policy ensures the supporting effect of the national currency, and in particular, the position of national producers (export and import facilities). Currency interventions are a crucial means to influence the volatility of the foreign exchange market. There exist different types of currency regulation regimes, each with its own set of pros and cons. Selecting the appropriate currency regime involves considering various factors such as the characteristics of the domestic financial market, the level of economic growth, and the country's overall development. In times of crisis such as during a war, fixing the exchange rate is often the most appropriate solution.

The hryvnia has experienced devaluation several times due to various reasons. In 1998-1999, factors such as the Asian financial crisis, GDP fall, trade balance deficit, and government policies caused instability, uncertainty for investors, and pressure on the exchange rate. However, it stimulated export and increased foreign currency reserves. From 2000-2004, Ukraine achieved macroeconomic stability despite political instability, which affected the hryvnia. In 2008-2009, the global financial crisis, world metal price drop, and capital outflow caused significant fluctuations in the exchange rate. Since 2014, the hryvnia has been undervalued due to three crises. At the beginning of the war in Ukraine, the Central Bank of Ukraine fixed the exchange rate. As a result, the float-managed exchange rate regime had both positive and negative consequences such as making export goods more competitive, improving the investment climate, putting pressure on foreign reserves, and causing inflationary pressure. The fixed exchange rate can have short-term positive effects during deep shocks such as war.

Despite facing difficult times, including the ongoing war, Ukraine has the opportunity to determine the direction of its economic expansion and strategic integration. Our suggestion is to invest in national production and the real sector, particularly the domestic market. Niche industries such as high-tech airplane production, oil pipelines, railway locomotives, wagons, and cars should be

prioritized, along with the development of the reprocessing industries to produce clothing, food products, and other goods. With the events of 2022 and assistance from around the world, Ukraine has a unique opportunity for reconstruction, rebuilding, and investing in a new type of economy.

In this scientific research was built the VAR model and additionally System Dynamics model. Based on the results, it can be inferred that the REER, which is the main competitiveness indicator, is expected to decline at the start of the year, making exports more appealing. However, it is predicted to increase in the second quarter, indicating a decrease in the country's trade competitiveness, followed by slight fluctuations. Inflation is anticipated to increase significantly initially and then decrease, albeit with some fluctuations. The net export dynamics display a logical correlation with the REER - a decline in REER makes exports more attractive, leading to an increase in net exports, and vice versa. The policy rate variation is associated with the alteration in reserves. The policy rate is projected to rise, which means that the volume of reserves will decrease since the exchange rate is fixed.

Based on the analysis and modeling conducted, the impact of currency policy on the country's trade competitiveness has been systematized. The necessity for Ukraine to return to a floating currency exchange rate after the end of the war is substantiated. At the beginning of the full-scale invasion in February 2022, the National Bank of Ukraine was compelled to fix the exchange rate to avoid panic and support the country's economy and financial activity. Such actions yielded positive results in the initial months of the war. However, in the long-term perspective, fixing the exchange rate could lead to a deepening of the country's economic problems. A floating national currency exchange rate more flexibly responds to market conditions, which can contribute to enhancing the competitiveness of exports and attracting foreign investments.

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CHAPTER 4. EXAMINATION OF THE DYNAMICS AND STRUCTURAL ASPECTS OF FINANCIAL DOLLARIZATION IN UKRAINE

4.1. Defining financial dollarization: approaches to assessment and categorization

Financial dollarization is a phenomenon in which a foreign currency, most often the US dollar, is used for financial transactions and is held as a store of value in place of the national currency. It can be present in various forms, including deposit dollarization (DD), loan dollarization (LD), and portfolio dollarization. The measurement and classification of financial dollarization have been an ongoing topic of interest for economists and policymakers, as high levels of dollarization can negatively affect the financial system's stability and the monetary policy's effectiveness. Various methods of assessing the degree of financial dollarization include ratio analysis, regression analysis, and portfolio optimization models. Additionally, financial dollarization can be classified based on its source, such as natural or induced dollarization, as well as its duration, whether it is short-term or long-term. Some common methods of measuring financial dollarization are presented in Table 4.1.

Table 4.1. Methods of assessing financial dollarization

Method	Definition
Currency Composition of Bank Deposits	This measure calculates the proportion of total bank deposits held in foreign currency, typically the US dollar. It indicates the extent to which the public holds foreign currency deposits in the banking system.
Currency Composition of Bank Loans	This measure calculates the proportion of total bank loans issued in foreign currency. It indicates the extent to which the banking system is providing foreign currency loans to the public.
Currency Composition of Capital Market Instruments	This measure calculates the proportion of capital market instruments issued in foreign currency, such as bonds and equities. It indicates the extent to which the capital market is denominated in foreign currency.
Currency Composition of Money Supply	This measure calculates the proportion of the money supply which is in foreign currency. It provides an indication of the amount the public holds foreign currency in circulation.

Source: developed by authors based on [1]

There are several methods for assessing financial dollarization, which primarily focus on deposit and loan dollarization. One method is the ratio of foreign currency deposits or loans to total deposits or loans, which measures the percentage of foreign currency in the banking system. Another method is the currency mismatch index, which calculates the difference between the share of foreign currency assets and the share of foreign currency liabilities in the banking system. A third method is a Herfindahl-Hirschman index, which measures the degree of concentration of foreign currency deposits or loans in a banking system. Other methods include the exchange rate pass-through index, which measures the sensitivity of prices to exchange rate changes, and the sensitivity of non-performing loans to exchange rate changes.

In addition to the currency composition view, some define currency substitution and dollarization index. Currency substitution is the process of measuring the extent to which individuals and organizations switch between various currencies, such as the national currency and the US dollar, in reaction to fluctuations in exchange rates or interest rates. The dollarization index is a comprehensive measure that accounts for multiple factors, such as currency composition and currency substitution, in its assessment.

These methods help policymakers and researchers to assess the level of financial dollarization in a country and to design appropriate policies to manage its potential risks.

Financial dollarization can be classified in different ways, depending on the scope and focus of the analysis. One common classification distinguishes between deposit and loan dollarization, as discussed earlier. Another classification distinguishes between external and internal dollarization. External dollarization refers to the use of foreign currencies, particularly the US dollar, for international transactions, trade, and external debt. In contrast, internal dollarization refers to the use of foreign currencies, particularly the US dollar, within the domestic economy, such as for savings, investment, credit, and pricing. Internal dollarization can further be classified into official and unofficial dollarization, depending on whether the use of foreign currencies is legal and recognized by the authorities or not. Another classification distinguishes between financial dollarization and real dollarization,

with the former referring to the use of foreign currencies in the financial system, and the latter referring to the use of foreign currencies in the real sector, such as for wages, rents, and consumption. These classifications reflect different aspects and implications of financial dollarization and can be useful for policy analysis and evaluation.

Another way to classify deposit and loan dollarization is to distinguish between retail and wholesale dollarization. Retail dollarization refers to the use of foreign currency by households and small businesses, while wholesale dollarization refers to the use of foreign currency by large corporations and financial institutions. These classifications can be useful for policymakers and researchers in identifying the main drivers of dollarization and designing appropriate policy responses.

While dollarization is often viewed as a negative phenomenon, a certain amount of foreign currency assets is normal for an economy, according to Khvedchuk et al.[2]. The concept of financial dollarization can be broadly divided into two types: natural and induced. Natural dollarization refers to the level of currency substitution that would exist in an economy in the absence of any external factors, such as financial market restrictions or macroeconomic instability. On the other hand, induced dollarization is the result of specific policies, events, or external shocks that lead to an increase in the use of foreign currency in the economy. The distinction between natural and induced dollarization is important, as the policies and measures needed to address them can differ significantly. Understanding the drivers of each type of dollarization can help policymakers make informed decisions about monetary policy, financial regulation, and other economic policies. In practice, measuring the natural level of dollarization is challenging and may differ significantly depending on the unique conditions of each country.

In research on financial dollarization, efforts have been made to determine the natural level of dollarization by controlling the impacts of macroeconomic stability, institutional quality, and other factors that might affect currency choice. Some studies have found that countries with good governance, high macroeconomic stability, and efficient financial markets tend to have lower levels of dollarization, while those with lower levels of these factors tend to have higher levels of dollarization. The notion of

the natural level of financial dollarization holds significance for policymakers and central banks, as it offers a baseline for comprehending the drivers of currency substitution and can influence decisions regarding monetary policy, financial regulation, and other economic policies.

The objective of the research conducted by NBU was to calculate the natural level of financial dollarization in Ukraine. The researchers employed portfolio allocation theory to estimate that the level of FD in Ukraine is approximately 10-20%. They identified various fundamental factors that impact FD, including macroeconomic instability, low quality of governance, interest rate differential, dollarization of the real sector, structural factors, and monetary policy regime.

Financial development in transition economies can lead to dollarization or euroization, which can be driven by three types of factors: the world factor, the regional factor, and the individual country factor [3]. The world factor is generated by financial system development and is common to all countries. The regional factor, such as the EU factor, can be seen in countries joining the EU, leading to convergence processes and affiliation with the union. The individual country factor is a unique set of determinants of financial dollarization in a specific country. This is particularly relevant for countries like Ukraine, which is in the process of becoming an EU member and may experience increased foreign currency dominance due to the liberated market. However, the relationship between financial market development and financial dollarization is a topic of ongoing debate in the literature. On the one hand, it is argued that a well-developed domestic financial market can provide alternative instruments that decrease financial dollarization. For instance, Kishor and Neanidis found that countries with deeper financial markets tend to have lower levels of financial dollarization [3]. On the other hand, the liberalization of financial markets and easier access to foreign instruments may foster financial dollarization. Therefore, the relationship between financial market development and financial dollarization may depend on the specific circumstances of each country, such as the quality of governance, macroeconomic stability, and structural factors. The extent to which the development of the domestic financial market affects financial

dollarization is an important question for policymakers, as it can assist in shaping de-dollarization strategies.

Considering periods of the high volatility of exchange rate, geopolitical concerns, a few banking crises, and the ongoing war in Ukraine, the uncertainty of residents in the domestic currency has increased and urged them to hedge their currency risks and hold savings in foreign currency. With low-developed financial markets, diversifying options occur to be very limited.

During the first decade of the 21st century, FD has been the focus of researchers and among the highest policy makers' concerns. Inflation targeting, an increase in institutional credibility, and overall openness of the economy enhanced the decline in the FD rates for most countries, including Ukraine. Successful steps towards market deepening, anchoring expectations, and managing exchange rates helped to decrease dollarization and mitigate associated risks.

Deposit dollarization is primarily formed by people's expectations of future inflation and local currency depreciation. High inflation or unstable inflation expectations can lead to a loss of confidence in the national currency, which may drive individuals and businesses to hold more of their wealth in dollars or other foreign currencies. This can increase the level of dollarization in a country's financial system. On the other hand, when inflation is low and stable, it can help to strengthen confidence in the national currency, which may reduce the demand for foreign currencies and decrease dollarization. Central banks can use monetary instruments, including adjusting interest rates or implementing inflation targeting with the aim to control inflation and inflation expectations and decrease the level of dollarization.

As historically foreign currency interest rates are very low in comparison with the local currency it would be rational to assume that local currency instruments would be in favor of the investors. Though it's rarely the case as in periods of high inflation interest rates offered by commercial banks hardly cover costs associated with inflation, so investors may prefer to invest in foreign currency with close to zero yields to at least hedge their funds from depreciation and obtain the relatively more stable currency at the end of a deposit period. In times of high macroeconomic uncertainty about future inflation and exchange rates and when there are any

restrictions on the flow of foreign currency, FX deposits may be the only investment opportunity that will cover economic agents' risks of funds depreciation, especially when the financial market is not developed or the access to the foreign markets is costly or limited.

Typically financial sector development can be distinguished into two categories: (i) deepening of the financial market, followed by the development of various alternative investment opportunities, such as medium and long-term domestic currency bonds, development of the forward market to mitigate exchange rate risks, indexed instruments to hedge from inflation, etc, (ii) and market liberation, in response to the openness of foreign markets and consequently investments in favor of foreign instruments due to the lower country-specific risks. The former is expected to decrease financial dollarization through a wider range of attractive domestic instruments. The latter instead is expected to increase financial dollarization through investment in foreign markets instruments.

Various kinds of research discuss the relationships between the depth of the financial market and financial dollarization. From one point of view, a deeper financial market can provide more opportunities for borrowers and lenders to transact in the local currency, thereby reducing the need for foreign currency borrowing and lending, hence reducing the level of FD. On the other hand, a shallow financial market can limit the availability of local currency financing options, leading to a greater reliance on foreign currency financing. This can increase the level of financial dollarization. In addition, a deeper financial market can offer more risk management instruments, such as derivatives and insurance products, which can help mitigate currency risk and reduce the need for foreign currency borrowing and lending.

Asel finds that financial sector development has a significant negative impact on deposit dollarization, indicating that a more developed financial sector can reduce dollarization. However, the impact on loan dollarization is insignificant, suggesting that further research is needed to better understand the relationship between financial sector development and loan dollarization. In contrast, Bannister's research reveals that financial dollarization, specifically deposit dollarization, has an adverse effect on financial development, which implies that a high level of dollarization slows down

the financial deepening. Another finding is that this negative relationship is common for countries with periods of high inflation [4].

High financial dollarization can have negative consequences for an economy. According to Levy-Yeyati financial dollarization can have several consequences, including increased vulnerability to external shocks, increased interest rate volatility, reduced effectiveness of the monetary policy, reduced ability of the domestic financial system to intermediate savings, and an increased likelihood of financial crises. In addition, Levy-Yeyati notes that dollarization can lead to a higher cost of capital for firms, which can in turn reduce investment and economic growth [5].

Financial dollarization can have a significant impact on a country's economy, particularly on its banking sector. The relationship between exchange rate fluctuations and DD is based on the concept of balance sheet effects. When the domestic currency depreciates, the value of foreign currency-denominated assets and liabilities increases, leading to a rise in FD. On the other hand, when the domestic currency appreciates, the value of foreign currency-denominated assets and liabilities decreases, leading to a decline in FD. As a result, exchange rate volatility can be a major factor in determining FD levels in an economy.

The relationship between FD and exchange rate fluctuations has been explored by various studies, including Leiderman et al., who argue that higher levels of FD can lead to a closer association between exchange rate fluctuations and nonperforming loans. This can have negative implications for the banking sector, which may struggle to collect payments from borrowers who have taken out loans denominated in foreign currency [6]. In this context, the depreciation of the national currency can bring currency exchange gains from borrowers, but also losses when repaying deposits. As a result, commercial banks often keep interest rates on foreign currency credits at a relatively high level compared to national currency credits, while interest rates on foreign currency deposits remain low compared to domestic deposits. This allows them to hedge against exchange rate fluctuations and minimize their exposure to potential currency exchange losses. However, this can also discourage households and firms from borrowing and depositing in national currency, exacerbating the issue of financial dollarization. Additionally, exchange rate volatility

can affect the profitability of banks, especially when they hold a large share of foreign currency-denominated assets and liabilities. Banks may also engage in currency speculation to hedge against exchange rate risk, which can further fuel currency substitution.

Therefore, policymakers and central banks need to carefully consider the effects of interest rate differentials and exchange rate changes on the banking sector and the wider economy when implementing monetary and financial policies.

4.2. Investigating the dynamics and structural characteristics of financial dollarization in Ukraine

The financial sector is a critical component of the economy, and its stability plays a crucial role in the economic development of a country. One of the significant concerns for policymakers is the degree of financial dollarization, particularly in emerging economies. Ukraine is such an economy where the level of dollarization in the banking system has been a persistent issue, impacting its economic stability and growth prospects.

In Figure 2.1. the dynamics of dollarization of deposits and loans to the residents (except for deposit corporations) are presented. The dynamics of deposit and loan dollarization in Ukraine have been a topic of concern for macroprudential regulators and researchers alike. The dollarization in the crisis years 2008-2009 (with the deposit dollarization reaching 50% and the loan dollarization of 59.1%) heavily influenced the economy of the country. The war on East of the country caused the deepening of the crises and increased the levels of dollarization in 2015 with deposit dollarization of 58.8% and loan dollarization 59.8%. However, since then, it was observed the record decrease of dollarization, which was, to our mind, influenced by the implementation of effective monetary policy, especially regarding inflation targeting. Besides, the experience from previous crisis periods, particularly the high currency risk, made hryvnia-denominated loans more attractive compared to foreign currency loans. As of February 2022, the amount of loans in foreign currency has fallen to 30%, and the share of deposits in foreign currency reached 36%.

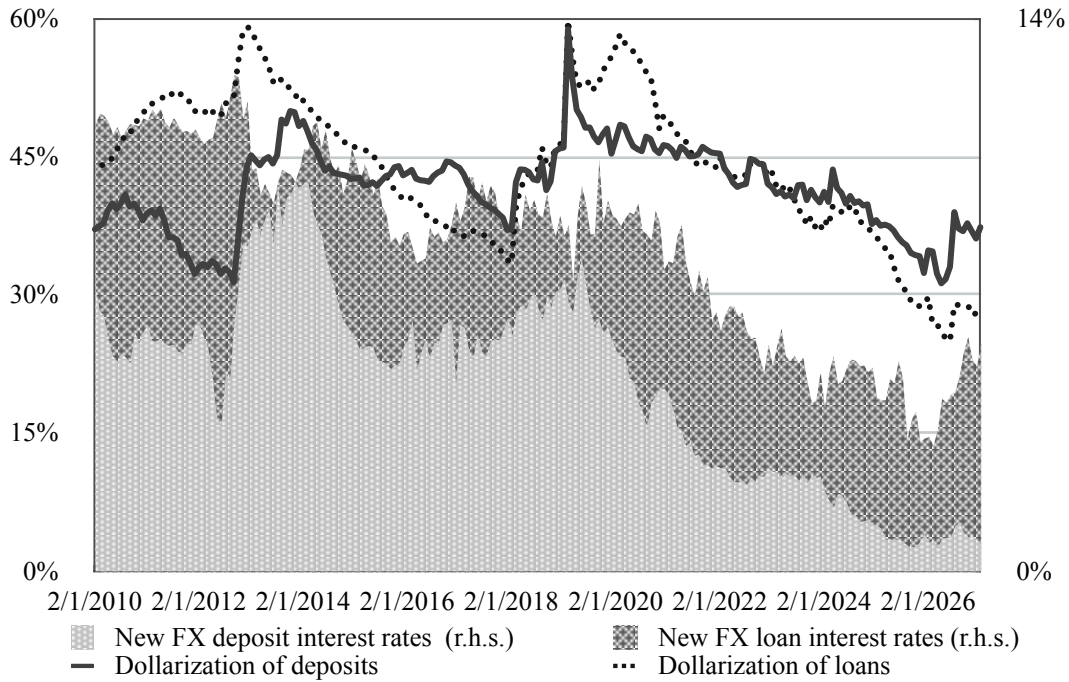


Figure 4.1. Share of FX loans and deposits from 2006 till 2022

Source: developed by authors based on data [7, 8]

Since the beginning of the full-scale invasion, NBU implemented measures that limited the rapid increase of DD and LD, as could have been expected based on the experience of the previous crises.

Fixation of the official UAH/USD exchange rate and foreign exchange restrictions developed and introduced by the NBU right after the beginning of the full-scale invasion, prevented the national currency depreciation and protected banks from foreign exchange deposit outflows. However, these temporary restrictions had limited effect and in the second half of 2022 LD and DD started to grow and reached their prewar levels. Partially such an increase in DD can be explained by hryvnia depreciation, as a response to the corrected fixed exchange rate of UAH to USD.

According to Banking Sector Review, the share of foreign exchange retail deposits remained almost unchanged in Q4 2022 (see Figure 4.2). The dollarization of corporate loans dropped by 3.6 pp in Q4 due to large inflows of hryvnia deposits.

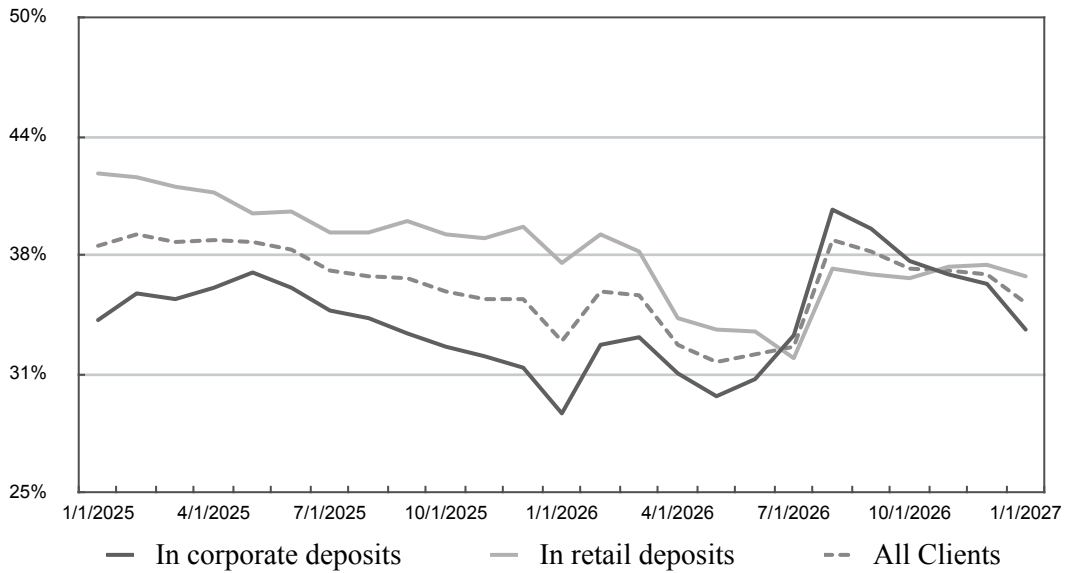


Figure 4.2. Share of FX deposits from 2021 till 2022 as of the end of the month by type of economic agents

Source: developed by authors based on data [8]

In the meantime, over the last quarter of 2022 foreign exchange term deposits grew more rapidly than those in the hryvnia (see Figure 2.4).

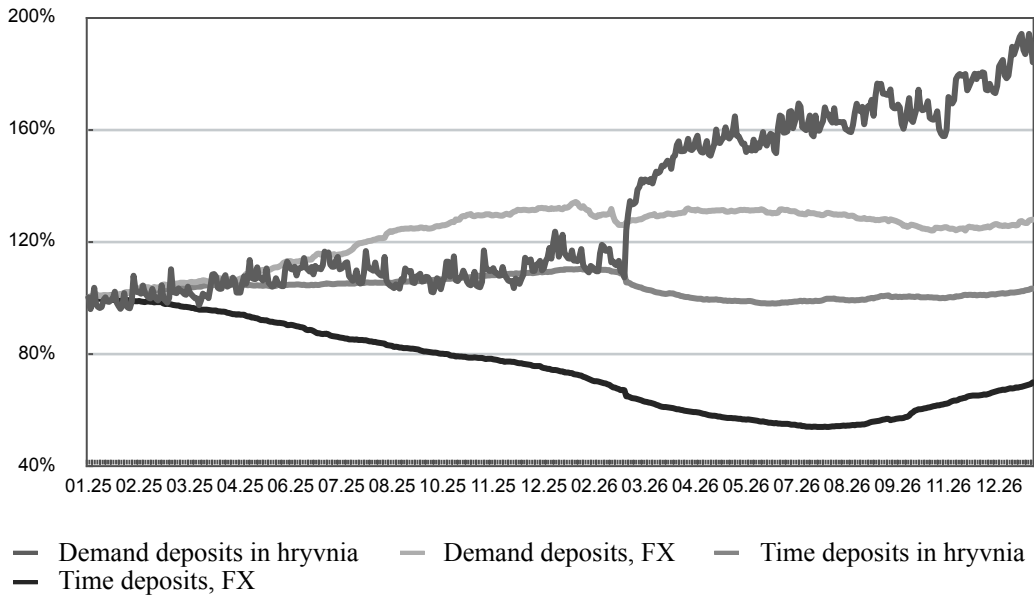


Figure 4.3. Daily retail deposits, 2020 = 100%

Source: developed by authors based on data [7, 8]

In the first half of 2022, the volume of hryvnia corporate loans increased due to government credit support programs and the foreign exchange corporate lending decreased. Volumes of foreign exchange lending decreased with higher probabilities

of non-performing loan repayments due to higher credit and currency risks. In 4Q 2022 hryvnia loans declined by 6,7% qoq, and foreign exchange loans by 5,2% qoq in dollar terms (see Figure 4.4). Corporate net loan portfolio in hryvnia decreased among all groups of banks. NBU states that the decline in the volume of the net hryvnia retail loan portfolio in Q4 was primarily in foreign and private banks due to the increase in provisions against credit losses.

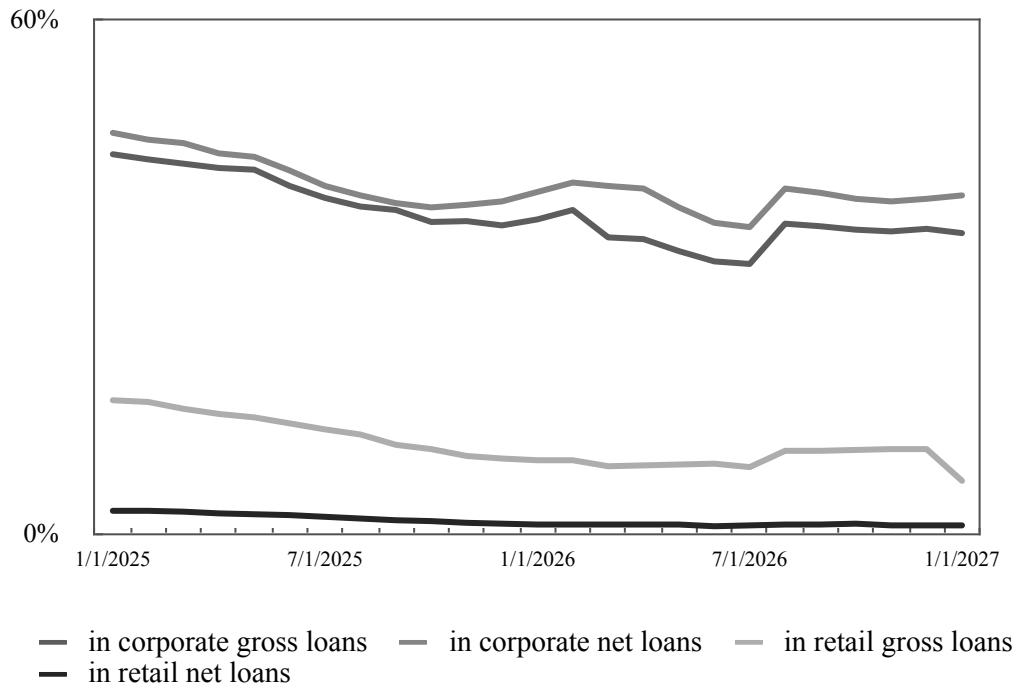


Figure 4.4. Share of FX loans (gross and net) from December 2019 till December 2022 as of the end of the month, by type of borrower

Source: developed by authors based on data [7, 8]

In conclusion, the statistical analysis conducted revealed the significant impact of high deposit and loan dollarization levels on Ukraine's financial system during crisis years and remains a concern for regulators and researchers. The NBU's measures limited the risks of rapid increases in deposit dollarization and loans dollarization by influencing both clients and banks. The government's credit support programs stimulated hryvnia corporate lending, leading to a decrease in foreign exchange lending due to the increase in credit and currency risks. State-owned banks continue to have high dollarization rates, primarily due to their business models.

Despite all the efforts of the NBU to minimize the level of dollarization, it is impossible to eliminate it completely, and it is impractical, because it is possible to

isolate the country from international trade. It is necessary to maintain dollarization at a natural level, at which benefits losses prevail from it [9]. In Ukraine this level should be in the range of 20–30% as a medium-term benchmark of the regulator's economic policy [2].

4.3. Modeling and analysis of financial dollarization phenomena

Financial dollarization, or the use of foreign currency for deposits and loans, is a significant issue for many economies, as it can lead to increased volatility and risks to financial stability. To better understand and analyze the drivers and consequences of dollarization, econometric models are often used. These models offer a systematic approach to understanding the drivers and consequences of dollarization by quantifying the relationships between various economic variables. Econometric models can simulate different scenarios to evaluate the effectiveness of potential policy interventions aimed at reducing dollarization levels, such as changes in monetary policy or regulatory adjustments. So, by leveraging such econometric models, policymakers, researchers, and financial analysts can gain deeper insights into the phenomenon of dollarization, devise strategies to manage its effects, and make informed decisions to enhance economic stability and performance.

However, due to the interdependence of variables such as deposit and loan dollarization, using separate econometric equations can lead to biased and inconsistent estimates. Therefore, a system of simultaneous equations is more appropriate for analyzing the dynamics of dollarization, as it accounts for the feedback effects and interrelatedness of the variables. To fully understand and estimate the complex interrelationships between the different variables affecting financial dollarization, it is important to utilize the system of simultaneous equations, which is better suited to capture the interdependent nature of the economic system and provide a more accurate and comprehensive analysis of the issue.

A system of simultaneous equations is a powerful tool in econometrics that allows for the analysis of complex economic relationships between multiple variables. One of the key benefits of this approach is that it can provide a more

accurate estimation of the relationships between variables, which can lead to more accurate forecasts. Additionally, a system of simultaneous equations can provide insights into the dynamic interactions between variables, which can help policymakers make more informed decisions. Furthermore, this approach can be used to test the robustness of economic theories and models, which can lead to a better understanding of economic behavior. Overall, a system of simultaneous equations can provide valuable insights into an economy functioning and can help policymakers make better decisions.

Such a system consists of linear regressions, where the dependent variable of one multifactorial regression becomes an independent variable in another regression. Such a systematic view allows to analyze how both direct and indirect effects influence the system and its outputs. The systematic approach is widely applicable for the analysis of macroeconomic indicators and specifically the effects on monetary transmission mechanism and provides a framework for policymakers to conduct scenario analysis.

The relationship between consumer price index, exchange rate, key policy rate, deposit dollarization, and loan dollarization has been the subject of much research and analysis in the field of macroeconomics. These variables were chosen because they are important indicators of the stability and health of a country's financial system. CPI is a measure of the average change in prices over time of goods and services consumed by households, and it reflects the level of inflation in an economy. The exchange rate, on the other hand, is the value of one currency in relation to another, and it can have a significant impact on a country's international trade and investment. The key policy rate is set by NBU to influence borrowing costs and money supply in an economy. Finally, DD and LD are important measures of the degree of dollarization in a country's financial system, which is a key indicator of financial stability. By analyzing the relationship between these variables using econometric tools, we can gain a better understanding of the factors that affect financial dollarization and how they interact with each other.

The objective of the empirical analysis was to estimate the effects of monetary policy and macroeconomic stability on the dollarization level in Ukraine [10].

Following the above mentioned, the system includes 5 linear regressions of main macroeconomic indicators and dollarization ratios. The dependent variables are the consumer price index (CPI), the exchange rate of UAH to USD on the FX market (ER_MARKET), policy rate of NBU (KEY_R), deposit dollarization as a part of FX deposits in total deposits of residents (DD), and loan dollarization as a part of FX loans in total loans (LD).

The basic underlying assumptions are the following:

A. Dollarization of deposits is impacted by the difference between deposit rates denominated in different currencies, and the volume of enterprise lending, and by macroeconomic indicators, for example the exchange rate on the FX market and CPI. This assumption is set based on the theory analysis about what investors take into account when choosing between instruments in different currencies.

B. Loan dollarization is influenced by the level of deposit dollarization as a redistributive function of banks - converting banks' liabilities (deposits) into assets (loans), and is also influenced by the macroeconomic environment presented in the model as the exchange rate and CPI.

C. The policy rate is developed according to Taylor Rule, hence its level is determined by the CPI gap and the output gap, as well as by the neutral interest rate.

D. Taking into account that Ukraine is a small open economy with high dependence on its trading partners, CPI is influenced by the levels of CPI of the main trading partners and the exchange rate of hryvnia to dollar. Being an inflation-targeting country, CPI is determined by the monetary policy instrument – the policy rate of NBU.

E. The exchange rate of hryvnia to dollar on the FX market was chosen instead of the official rate as far as because, in times of different exchange rate regimes, the market level would present a more realistic situation on the market. The

The general specification of the developed system can be presented as the following:

$$\begin{aligned}
 \text{CPI}_t &= f_1 (\text{KEY_R}_{t-6}, \text{ER_MARKET}_{t-3}, \text{PCPI}_{t-1}, \text{CPI}_{t-4}, \text{INR_RESERV}_{t-7}) \\
 \text{ER_MARKET}_t &= f_2 (\text{KEY_R}_{t-1}, \text{ER_MARKET}_{t-1}, \text{ER_OFF}_{t-1}, \\
 &\text{INR_RESERV}_{t-6}, \text{DEBT_TO_GDP}_t, \text{NX}_t) \\
 \text{KEY_R}_t &= f_3 (\text{KEY_R}_{t-1}, \text{GDP_GAP}_{t-1}, \text{CPI}_t - \text{CPI_TARGET}_t, \\
 &\text{ER_MARKET}_{t-1}, \text{NR}_{t-2}) \\
 \text{DD}_t &= f_4 (\text{DD}_{t-1}, \text{ER_MARKET}_t, \text{ER_MARKET_VOL}_{t-3}, \text{CPI_VOL}_{t-4}, \\
 &\text{CREDIT_TO_BUSINESS}_t, \text{DEPOSIT_RATE_DIFFERENTIAL}_{t-4}) \\
 \text{LD}_t &= f_5 (\text{LD}_{t-1}, \text{DD}_t, \text{ER_MARKET}_t, \text{ER_MARKET_VOL}_t, \text{CPI_VOL}_{t-2}, \quad (4.1) \\
 &\text{CPI}_{t-1})
 \end{aligned}$$

where t – time period, CPI – consumer price index to December previous year, %; ER_MARKET – exchange rate of UAH to USD on the FX market, UAH/USD; KEY_R – policy rate of NBU, %; DD – a fraction of deposits of residents in foreign currency; LD – a fraction of loans to residents in foreign currency; PCPI – weighted on volumes of trade CPI of main trading partners; ER_OFF – official exchange rate of UAH to USD, UAH/USD; NX – net export, million USD; INR_RESERV – international reserves, million US dollars; DEBT_TO_GDP – the ratio of debt to real GDP; GDP_GAP – GDP gap, calculated using Kalman filter; CPI_TARGET – inflation target, %; NR – neutral real interest rate, %; CREDIT_TO_BUSINESS – loans to the corporate sector, million UAH; DEPOSIT_RATE_DIFFERENTIAL – spread between deposit rates in UAH and USD, %; ER_MARKET_VOL – volatility of exchange rate of UAH to USD; CPI_VOL – volatility of consumer price index.

Specification of CPI equation:

The main goal of NBU is to keep inflation controlled, stable, and on the targeted level. Since the beginning of the inflation-targeting policy, the key policy rate was the main instrument to stabilize inflation. The effect of the policy rate change is realized through several monetary transmission channels. The policy rate determines the value of money and affects the real sector, hence inflation. Though it

takes time for the economy to respond to the changes, and NBU assumes that the average delay time fluctuates from 6 to 18 months. The lagged effect of the previous CPI of a year ago can be explained by the seasonal effect, typically, the Ukrainian economy is highly season-dependent, and producers' behavior patterns from year to year may be repetitive. The exchange rate with a lag of 3 quarters determines the effect of exchange rate fluctuations passthrough on the internal prices. Being one of the biggest agriculture producers in the world, Ukraine is very subject to fluctuations in prices on the external market, that's why it seems important to include weighted CPI of countries main trade partners: China, Poland, Turkey, Spain, Italy, Netherlands, Egypt, India, Germany, Romania, the USA, Slovakia, Hungary, Austria, and Czech Republic. Also, the volatility of raw materials and energy materials prices in the EU highly affects the situation on the global market and prices in Ukraine as well, as Ukraine imports a big fraction of fuel from Europe. International reserves are included to implement the effect of exchange rate volatility passthrough on the internal prices. According to the above-mentioned, the specification of the consumer price index is the following:

$$CPI_t = \alpha_0 + \alpha_1 * D(KEY_R_{t-6}) + \alpha_2 * D(LOG(ER_MARKET_{t-3})) + \alpha_3 * PCPI_{t-1} + \alpha_4 * CPI_{t-4} + \alpha_5 * LOG(INR_RESERV_{t-7}) \quad (4.2)$$

where CPI_t – consumer price index to December of the previous year, %; ER_MARKET_t – exchange rate of UAH to USD on the FX market, UAH/USD; KEY_R_t – key policy rate of NBU, %; $PCPI_t$ – weighted on volumes of trade CPI of main trading partners; INR_RESERV_t – international reserves, million US dollars.

Specification of exchange rate equation:

The exchange rate is one of the most important variables to determine both inflation and the level of dollarization. In the quarterly projection model (QPM) which is a semi-structural model that NBU uses for its analysis, monetary policy operates through two main transmission channels: the interest rate channel and the exchange rate [11]. In the initial phase, an increase in interest rates causes the local currency to appreciate due to uncovered interest parity. The economy's openness causes the influence of the exchange rate on the consumer prices in Ukraine vis the

mechanism of imported inflation, and they also affect economic activity by influencing demand for foreign goods, which in turn affects inflation [11]. Moreover, the effect of key policy rate change is asymmetrical, meaning that large changes have more effect than small changes. To catch this difference DUMMY1 is introduced in the model, DUMMY1 is a binary variable that represents the volume of change in the policy rate, where 1 is set when the absolute change of policy rate is bigger than the average absolute change in the time series, and 0 is set when it is smaller. International reserves play a crucial role in maintaining exchange rate stability during economic shocks that may arise from periods of crisis. When the exchange rate is fixed, the central bank of Ukraine makes interventions in the foreign exchange market to maintain the stability of the exchange rate. On the other hand, during a floating exchange rate regime, central bank rate changes have a bigger influence on the exchange rate. A rise in the central bank rate causes an appreciation of the currency, while a decrease causes a depreciation. With the history of switching between floating and fixed regimes, the official exchange rate is introduced to represent the limitations of the NBU on the FX market. Net export is included in the specification to reflect the effect of the trade balance on the exchange rate. Additionally, the debt to GDP ratio reflects the impact of changes in external liabilities, as well as the demand and supply of foreign currency, and therefore, affect the exchange rate. According to the above-mentioned, the specification of the exchange rate equation is the following:

$$\begin{aligned}
 \text{LOG}(ER_MARKET_t) = & \alpha_0 + \alpha_1 * D(KEY_R_{t-1}) * DUMMY1_t + & (4.3) \\
 & + \alpha_2 * D(KEY_R_{t-1}) * (1-DUMMY1_t) + \alpha_3 * \text{LOG}(ER_OFF_{t-1}) + \\
 & + \alpha_4 * \text{LOG}(INR_RESERV_{t-6}) + \alpha_5 * \text{LOG}(DEBT_TO_GDP_t) + \alpha_6 * \\
 & D(NX_t)
 \end{aligned}$$

where ER_MARKET_t – exchange rate of UAH to USD on the FX market, UAH/USD; KEY_R_t – policy rate of NBU, %; INR_RESERV_t – international reserves, million US dollars; $DEBT_TO_GDP_t$ – the ratio of debt to real GDP; $DUMMY1_t$ – dummy-variable of the volume of change of policy rate; ER_OFF_t – official exchange rate of UAH to USD, UAH/USD; NX_t – net export, million USD.

Specification of policy rate equation:

The key policy rate is the main tool for the inflation-targeting policy of NBU. The most famous rule of monetary policy is the Taylor rule. It has been modified and applied to national models of many central banks, depending on its needs and purposes, and also taking into account specific features of individual economies. To capture the conservative behavior of a central bank, the policy rate in QPM and its monetary policy rule specification considers its lagged value, which represents persistence in the reaction function. Incorporating both the GDP gap and CPI gap in the model demonstrates the balance or trade-off between stabilizing output and managing inflation, highlighting the flexible nature of the inflation targeting framework [11].

Over the long run, after all, shocks have dissipated, the central bank rate reaches its neutral level which indicates an equilibrium value for the interest rate and short-term dynamics, signifying a state of neither being accommodative nor restrictive in monetary policy [11]. The exchange rate is considered through the indirect impact – it impacts inflation, which in turn can influence the central bank's monetary policy decisions. DUMMY2 is introduced in the model, DUMMY2 is a binary variable that represents the volume of change in the exchange rate, where 1 is set when the absolute change of exchange rate is bigger than the average absolute change in the time series, and 0 is set when it is smaller. According to the above-mentioned, the specification of the policy rate equation is the following:

$$\begin{aligned} KEY_R_t = & \alpha_0 + \alpha_1 * KEY_R_{t-1} + \alpha_2 * D(GDP_GAP_{t-1}) + \\ & + \alpha_3 * (CPI_t - CPI_TARGET_t) + \alpha_4 * D(ER_MARKET_{t-1}) * DUMMY2_t \\ & + \alpha_5 * D(ER_MARKET_{t-1}) * (1 - DUMMY2_t) + \alpha_6 * D(NR_{t-2}) \end{aligned} \quad (4.4)$$

where KEY_R_t – policy rate of NBU, %; CPI_t – consumer price index to December previous year, %; ER_MARKET_t – exchange rate of UAH to USD on the FX market, UAH/USD; GDP_GAP_t – GDP gap, calculated using Kalman filter; CPI_TARGET_t – inflation target, %; NR_t – neutral real interest rate, %; $DUMMY2_t$ – dummy-variable of the volume of change of exchange rate.

Specification of deposit dollarization equation:

Based on the analyzed literature, deposit dollarization is mostly seen as a response to high uncertainty about the macroeconomic situation in the nearest future. The equation includes a lagged deposit dollarization ratio to account for persistence effects. The exchange rate is considered in the model as it falls under the MVP framework: depreciation of the national currency may increase the incentive for deposit dollarization as individuals and businesses seek to protect the value of their savings from currency fluctuations and invest in a more stable currency. The same incentive applies to inflation: if people experience a relatively low level of inflation, the credibility of the central bank rises as economic agents assume that the central bank keeps inflation under control, and hence their expectations about future inflation become anchored to the central bank's target and forecast. Having stable, moderate inflation, the demand for investing in national currency instruments increases. However, there is evidence from research that in the short term, it is rather inflation volatility that is perceived by households and business entities rather than inflation itself [12]. During crisis years it becomes more difficult for the central bank to manage inflation, hence economic agents expect bigger inflation deviations and higher depreciation rates. Consequently, inflation volatility and exchange rate volatility have been introduced in the model estimated using the GARCH methodology. The volume of corporate lending is used in the equation as the proxy for the demand for funding in banks. With the increase in demand for corporate lending, banks would try to engage more funding, e.g. they would rise interest rates. Taking into account that the business sector actively engages in trading with foreign companies and customers, they would need funds in foreign currency to conduct their business operations. Volatilities are presented as lagged values because it takes time for the economic agents to perceive the fluctuations in these indicators. The interest rate differential determines the spread between the yield on hryvnia and FX deposits. With the increase of the spread, hryvnia instruments would seem more attractive for investors than FX instruments. According to the above-mentioned, the specification of the deposit dollarization equation is the following:

where DD_t – a fraction of deposits of residents in foreign currency; ER_MARKET_t – exchange rate of UAH to USD on the FX market, UAH/USD; $CREDIT_TO_BUSINESS_t$ – loans to the corporate sector, million UAH; $DEPOSIT_RATE_DIFFERENTIAL_t$ – spread between deposit rates in UAH and USD, %; $ER_MARKET_VOL_t$ – volatility of exchange rate of UAH to USD; CPI_VOL_t – volatility of consumer price index.

Specification of loan dollarization equation:

There is an important empirical evidence that a positive correlation between deposit and loan dollarization remains. As deposits are an important lending source, it affects banks' decisions and capacities to provide loans in foreign currency. Moreover, with expected depreciation, banks may receive FX gains from the revaluation of loans denominated in foreign currency, basically shifting currency risk to their borrowers. However, depreciation also increases credit risk, hence, banks have to find an optimal balance for FX lending. Considering currency risk, LD would greatly depend both on the exchange rate and its volatility. When inflation increases, it leads to a decrease in the purchasing power of the domestic currency. This, in turn, increases the cost of borrowing in domestic currency for businesses. As a result, businesses may decide to borrow in foreign currency as it may provide lower borrowing costs due to lower interest rates in foreign currency. However, borrowing in foreign currency also carries the risk of exchange rate fluctuations, which can lead to an increase in the cost of borrowing in domestic currency if the domestic currency depreciates against the foreign currency. Therefore, the decision to borrow in foreign currency is influenced by a trade-off between the potential cost savings from lower interest rates and the risk of exchange rate fluctuations. According to the above-mentioned, the specification of the loan dollarization equation is the following:

$$LD_t = \alpha_0 + \alpha_1 * LD_{t-1} + \alpha_2 * DD_t + \alpha_3 * DLOG(ER_MARKET_t) + \alpha_4 * ER_MARKET_VOL_t + \alpha_5 * CPI_{t-1} + \alpha_6 * CPI_VOL_{t-2} \quad (4.6)$$

where , LD_t – a fraction of loans to residents in foreign currency; DD_t – a fraction of deposits of residents in foreign currency; CPI_t – consumer price index to December previous year, %; ER_MARKET_t – exchange rate of UAH to USD on the

FX market, UAH/USD; $ER_MARKET_VOL_t$ – volatility of exchange rate of UAH to USD; CPI_VOL_t – volatility of consumer price index.

To make a conclusion, the model involves 5 equations of main macroeconomic and financial variables: consumer price index, exchange rate, key policy rate, and deposit and loan dollarization, they are endogenous variables. Among the exogenous variables are CPI of the main trading partners, official exchange rate, international reserves, debt to GDP ratio, net export, GDP gap, inflation target, neutral interest rate, volatilities of CPI and exchange rate, lending to business, deposit rate differential. Determined (lagged) variables in the system are key policy rate, exchange rate, CPI, international reserves, and deposit and loan dollarization ratios. This model gives the possibility to include the transmission of macroeconomic variables and monetary instruments' effects on financial dollarization. Specifications of the equations of the system, determination and Durbin-Watson coefficients are presented in table 4.2.

Table 4.2. System's equations specification

№	Specification of the system's equations	Determination coefficient
1	Consumer price index equation, %	
	$CPI = 36.74 - 0.82 * D(KEY_R(-6)) + 95.66 * D(LOG(ER_MARKET(-3))) + 2.17 * PCPI(-1) + 0.16 * CPI(-4) - 4.3 * LOG(INR_RESERV(-7))$	90,33% DW=2.15
2	Exchange rate equation, UAH/USD	
	$LOG(ER_MARKET) = -0.09 - 0.015 * D(KEY_R(-1)) * DUMMY1 - 0.005 * D(KEY_R(-1)) * (1 - DUMMY1) + 0.073 * LOG(INR_RESERV(-6)) + 0.162 * LOG(DEBT_TO_GDP) + 0.762 * LOG(ER_OFF(-1)) - 9.212e-06 * D(NX)$	85,69% DW=2.14
3	Key policy rate equation, %	
	$KEY_R = 2.26 + 0.76 * KEY_R(-1) - 4.76 * D(GDP_GAP(-1)) + 0.14 * (CPI - CPI_TARGET) + 3.19 * (D(ER_MARKET(-1))) * DUMMY2 + 1.06 * (D(ER_MARKET(-1))) * (1 - DUMMY2) - 1.09 * D(NR(-2))$	88,72% DW=1.45
4	Deposit dollarization equation	
	$DD = -2.77 + 0.66 * DD(-1) + 0.14 * DLOG(ER_MARKET) + 0.000404 * ER_MARKET_VOL(-3) + 9.489e-05 * CPI_VOL(-4) + 0.21 * LOG(CREDIT_TO_BUSINESS) + 0.0035 * DEPOSIT_RATE_DIFFERENTIAL(-4)$	91,59% DW=2.2
5	Loan dollarization equation	
	$LD = -0.118 + 0.94 * LD(-1) + 0.32 * DD + 0.11 * DLOG(ER_MARKET) - 0.00013 * CPI_VOL(-2) - 0.00056 * ER_MARKET_VOL + 0.00086 * CPI(-1)$	98,24% DW=1.82

Source: developed by authors in EViews 12

The dataset includes 34 quarterly observations from 2014 till the 1st half of 2022 with forecasting of next 4 quarters.

The conclusion on the equations' adequacy is presented in table 4.3-4.7.

Table 4.3. Results of testing for compliance with classical assumptions for the consumer price index equation

№	Assumption	Test	Critical value	Conclusion
1	Absence of heteroskedasticity	White Test, H0 – absence of heteroskedasticity	0.9480	Yes
2	Absence of autocorrelation	Breusch-Godfrey LM Test, H0- absence of serial correlation	0.9779	Yes
		Durbin-Watson test	2.15	Yes
3	Absence of multicollinearity	Test VIF, H0 – absence of multicollinearity	<10	Yes
4	Residuals normal distribution	Jarque-Bera test, H0 – normal distribution	0.56	Yes
5	Correctness of specification	RESET-test, H0 – correct specification	0.0193	No
		Adjusted R-squared	0.92	Yes
		Fisher F-criteria	p-value < 0.1	Yes

Source: developed by authors in EViews 12

The equation of the consumer price index is consistent with most of the tests, except the RESET-test for the correctness of specification. Hence, additional criteria were taken into account, such as the high explanatory power of the regression (R-squared 92%), and all the independent variables are significant with confidence limits of 10%.

Table 4.4. Results of testing for compliance with classical assumptions for the exchange rate equation

№	Assumption	Test	Critical value	Conclusion
1	Absence of heteroskedasticity	White Test, H0 – absence of heteroskedasticity	0.7278	Yes
2	Absence of autocorrelation	Breusch-Godfrey LM Test, H0- absence of serial correlation	0.8479	Yes
		Durbin-Watson test	2.14	Yes

<i>Continuation of Table 4.4</i>				
№	Assumption	Test	Critical value	Conclusion
3	Absence of multicollinearity	Test VIF, H0 – absence of multicollinearity	<10	Yes
4	Residuals normal distribution	Jarque-Bera test, H0 – normal distribution	0.9	Yes
5	Correctness of specification	RESET-test, H0 – correct specification	0.7230	Yes
		Adjusted R-squared	0.86	Yes
		Fisher F-criteria	p-value < 0.1	Yes

Source: developed by authors in EViews 12

The equation of the exchange rate is consistent with all of the tests, has high explanatory power of the regression (R-squared 86%), and all the independent variables are significant with confidence limits of 10%.

Table 4.5. Results of testing for compliance with classical assumptions for key policy rate equation

№	Assumption	Test	Critical value	Conclusion
1	Absence of heteroskedasticity	White Test, H0 – absence of heteroskedasticity	0.1279	Yes
2	Absence of autocorrelation	Breusch-Godfrey LM Test, H0-absence of serial correlation	0.3301	Yes
		Durbin-Watson test	1.45	Yes
3	Absence of multicollinearity	Test VIF, H0 – absence of multicollinearity	<10	Yes
4	Residuals normal distribution	Jarque-Bera test, H0 – normal distribution	0.07	Unclear
5	Correctness of specification	RESET-test, H0 – correct specification	0.7160	Yes
		Adjusted R-squared	0.89	Yes
		Fisher F-criteria	p-value < 0.15	Yes

Source: developed by authors in EViews 12

The equation of the key policy rate is consistent with most of the tests, the test of the normal distribution of residuals is unclear, the problem for that can be a very limited number of observations, however taking into account other tests, and the prevalence of the problem of non-normal distribution for small datasets, the equation was developed as best possible to satisfy key tests, it also has high explanatory power of the regression (R-squared 89%), and all the independent variables are significant with confidence limits of 15%.

Table 4.6. Results of testing for compliance with classical assumptions for deposit dollarization equation

№	Assumption	Test	Critical value	Conclusion
1	Absence of heteroskedasticity	White Test, H0 – absence of heteroskedasticity	0.5093	Yes
2	Absence of autocorrelation	Breusch-Godfrey LM Test, H0- absence of serial correlation	0.3337	Yes
		Durbin-Watson test	2.2	Yes
3	Absence of multicollinearity	Test VIF, H0 – absence of multicollinearity	<10	Yes
4	Residuals normal distribution	Jarque-Bera test, H0 – normal distribution	0.87	Yes
5	Correctness of specification	RESET-test, H0 – correct specification	0.1304	Yes
		Adjusted R-squared	0.92	Yes
		Fisher F-criteria	p-value < 0.05	Yes

Source: developed by authors in EViews 12

The equation of the deposit dollarization is consistent with all of the tests, has high explanatory power of the regression (R-squared 92%), and all the independent variables are significant with confidence limits of 5%.

The equation of the loan dollarization is consistent with most of the tests, has high explanatory power of the regression (R-squared 98%), and all the independent variables are significant with confidence limits of 5%.

Table 4.7. Results of testing for compliance with classical assumptions for loan dollarization equation

№	Assumption	Test	Critical value	Conclusion
1	Absence of heteroskedasticity	White Test, H0 – absence of heteroskedasticity	0.5085	Yes
2	Absence of autocorrelation	Breusch-Godfrey LM Test, H0- absence of serial correlation	0.7360	Yes
		Durbin-Watson test	1.82	Yes
3	Absence of multicollinearity	Test VIF, H0 – absence of multicollinearity	<10	No
4	Residuals normal distribution	Jarque-Bera test, H0 – normal distribution	0.33	Yes
5	Correctness of specification	RESET-test, H0 – correct specification	0.2014	Yes
		Adjusted R-squared	0.98	Yes
		Fisher F-criteria	p-value < 0.05	Yes

Source: developed by authors in EViews 12

Previously specified regression equations are then combined and united into one system. To conduct this step, exogenous and determined (lagged endogenous) variables have been defined. This division is needed to test the system for the identity check according to the condition of the order. The condition of the order is defined based on the following formula:

$$(K-k)=(m-1) \quad (4.7)$$

where K – the sum of exogenous and determined variables in the system, k – the sum of exogenous and determined variables in the equation, and m – the number of endogenous variables in the equation.

If $(K-k)$ is lower than $(m-1)$ then the system is underidentified, if it is greater – the system is overidentified. The developed system has 28 exogenous and determined variables and 5 endogenous. Every equation was tested separately for the identity check (see Table 4.8).

Table 4.8. Results of the system test for the identity check according to the condition of the order

Endogenous variables	Exogenous variables	Determined (lagged endogenous) variables	Condition of the	Conclusion
Consumer price index equation				
CPI _t	PCPI _{t-1}	KEY_R _{t-6} , ER_MARKET _{t-3} , CPI _{t-4} , INR_RESERV _{t-7}	28-5>1-1	Overidentified
Exchange rate equation				
ER_MARKET _t	ER_OFF _{t-1} , INR_RESERV _{t-6} , DEBT_TO_GDP _t , NX _t , DUMMY1	KEY_R _{t-1} , ER_MARKET _{t-1}	28-7>1-1	Overidentified
Key policy rate equation				
KEY_R _t , CPI _t	GDP_GAP _{t-1} , CPI_TARGET _t , NR _{t-2} , DUMMY2	KEY_R _{t-1} , ER_MARKET _{t-1}	28-6>2-1	Overidentified
Endogenous variables	Exogenous variables	Determined (lagged endogenous) variables	Condition of the order	Conclusion
Deposit dollarization equation				
DD _t , ER_MARKET _t	ER_MARKET_VOL _{t-3} , CPI_VOL _{t-4} , CREDIT_TO_BUSINES S _t , DEPOSIT_RATE_ DIFFERENTIAL _{t-4}	DD _{t-1}	28-5>2-1	Overidentified
Loan dollarization equation				
LD _t , DD _t , ER_MARKET _t	ER_MARKET_VOL _t , CPI_VOL _{t-2}	LD _{t-1} , CPI _{t-1}	28-4>3-1	Overidentified

Source: developed by authors

The system can be estimated based on a two-stage or three-stage least squares estimation method. The estimated system output from both methods is shown in Annex B.

Based on the decrease of the determinant residual covariance value from 7,19E-11 to 5,95E-11 when switching from the two-stage to three-stage least squares method, the latter was chosen for final system estimation.

The system was therefore tested for the residual autocorrelations using the Portmanteau Autocorrelation test. Results of the test confirm that there are no residual autocorrelations in the system up to lag 12.

It is crucial to assess the forecast quality of any model as it enables the evaluation of the model's ability to predict outcomes and analyze various scenarios of potential economic events based on different initial conditions and assumptions. By assessing how well the model can forecast future outcomes, we can determine its usefulness for decision-making purposes. If the model consistently produces inaccurate forecasts, it may not be suitable for making reliable predictions, and relying on its results could lead to poor decisions. Estimating the forecast quality of a model also provides insights into the model's underlying assumptions and parameters and can help identify areas where improvements can be made. Ultimately, by evaluating the forecast quality of a model, we can gain a better understanding of its limitations and potential biases, and make more informed decisions based on its predictions.

The first step to assess forecast quality is to simulate the model and compare it with historical results. Simulated and historical results for endogenous variables are shown in Figure 4.6 and Figure 4.7.

When analyzing results for macroeconomic variables, we can see that the simulated results replicate the actual behavior pretty accurately. What is important in such results is that it manages not only to capture the trend but also to replicate the turning points. The model managed to capture the changes in the economy caused by the Russian full-scale invasion, and the consequent actions of the NBU – the increase of the central bank rate, a sharp growth in the market exchange rate and the surge in inflation. A very accurate forecast for the last periods allows relying on the model for short-term forecasting.

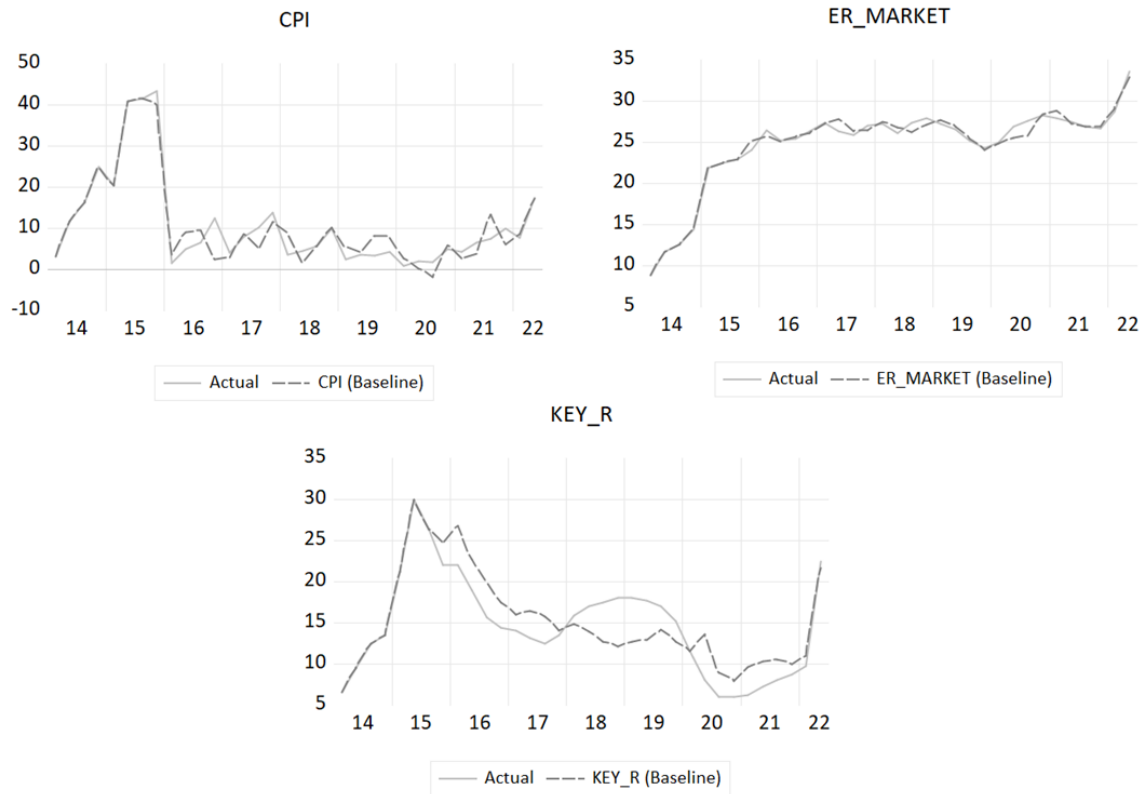


Figure 4.6. Historical and simulated results for consumer price index, exchange rate, and key policy rate

Source: developed by authors in EViews 12

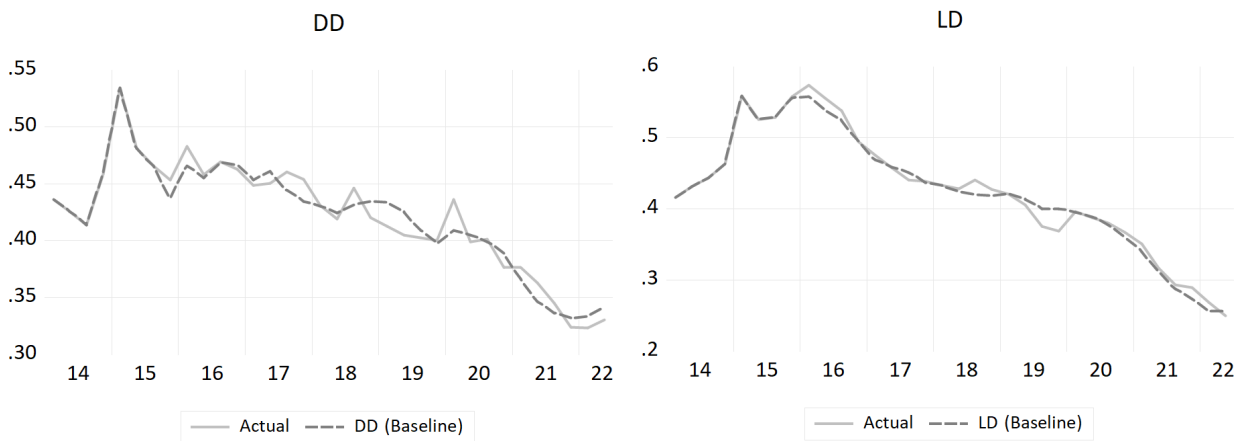


Figure 4.7. Historical and simulated results for deposit and loan dollarization

Source: developed by authors in EViews 12

Deposit and loan dollarization simulated results are also pretty accurate and manage to replicate the turning points, however for the DD, the peaks are rather smoothed by the model.

Deposit and loan dollarization is going to stay at a relatively high level due to still high inflation risks and exceeding their pre-war level. As the market is highly uncertain and limited, and the transmission mechanism is not as effective as before the war, NBU has to pay attention to macroprudential regulatory tools.

A system of simultaneous equations proved to be a very efficient method to analyze how the macroeconomic situation affects financial dollarization. Deposit dollarization is driven by its previous level, the exchange rate, and its volatility, as well as by consumer price index volatility. It also depends on the demand for corporate lending, reflecting the redistributive function of banks and the difference between national and foreign currency deposit rates. In the meantime, loan dollarization depends on deposit dollarization, exchange rate, inflation, and their volatilities. In the model, only macroeconomic indicators and monetary policy tools are endogenized, which brings to a conclusion that a stable, controlled macroeconomic environment, increases the confidence of both investors, borrowers, and banks, providing grounds for trust to NBU, the national currency instruments, and consequently for lower levels of financial dollarization.

In addition, as one of the financial stability goals is to ensure low financial dollarization, monetary policies should be followed by relevant macroprudential policies.

Scenario analysis is an essential part of developing a system of simultaneous equations for analyzing complex economic systems such as financial dollarization. This technique involves creating hypothetical scenarios based on different assumptions and modeling the impact of these scenarios on the system under study. Through scenario analysis, we can explore how the system may react to changes in key variables and evaluate the effectiveness of different policy options. This approach can help policymakers and researchers identify potential risks and challenges and develop effective strategies to manage them. By incorporating scenario analysis into the system of simultaneous equations, we can enhance our understanding of complex economic phenomena and improve the accuracy of our forecasting and policymaking.

Next step will be developing the System Dynamics model. The System Dynamics (SD) approach is another method that enables analyzing complex

problems, such as the causes and consequences of financial dollarization. In essence, system dynamics provides a powerful framework for analyzing dollarization, allowing for a deep understanding of its dynamics and informing more effective policy decisions. This approach is particularly valuable in economics, where the interplay of various factors can be complex and non-intuitive. It allows modeling relationships and feedback in the system based on incorporated assumptions. When analyzing such systems it appears to be a flexible tool: it is applicable for changing parameters, developing scenarios, and testing hypotheses. While developing the system dynamics model the modeler receives incentives for leverage points in the system. These insights from the developed model can be very valuable for policymakers, and system dynamics software provides opportunities for versatile approach in analyzing the problem and finding possible solutions.

There is little literature on the analysis of financial systems using system dynamics, hence this research aims to provide grounds for the application of SD models in the risk-management practices of banks. Dollarization can be analyzed in terms of stocks (such as the total amount of foreign currency deposits) and flows (such as changes in the rate of foreign currency deposits over time). System dynamics models use differential equations to represent these stocks and flows, providing a dynamic view of how dollarization evolves.

The key part of the model structure is a simplified balance sheet and financial results statement of banks. Assets of the bank consist of hryvnia loans, FX loans, bonds, and reserves. Liabilities consist of hryvnia deposits, FX deposits, and financial capital. The balance sheet structure is important because it allows the calculation of important risk management indicators, such as liquidity ratios, and others, which then can be used by the regulators to analyze the financial health of the banking sector and for the development of macroprudential strategies.

The financial result includes banks' income and expenses, such as net interest income, net commission income, foreign currency gains or losses, and other income and expenses.

Macroeconomic indicators, such as inflation, policy rate, and exchange rate are taken exogenously, in contrast to the system of simultaneous equations developed

in the previous part, for simplification purposes. These macroeconomic indicators are mostly used in terms of perception, relative changes, and expectations.

In contrast to the system of simultaneous equations, both hryvnia and FX deposit and loan rates are endogenized. This structure allows tracking of the response of banks to various changes both in the macroeconomic situation and monetary policy. Also exchange rate is taken exogenously, and this part of the model can be developed in further research. System dynamics models can simulate different economic scenarios and policy interventions to see their potential impacts on dollarization. For example, the model could simulate the effect of a new monetary policy or regulatory changes on the level of foreign currency deposits and loans.

The simplified causal-loop diagram is presented in Figure 4.8.

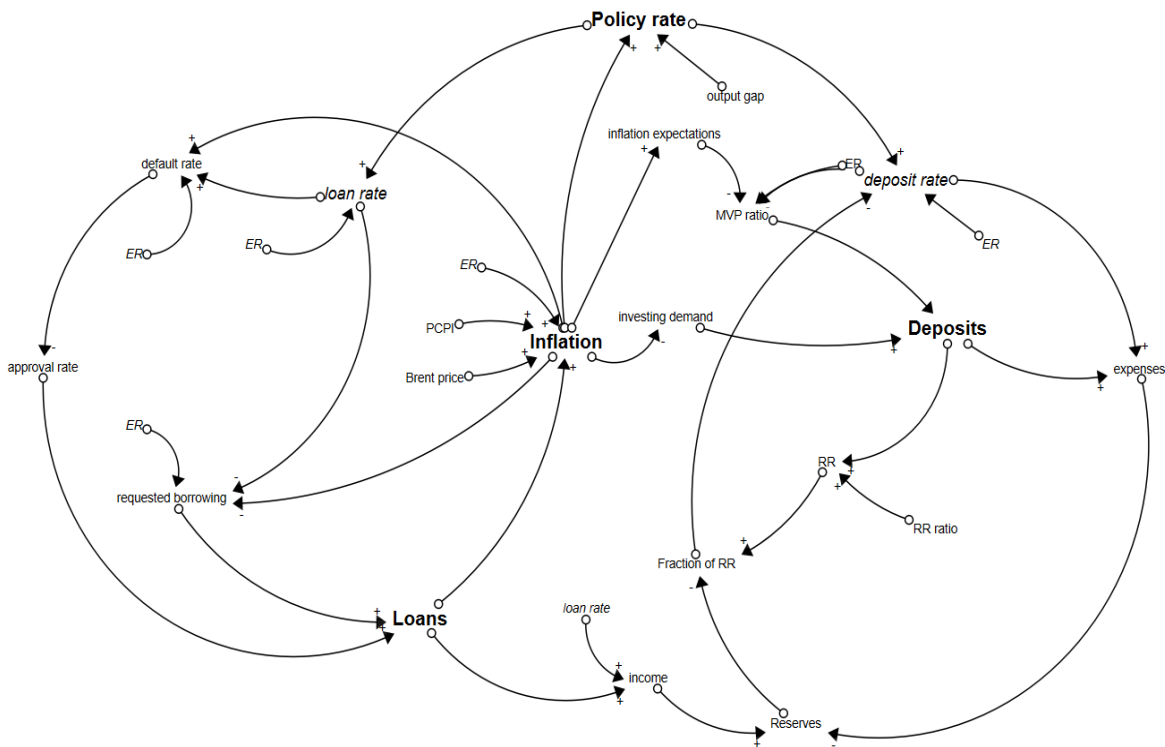


Figure 4.8. Simplified causal-loop diagram of banking sector and monetary policy

Source: developed by authors in Stella Architect

The assumptions developed to describe deposit dollarization are the following:

1. Demand for investing in deposits is driven by its persistent level and changes in inflation – with the increase in inflation, purchasing power of individuals and businesses decreases, hence people invest less, as they have to pay more to maintain their needs.
2. With hryvnia depreciation people tend to invest in foreign currency deposits to hedge from currency risk.
3. With the increase in inflation expectations, people tend to invest in foreign currency deposits due to higher uncertainty and a desire to hedge from inflationary risks.
4. Inflation expectations depend on the monetary credibility and forecast of the NBU. Monetary credibility is adjusted with a delay of 2 years based on the gap between actual inflation and its target. With the decrease of inflation closer to its target, the monetary credibility increases, and consequently inflation expectations will be closer to the forecast communicated by the NBU.
5. If the deposit rate differential that is a difference between hryvnia and FX deposit rates increases it means that hryvnia deposits have higher yields than FX deposits, hence investors would prefer to hold them in their portfolios.
6. Hryvnia deposit rate is positively affected by the change in the policy rate, this assumption is based on the estimated correlation of 0,65.
7. FX deposit rate is also positively affected by policy rate with the estimated correlation of 0,31. It is negatively affected by the change in the exchange rate, as banks don't have the incentive to carry currency risk, the estimated correlation is -0,77. The required reserves ratio set by NBU also affects the willingness of banks to increase the deposit rate on FX deposits: with the increase of the ratio banks will lower their interest rate, and the estimated correlation is -0,3.

The assumptions developed to describe loan dollarization are the following:

1. The demand for loans in hryvnia is driven by the respective interest rate. With the increase of the hryvnia loan rate, customers will be less willing to take loans due to the high costs of its maintenance. The same logic is applied to the effect of inflation on demand for hryvnia loans: higher inflation may reduce the purchasing

power of customers, making them more cautious about taking on new debt, also it can reduce demand for credit as businesses and consumers cut back on spending.

2. The demand for FX loans is driven by the respective loan rate: with the increase in the rate, customers will be willing to take fewer loans due to high service costs. It can also be driven by the difference in loan rates in hryvnia and FX: usually, FX rates are lower than the ones nominated in hryvnia. The exchange rate negatively affects FX borrowing demand, as with hryvnia depreciation costs of debt maintenance increase as well.
3. Hryvnia loan rate is positively affected by the policy rate, the estimated correlation is 0,87, and by the hryvnia deposit rate: if banks increase deposit rates, they will want to increase the spread as well to prevent losing interest income. The estimated correlation between hryvnia deposit and loan rates is 0,85.
4. FX loan rate is positively affected by the policy rate, the estimated correlation is 0,32, and is negatively affected by the exchange rate: with hryvnia depreciation banks will try to manage the risks associated with foreign currency lending, such as exchange rate fluctuations and default risk. The estimated correlation between FX loan rates and the exchange rate is -0,6.

SD model overview is shown in Annex C in regard to separate model structures: Monetary Policy, Deposits, Loans, Interest Rates, Customers demand for savings, Customers demand for borrowings, Balance Sheet, and P&L.

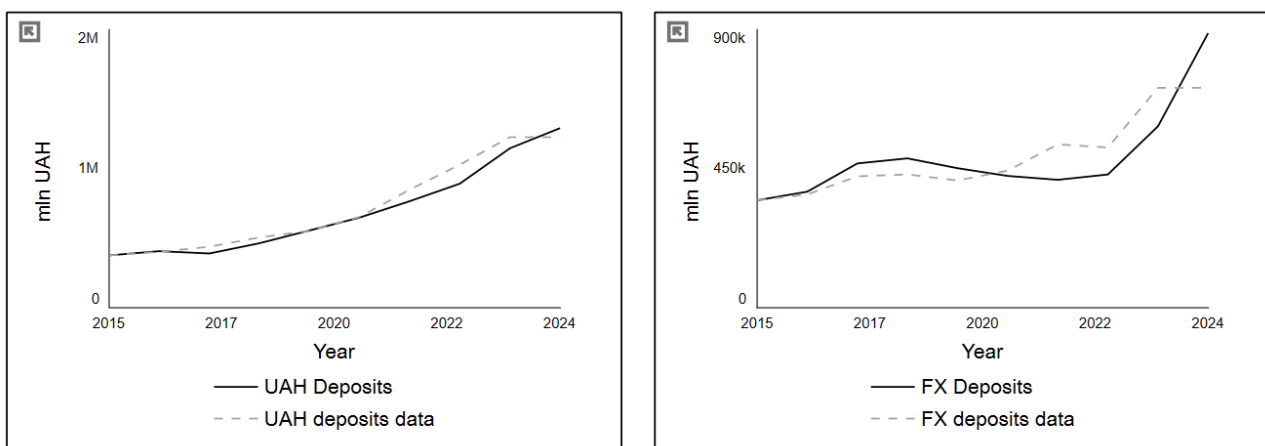


Figure 4.9. Deposits simulation from 2015 till 2024

Source: developed by authors in Stella Architect

Simulation for deposit dynamics is shown in Figure 4.9. From the graphs, we can see that the simulated results reflect historical data very accurately. Total deposit demand also accounts for the effect of currency restrictions, based on sensitivity analysis estimated multiplier for the increase in demand for deposits in 2022 is 0,4.

Simulated deposit dollarization is also consistent with the historical data (see Figure 4.10). In 2022 even though FX deposits have increased a lot, the overall growth rate of deposits was higher, hence it didn't exceed the pre-war levels. A combination of currency restrictions and an increase in reserve requirements restricted excessive dollarization in 2022. However, the dollarization will continue increasing and as of the end of 2023, it will reach 41%. This result is similar to the one derived from a system of simultaneous equations.

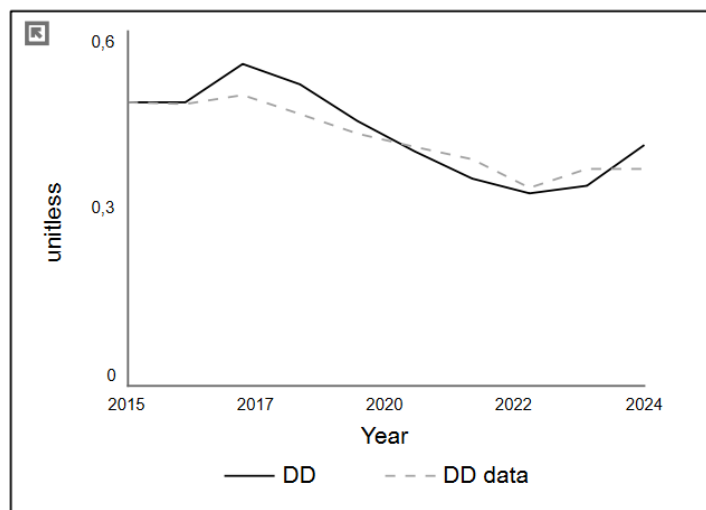


Figure 4.10. Deposits dollarization simulation from 2015 till 2024

Source: developed by authors in Stella Architect

In contrast, loans simulation is more accurate after 2016 and has a gap at the beginning of the simulation, however, this gap between actual and simulated data occurs due to delays in the system, hence the model couldn't account for lagged effects that occurred before 2015 (see Figure 4.11). This problem can be easily solved with the expansion of the analyzed period. The model shows the overall trend in the decrease of loans in the financial system. This result is consistent with the Financial Stability Report of NBU where it is mentioned that having high liquidity banks don't have incentives to provide loans with higher currency and default risk [7].

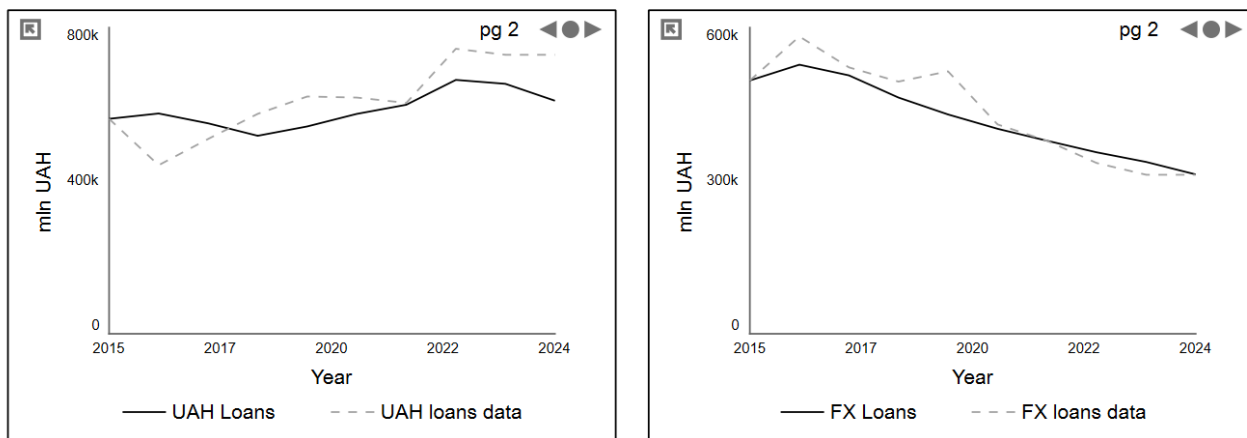


Figure 4.11. Loans simulation from 2015 till 2024

Source: developed by authors in Stella Architect

Loans dollarization, according to Figure 4.12, will stay on the same level. Even though FX loans are decreasing, overall lending is decreasing a bit faster. This outcome can be a result of the decrease in total lending demand from businesses and individuals, due to a decrease in their purchasing power and high uncertainty about their capabilities to fulfill debt obligations. Also, due to the decrease in foreign trade, and the decline in economic activity in general, the demand for foreign currency decreased as well. The low level of loan dollarization would be explained through the overall decrease in demand for borrowings in both hryvnia and foreign currency.

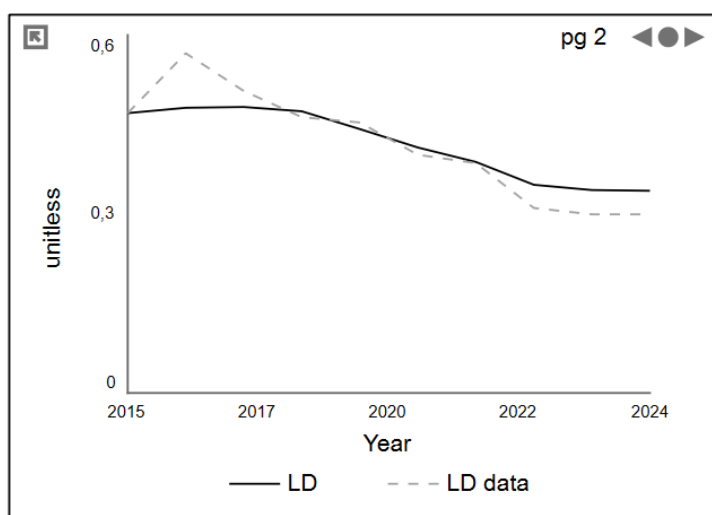


Figure 4.12. Loans dollarization simulation from 2015 till 2024

Source: developed by authors in Stella Architect

To sum up, the system dynamics approach appeared to be a useful tool for analyzing a complex system such as the banking sector. The iterative nature of the modeling process deepened the understanding of the interactions between different variables and feedback loops. The high accuracy of the simulation within the complexity of the system, as well as the possibility to observe both short-term and long-term effects of different policy choices, are the main advantages of the system dynamics approach. According to the results of the SD model, deposit dollarization will continue increasing, however, its growth will be moderate. At the same time loan dollarization will stay on the same level due to both decreases in overall demand for borrowings and banks' unwillingness to take on additional risks during the crisis period.

4.4. De-dollarization policies and prospects for the de-dollarization of the Ukrainian economy

De-dollarization policies are becoming increasingly important for many countries as they seek to reduce their dependence on foreign currencies and promote economic stability. While the specific strategies for de-dollarization may vary, it is generally recognized that reducing dollarization can help countries avoid financial crises and currency shocks. However, the success of de-dollarization policies can depend on a range of factors, such as the strength of a country's financial institutions, the degree of public trust in the national currency, and the effectiveness of government policies in promoting alternative investment options. Therefore, it is important for policymakers to carefully consider the various approaches to de-dollarization and choose those that are most likely to be successful in their specific economic and political context.

The paper of Alvarez-Plata and Garcia-Herrero proposes a classification of de-dollarization strategies based on the policy approach adopted by the central bank [13]. They classify these strategies into two broad categories: market-based and administrative-based. Market-based strategies aim to reduce dollarization through the promotion of alternative financial instruments in local currency, such as government

bonds or certificates of deposit. This approach assumes that the market is efficient and that it will respond to incentives provided by the central bank. Administrative-based strategies, on the other hand, involve the implementation of regulatory measures by the central bank to discourage the use of the dollar in the financial system. These measures can include the use of reserve requirements, taxation, or limits on foreign currency lending. The authors note that both market-based and administrative-based strategies have their advantages and disadvantages and that the effectiveness of each strategy depends on the specific economic and institutional context of the country in question. The authors conclude that de-dollarization policies can be successful if they are implemented in a gradual and coordinated way, involve a combination of macroeconomic and financial measures, and are supported by sound monetary and fiscal policies [13].

The transmission mechanism refers to the process by which monetary policy decisions made by a central bank are transmitted to the real economy.

A strong transmission mechanism means that changes in monetary policy are transmitted quickly and effectively to the broader economy, which can help to reduce dollarization by affecting the relative attractiveness of local currency assets. For example, an increase in interest rates on local currency deposits can make them more attractive relative to foreign currency deposits, while an increase in reserve requirements can limit the availability of foreign currency loans.

However, if the transmission mechanism is weak, monetary policy measures may have a limited impact on deposit and loan dollarization. This can occur if financial markets are underdeveloped if there is a lack of confidence in the stability of the local currency, or if there are regulatory or institutional barriers that limit the effectiveness of monetary policy measures. In such cases, policymakers may need to implement additional measures, such as administrative-based policies, to reduce dollarization.

As countries around the world seek to reduce their dependence on foreign currencies, de-dollarization has become a popular policy objective. While the benefits of reducing the share of foreign currency deposits and loans are well-known, the process of achieving this goal can be challenging. One of the key questions

policymakers face is identifying the most effective leverage points for implementing de-dollarization policies. The term "leverage points" refers to the areas where a small change can have a significant impact on the entire system. In the context of de-dollarization, these are the areas where policy interventions can have the most significant effect on reducing the dollarization level of the economy.

Table 4.9. Leverage points to affect dollarization

De-dollarization policy	Description
Monetary policy	Central banks can use monetary policy to affect the demand for foreign currency loans and deposits. By increasing interest rates, the central bank can make local currency deposits and loans more attractive, thereby reducing the demand for foreign currency deposits and loans. As seen from the SD model in the previous chapter, generally hryvnia loans and deposits rates are more sensitive to changes in the policy rate.
Exchange rate policy	Exchange rate policy can affect dollarization by influencing the relative attractiveness of local and foreign currency deposits and loans. If the exchange rate is stable and predictable, it may reduce the demand for foreign currency deposits and loans. A developed system of simultaneous equations has shown the importance of both exchange rate and their volatility for changes in dollarization.
Prudential regulations	Prudential regulations can be used to reduce the risks associated with foreign currency loans and deposits. For example, banks may be required to hold more capital against foreign currency loans, which would make such loans less profitable and reduce the demand for them.
Financial education	Improving financial literacy can reduce the demand for foreign currency loans and deposits by making individuals and businesses more aware of the risks associated with such transactions. This can be done through public education campaigns, financial literacy courses, and other similar initiatives. NBU's communication strategy is very important for anchoring expectations, and increasing the credibility of the institution, and hence its actions.

Source: developed by authors

All of the mentioned above policies and respective leverage points proved to be somewhat successful both in Ukraine and other countries. Now since the potential leverage points for de-dollarization policies have been identified, the next step is to consider how these policies can be effectively implemented. In this regard, it is useful

to draw on the experiences of other countries that have implemented de-dollarization policies in the past. By examining the successes and failures of these policies, valuable insights into what works and what does not can be gained.

Ukraine can take several countries as a reference for successful de-dollarization policies and tools (see Table 4.10).

Table 4.10. Successful de-dollarization practices

Country	Years	Results	Policies and tools
Kazakhstan	2010-now	The fastest rate of credit de-dollarization in the CCA region – from 67% in 2010 to 34% in 2021. LD decreased faster than DD.	Inflation targeting, increase in liquidity coverage ratios for FX obligations, long-term domestic capital market development.
Israel	1990-2004	DD largely and permanently decreased from 50% in the early	Growing the market of government bonds in national currency, inflation targeting.
Peru	2005-2019	LD decreased from around 80% in 2000 to 27,7% in 2015.	Limitations on the availability of FX deposits, inflation targeting, counter-cyclical reserve requirements.

Source: developed by authors based on data [13, 14, 15]

Kazakhstan has been implementing de-dollarization policies since 2013 to reduce the share of foreign currency deposits to 30% by 2020. According to the National Bank of Kazakhstan, deposit dollarization dropped from 70% at the end of 2015 to 36% in December 2021 [15]. Similarly to Ukraine, Kazakstan officially adopted inflation targeting as its monetary policy framework in 2016, following a period of floating exchange rates. The National Bank of Kazakhstan has implemented several measures to encourage the use of the national currency, including lowering interest rates on foreign currency deposits, introducing preferential lending rates for borrowers in tenge, and requiring banks to maintain a certain ratio of tenge deposits to foreign currency deposits [15]. The country considers macroeconomic stability as the key factor for de-dollarization.

Another successful example is Israel. The period of dollarization in Israel started around 1990 and it was the first emerging country to have introduced

inflation-targeting [13]. Israel is an example of how the provision of alternatives to dollar-denominated assets helped to reduce dollarization by promoting national currency bonds. The Bank of Israel has implemented measures to encourage the use of shekels in international trade and to increase the availability of shekel-denominated financial instruments. These measures have included the establishment of shekel clearing arrangements with other countries, the issuance of government bonds in shekels, and the expansion of the domestic corporate bond market. The combination of the promotion of government bonds and the period of disinflation reduced investors' uncertainty about local currency assets [13]. In 2014, the Bank of Israel introduced regulations to limit foreign currency mortgage lending to homebuyers, to reduce the risks associated with exchange rate fluctuations. The regulations required banks to maintain higher capital reserves for foreign currency mortgages and to offer homebuyers the option of taking out a mortgage in shekels instead of dollars.

Peru has also been implementing de-dollarization policies in recent years, including requiring banks to maintain a certain level of local currency reserves and implementing tax breaks for companies that borrow in local currency. The central bank has also been gradually lowering interest rates on local currency deposits and raising interest rates on foreign currency deposits. Its experience can be characterized as the interaction between monetary and macro-prudential policy [16]. The central banks directly reduced vulnerabilities such as loan dollarization through the use of supplementary reserve requirements to enable traditional monetary policy to effectively fulfill its role [16].

There are various policies and strategies implemented by different countries to reduce dollarization in their respective banking systems. However, it is difficult to estimate the effectiveness of any particular instrument in isolation since dollarization is a complex issue that needs to be tackled from multiple angles. From the examples discussed above, it is evident that the common rule for successful de-dollarization is the achievement of economic stability, low inflation, and a stable exchange rate. It is only when these conditions are met that policymakers can effectively implement policies such as reserve requirements and macroeconomic policies to reduce

dollarization. Therefore, policymakers need to focus on maintaining a stable economic environment and addressing the root causes of dollarization rather than relying on individual policies in isolation.

Central banks have a range of macroprudential policy tools at their disposal to control deposit and loan dollarization. Some of the mechanisms through which central banks' policies can affect FD are presented in table 4.11.

Overall, the effectiveness of these policies depends on a range of factors, including the degree of financial dollarization, the structure of the banking sector, and the broader macroeconomic environment. Therefore, central banks must carefully calibrate their policies to achieve their intended goals.

Table 4.11. Macroprudential policy tools and mechanisms to control dollarization

Policy tool	Mechanism
Reserve requirements	Central banks can set reserve requirements on deposits denominated in foreign currency to make them less attractive for banks. When banks hold a larger percentage of reserves, they have less money available to lend, which can reduce the demand for foreign currency loans.
Loan-to-value (LTV) ratios	Central banks can set loan-to-value (LTV) ratios for foreign currency loans, which limit the amount of foreign currency a borrower can receive as a percentage of the collateral value. This can reduce the demand for foreign currency loans by making them less attractive.
Risk weights	Central banks can assign higher risk weights to foreign currency loans, which means that banks will need to hold more capital against these loans. This can make foreign currency loans less profitable for banks and reduce their supply.
Capital requirements	Central banks can increase capital requirements for banks that hold a high level of foreign currency deposits or loans. This can motivate banks to decrease their vulnerability to foreign currency by decreasing the foreign currency operations.
FX liquidity management	Central banks can also use foreign exchange liquidity management tools to influence the supply and demand for foreign currency. For example, they can use currency swaps to provide liquidity to banks that need foreign currency, or they can intervene in the foreign exchange market to influence the exchange rate.

Source: developed by the author based on [1, 17]

The National Bank of Ukraine has been using several macroprudential policies to control deposit and loan dollarization, such as reserve requirements, liquidity requirements, and capital adequacy ratios. The NBU has been adjusting these requirements to encourage the shift towards local currency lending and to support the stability of the financial system. The liquidity requirements have also been used to encourage banks to lend in local currency. These requirements ensure that banks maintain a sufficient level of liquidity in their operations, and they are adjusted periodically based on market conditions and the level of dollarization in the banking system. In 2021, the NBU lowered the liquidity ratio from 80% to 70% to support economic recovery and facilitate lending in local currency. Finally, the capital adequacy ratios have been used to ensure that banks maintain sufficient capital to absorb potential losses and maintain their solvency in times of stress. These ratios have been adjusted over time to reflect changes in market conditions and the level of risk in the financial system. In 2020, the NBU introduced a new capital adequacy ratio framework that took into account the specific risks associated with dollarization and required banks to hold higher levels of capital for foreign currency loans and deposits. The new framework is based on the Basel III standards and takes into account the specific features of the Ukrainian banking system. The CAR is a key measure of a bank's financial strength, calculated as the ratio of its capital to its risk-weighted assets. The NBU's new framework includes higher minimum CAR requirements for banks, as well as additional capital buffers to be built up during good times to be drawn down during bad times. The framework also introduces a leverage ratio requirement, which limits a bank's overall exposure to risk. The new CAR framework is intended to enhance the stability of the banking system and ensure that banks have sufficient capital to withstand financial shocks, thereby reducing the risk of bank failures and systemic instability.

The suggested strategy for the de-dollarization of the Ukrainian financial sector can be summed up in the steps presented in Figure 4.13.

INFLATION TARGETING	FINANCIAL MARKET DEEPENING	ADMINISTRATIVE MEASURES
<p>Inflation targeting proved to be effective for de-dollarization both in Ukraine and other countries.</p> <p>Interest rate, inflation expectations and exchange rate channels are the strongest ones when conducting monetary policy in Ukraine, and have both direct and indirect affects on macroeconomic stability, hence the use of local currency.</p>	<p>Increase the accessibility of government bonds denominated in hryvnia through technological improvements, simplification of investors' experience.</p> <p>Increase the awareness among the population through marketing campaigns, educational programs, seminars, and online resources.</p> <p>Alternative hedging instruments, such as newly introduced instrument of the NBU for the protection of</p>	<p>Limitations on operations with foreign currency during martial law.</p> <p>Higher reserve requirements on FX</p>

Figure 4.13. De-dollarization strategy for Ukraine

Source: developed by authors

Looking back at the experience of NBU in managing dollarization, inflation targeting played a crucial role in anchoring people's expectations and maintaining a stable macroeconomic environment. However, maintaining a low level of dollarization during a period of war requires a comprehensive approach that includes a combination of macroeconomic and microeconomic policies. The NBU can take several steps to promote the use of the national currency and reduce dollarization in the banking system. These measures may include implementing monetary policy tools, such as interest rate differentials, reserve requirements, and capital adequacy ratios, to incentivize the use of local currency. The NBU may also consider introducing measures to reduce foreign currency lending, such as limiting the availability of foreign currency loans or implementing stricter collateral requirements for such loans. Additionally, the NBU can work to improve financial literacy and

education, increase public awareness of the risks associated with dollarization, and promote the benefits of using local currency. Finally, the NBU needs to maintain a stable macroeconomic environment characterized by low inflation and a stable exchange rate, which are critical factors in reducing dollarization.

Case of Israel in usage of national currency bonds may be a good example for how the deepening of the financial market can influence dollarization.

Another potential instruments to be used after the crisis period are dollar-indexed deposits and inflation-indexed bonds. These instruments have been also adopted in Israel in complex with other prudential rules, that would ensure that banks met the prudential requirements such as open position limits [21]. Dollar-indexed deposits are a type of financial instrument where the interest rate and principal are denominated in local currency but linked to the exchange rate of the US dollar. These deposits can affect dollarization by providing a way for individuals and businesses to obtain exposure to US dollars without actually holding dollars. Dollar-indexed deposits can be seen as a substitute for holding US dollar deposits, which can contribute to reducing dollarization in the banking system. However, the impact of dollar-indexed deposits on dollarization depends on how they are designed and implemented. If these deposits are not properly regulated, they can potentially increase dollarization by providing a way for individuals and businesses to access US dollars while still avoiding regulatory controls. Therefore, policymakers need to carefully consider the potential benefits and risks of dollar-indexed deposits and design appropriate regulatory frameworks to ensure that they contribute to sustainably reducing dollarization.

A similar logic is applied to the instrument that NBU introduced at the end of 2022 as an additional tool for the protection of hryvnia savings from exchange rate fluctuations while also helping to preserve its international reserves. With this new instrument, individuals can buy US dollars at the official exchange rate, make a term FX deposit with a bank, and withdraw the deposit by selling the dollars back to the bank for hryvnias after it matures. There will be no limits on the number or size of deposits per client. The banks can buy an amount of US dollars equal to the volume of such deposit transactions and deposit the purchased foreign currency into a

separate account with the NBU. The NBU will charge interest on the foreign exchange balance in the respective separate account with the NBU, to be paid in hryvnias. This tool is expected to reduce demand for foreign exchange cash, stabilize expectations, and ease exchange rate pressure in the cash segment of the foreign exchange market. It will also incentivize banks to compete for hryvnia deposits and improve the monetary transmission mechanism [22].

The Strategy of Ukrainian Financial Sector Development until 2025, which was implemented by the National Bank of Ukraine and other financial authorities, was focused on several strategic elements, such as financial stability, macroeconomic development, financial inclusion, expanding the financial markets, and increase of innovations. This strategy aimed to align Ukraine's financial sector with international best practices and commitments, such as those outlined in the EU-Ukraine Association Agreement. It included various measures such as improving the regulation and supervision of the financial sector, enhancing corporate governance and risk management, supporting lending to the economy, and developing nonbank financial services markets. This comprehensive approach was designed to bolster the overall resilience and efficiency of Ukraine's financial sector [1].

To sum up, National Bank of Ukraine conducts a very effective monetary and macroprudential policy that allows managing the dollarization. The experience of other countries indicates that macroeconomic stability should be the key objective, without which any additional policies targeted at de-dollarization won't be fully realized. The deepening of the financial market should be the main strategy to de-dollarize the economy. Easier access and promotion of hryvnia instruments, in particular popularization of hryvnia-denominated deposits and bonds, should be the priority for the National Bank of Ukraine and Ministry of Finance. Ensuring macroeconomic stability will keep dollarization on a relatively low level, however, to decrease its incentives for both banks and individuals and business entities should be provided.

CONCLUSIONS TO CHAPTER 4

In this Chapter analysis on financial dollarization in Ukraine was conducted. The overall dollarization of economy is difficult to measure due to limited control over cash transactions, it can be classified also between financial dollarization and real dollarization, which covers the use of foreign currencies by the real sector in forms of wages nominated in foreign currency, rents, and consumption, etc. Deposit and loan dollarization serves as a pretty accurate proxy for analysis of financial dollarization. Conducted analysis of the available literature revealed high emphasis on deposit dollarization, especially in terms of undeveloped financial markets.

System of simultaneous equations has been developed to analyze the influence of macroeconomic indicators on deposit and loan dollarization. The specified system of simultaneous equations comprises five main endogenous variables, including the consumer price index, exchange rate, key policy rate, and deposit and loan dollarization ratios, along with several exogenous variables such as the CPI of the main trading partners, official exchange rate, international reserves, and more. The model can provide a comprehensive analysis of the causes and consequences of financial dollarization.

SD approach has been applied to capture the complex feedback loops and non-linear dynamics. It allows to find leverage points in the system, and to test resilience of the system to different policies. In contrast to system of simultaneous equations, more variables, such as deposit and loan rates have been endogenized. It also includes hypotheses on how investors demand for deposits is formed and how it distributes among foreign currency and hryvnia deposits. Similarly, it covers how the need for borrowings is formed and how banks set the approval rate on loans based on estimated default risk. The results of the simulation indicate that deposit rate will keep increasing in 2023 and will reach around 41% which is consistent with development of DD under system of simultaneous equations. LD in its turn is expected to stay at the same level as a response to overall high credit risk and both reluctance of banks to caring extra risks during crisis period and cautious of borrowers in regards to higher borrowing costs and accordingly debt service.

It has been found that the NBU conducts a highly effective monetary and macroprudential policy that enables the management of dollarization levels. International experiences suggest that macroeconomic stability is a crucial goal; without it, additional measures aimed at de-dollarization may not be fully realized. Deepening the financial market should be a primary strategy for de-dollarizing the economy. Facilitating access to and promoting hryvnia instruments, particularly hryvnia deposits and bonds, should be a priority for the NBU and the Ministry of Finance. Ensuring macroeconomic stability will maintain dollarization at a relatively low level, but it's necessary to anticipate reducing incentives for dollarization for banks, the population, and businesses.

De-dollarization strategy for Ukraine has been proposed with the focus on the following three elements: inflation-targeting, financial market development and administrative measures. To conclude, the experience of the central bank of Ukraine has showed that maintaining a low level of dollarization during a period of war requires a complex approach, and it includes macroeconomic and microeconomic policies. The usage of inflation targeting was important in anchoring people's expectations and maintaining a stable macroeconomic environment. The central bank of Ukraine can take several steps to reduce dollarization in the banking system, including using monetary policy instruments, reducing foreign currency lending, improving financial literacy, and promoting the benefits of using local currency. Promoting government bonds among individuals, which was used in Israel, can be an effective instrument. There can be used such elements of policy as public awareness campaigns, offering attractive interest rates, and simplifying the process of buying and selling bonds can incentivize individuals to invest in hryvnia bonds. Overall, reducing dollarization requires a concerted effort from the government, the central bank, and the public.

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CHAPTER 5. ANALYSIS OF UKRAINE'S BUDGET SYSTEM IN WARTIME AND POST-WAR PERIODS

5.1. Understanding the essence of the state budget and budget deficit

State budget plays an important role in the state finances. It ensures distribution of financial resources inside the country, performs a social function, is the source of financing defense, security of the country, development of important for the society spheres, such as education, medical care, public order, culture, and administrative services.

According to the Budget Code of Ukraine “Budget is a plan of formation and usage of financial resources to ensure the tasks and functions carried out by the state authorities, the authorities of the Autonomous Republic of Crimea, and the local self-government bodies during the budget period” [1].

In general in the scientific literature there different definitions of the budget deficit. Ukrainian scientist Fedosov O. pointed out that budget is a system of regulated relationships between the state and legal entities or persons concerning the allocation and redistribution of GDP. The purpose of the budgetary process is the formation and utilization of the state budget fund, ensuring the fulfilment of functions of the state [2].

Lyutyy I. notes that the budget can be characterized as a system of financial relations that arise between the state and physical or legal entities. The state budget is a centralized fund of financial resources that provide funding for the state apparatus, armed forces, the fulfilment of key state functions, and is also an important instrument of state economic regulation, which influences the economic situation, and helps to mitigate crises [3].

With the aim to activate the influence of state budget on the social and economic development of the state there should be taken measures for the increase the effectiveness of budget management, providing the balancing of the budget, effective usage of expenditures, improvement of transfers between state and local budgets and financial control of the budget expenditures [4].

State budget is the biggest centralized financial fund, its administrator is the government of the country. State budget gives the possibility to distribute the financial resources to the most important spheres with the aim of social and economic development [5].

Important element of budget policy is timely reaction on the economic cycles, preventing the economic crises, maintaining the limits of budget deficit and government debt. The priority has the questions of middle-term and long-term budget planning. The formation of long-term strategy and defining its main goals is crucial.

Though, in the conditions of limited budgetary funds, there is a need to define the priority spheres of financing for the fulfilment of the state functions and social and economic development of the country [4].

Budget is formed from the expenditures and income parts.

Budget Code of Ukraine defines income as all tax, no-tax and other income, which are received on a non-payable basis and defined by the legislation of Ukraine.

They include also transfers, payments for the administrative services, own income of state entities [1], as well as cost from government borrowings, financial resources received from the privatization of state ownership, return of budget costs from the deposits [6].

According to the Budget Code, budget expenditures are the resources, which are allocated for the implementation of the budget programs, which are specified by budget. It is important to pay attention, that expenditures do not include: repayment of government debt, giving loans, depositing resources on the accounts, buying securities.

State expenditures are an important element of state regulation, as far as determine the spheres of usage the financial resources with taking into consideration the priority spheres of development of the country. Important element is distribution of budget costs and formation of the optimal structure of the state budget. Prognosing and planning of state expenditures, their regulation has an important role for the increase of effectiveness and efficiency of budget resources [4].

Stable economic development of the state requires not only the regulation of the amount of state expenditures, but formation of the optimal structure of the state budget.

In the process of planning the expenditures, it is important to take into consideration the phase of the economic cycle, data about the previous expenditures, indicators of social and economic development of the state.

The budget income according to the Budget Code of Ukraine includes:

1. tax income – established by the law national taxes. Also, local taxes.
2. non-tax income: income from ownership and business activity, administrative fees and charges, own income of state institutions;
3. income from the operations with capital;
4. transfers are funds received on non-repayable basis from other bodies of state power, local self-government, other states, or international organizations.

Expenditures and credits of budget are classified the following way:

1. budget programs;
2. the primary manager of budget funds (departmental classification of expenditures and budget financing);
3. functions.

According to the economic classification budget expenditures are classified on current capital expenditures [1].

Deficit/surplus of the state budget – it is the difference between the state expenditures and tax income, that also equals the difference of change the amount of government debt. If the government debt is absent and income exceed budget expenditures, in this case the budget is in the surplus. But such a situation is rather rare and countries usually try to balance the budget, when the expenditures equal to income [7].

Enzo Croce addressed in his research the issues surrounding the assessment of the state budget balance, as measuring the balance raises three different types of questions: the basis of measurement, defining the scope of the public sector to be covered, and the relevant time horizon. The quantitative indicator of the fiscal balance can vary depending on the chosen concept [8].

For a thorough analysis of the budget deficit, it is important to note the duality of the state of the government budget, namely the structural and cyclical states of the government budget deficit. Structural and cyclical deficits of the government budget are two different concepts used to analyze budgetary indicators and determine potential directions of fiscal policy. The structural deficit reflects the fundamental budget deficit that exists independently of the current state of the economy. It is associated with basic budgetary policy and includes consistent budget imbalances that are not dependent on fluctuations in economic activity. The structural deficit requires long-term changes in budget policy, such as tax system reform, changes in government spending, or social programs.

Formula for the structural deficit has the following view:

$$D_p^b = Y_p \times t - G \quad (5.1)$$

where, Y_p – potential GDP;

t – aggregated rate of taxation,

$Y_p \times t$ – income of budget for full employment,

G – budget expenditures.

The Ukrainian scientist Yuriy S. in his studies provides the following approach to calculating the deficit. Formula for the actual deficit has the following view:

$$D^b = Y \times t - G \quad (5.2)$$

де Y – actual GDP,

$Y \times t$ actual income of the budget.

The author notes, that the state, when structural deficit exceeds the actual one is the cyclical deficit, and it is calculated with the following formula [9]:

$$D_c^b = D^b - D_p^b \quad (5.3)$$

The cyclical deficit results from fluctuations in the economic cycle. During economic downturns, tax revenues decrease due to reduced income of individuals and company profits, while government expenditures may increase due to higher social support costs, leading to a temporary increase in the deficit. Conversely, during an

economic boom, the cyclical deficit can turn into a surplus as increased incomes boost tax revenues, and the need for social support decreases.

For a comprehensive analysis of fiscal policy, it's important to consider both these concepts. Managing the structural deficit sustainably ensures financial stability and a healthy foundation for the economy, while flexible responses to cyclical changes help avoid deep recessions and excessive overheating of the economy.

With the aim to cover the budget deficit, state attract resources using two channels- inflation and non-inflation. The description is presented in the Table 5.1. It's important to balance these methods, as excessive reliance on inflationary financing can destabilize the economy, while non-inflationary methods have their limits and impacts on future fiscal flexibility and economic health.

Table 5.1. Sources of financing the budget deficit

Character	Essence
Inflationary	Monetization of the deficit including: <ul style="list-style-type: none"> - receiving loans from the central bank; - buying state securities by the central bank
Non-inflationary	Internal government borrowings External government borrowings Income from privatization Other income

Source: composed by authors based on [1, 9]

The budget deficit is a part of state budget policy in various countries worldwide, even in developed ones. It is a rather complex phenomenon with different consequences. It can have a somewhat positive stimulating effect on the economy, but only in small amounts [4]. However, primarily, the budget deficit has negative implications and leads to a reduction in spending on the state's social functions in the future, as well as a decrease in capital expenditures. Additionally, the budget deficit leads to government borrowing and an increase in national debt. In some cases, chronic government deficits can result in default.

A budget deficit is an integral part of the modern fiscal policy of states worldwide, including developed countries. It is a complex phenomenon with ambiguous consequences. While a budget deficit can have a positive stimulatory

effect on the economy in small amounts, it predominantly leads to negative outcomes such as reduced spending on social functions of the state in the future and decreased capital expenditures. Budget deficits also result in increased public borrowing and rising national debt. In some cases, chronic government deficits can lead to default. Therefore, managing the budget deficit is crucial for a stable economy, responsible fiscal policy, and the welfare of the population.

5.2. Analysis of the expenditures of the state budget of Ukraine

For many years, the budget system of Ukraine has been characterized by instability and constant reforms, budget deficits, a significant amount of national debt, and imperfections in intergovernmental relations (Figure 5.1). In 2014-2015, after a major budget crisis triggered by military actions in the east, reforms in the budgetary system and relations began.

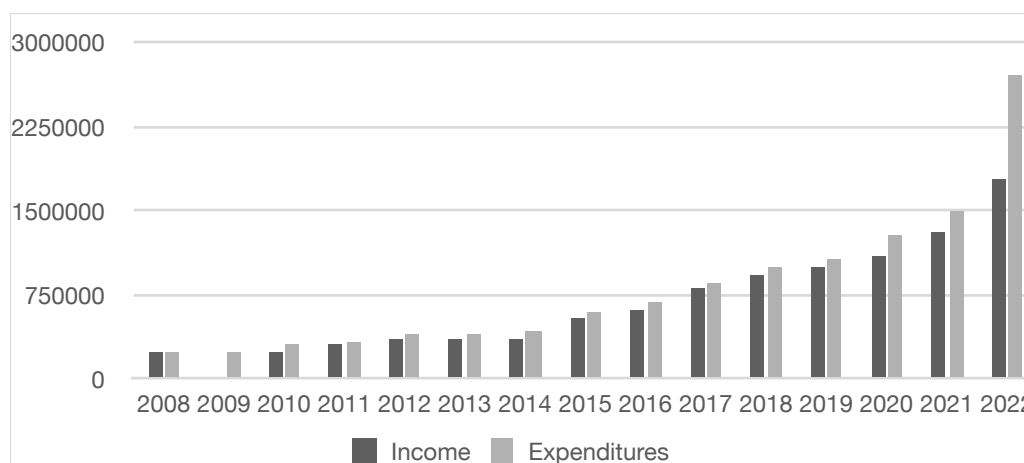


Figure 5.1. Amount of budget income and expenditure, million UAH

Source: developed by authors based on the data [10]

They included gradually reducing the share of government spending in GDP, implementing medium-term budgeting, improving program-based budgeting methods, maintaining a relatively low budget deficit using fiscal rules, and effectively implementing decentralization reforms. These reforms elevated Ukraine's budgetary relations to a qualitatively new level of efficiency and transparency. However, they were significantly undermined by the pandemic and full-scale war. The shift in

budget policy priorities led to the complete or partial pause of most budgetary reforms. Nevertheless, the budgetary system remains one of the key mechanisms for meeting military and social needs during the war and for the successful post-war reconstruction of Ukraine.

It can be observed the existence of the budget deficit of the state budget of Ukraine for many years (Figure 5.2.). It is obvious, that it increased in the periods of economic instability. The increase of budget deficit in relation to GDP occurred after the financial crisis 2008-2009, also after first invasion of Russia in 2014, during pandemic, and the highest deficit can be observed after the full-scale war in the years 2022-2023.

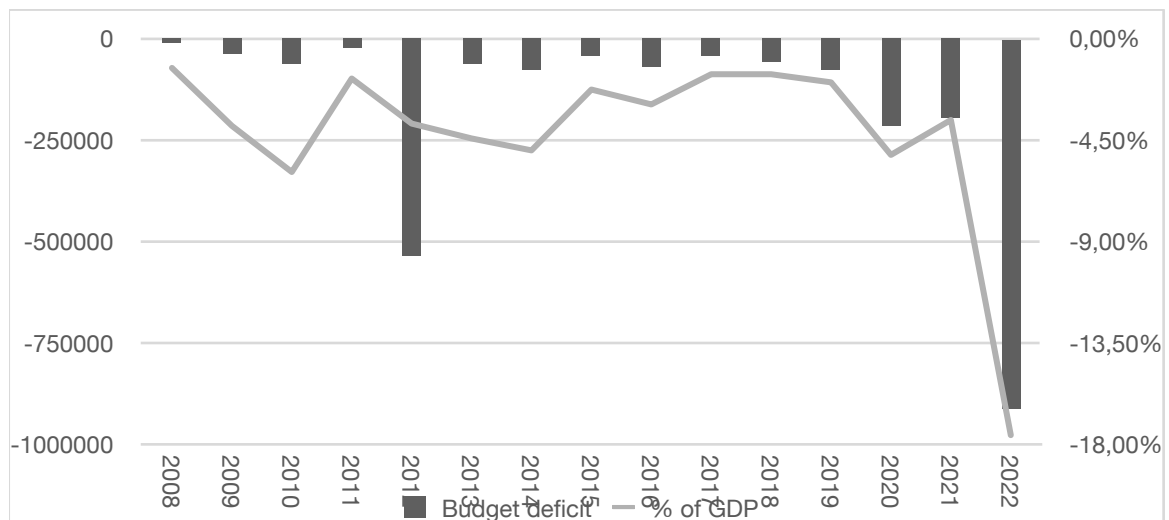


Figure 5.2. Deficit of state budget of Ukraine, million UAH

Source: developed by authors based on the data [10]

In 2022 the budget system of Ukraine has faced serious incur, as the economy and society together. The main consequences of full-scale invasion of Russia were: the decrease of the budget income, increase of budget deficit, high relying of the budget expenditures on the international help and loan agreements with the partners, structural change of the expenditures, rapid increase of expenditures on defense and security, usage of new debt instruments- war bonds, increase of burden for the local budgets. In this complicated external and internal conditions, it became impossible to use budget rules for the norming of the budget system. Instead, it raised the necessity to adapt fast to the external environment and conditions and search the possibilities to finance expenditures of the state for the urgent needs of war and society.

Nowadays the main reasons of disbalance in the budget system of Ukraine are considered to be dependance on international help and non-stability of political situation. Because of war the structure of the budget income does not influence positively the economic development, and the amount of resources for the education, science, reconstruction of infrastructure and reform is not enough.

The problem of the budget system is that, because of the marital law and reorienting the economy to provide the needs of defence, it occurs a full or partly stop of budget programs and reforms.

In 2022 expenditures of the state budget increased for 1214,2 billion UAH, that is 81,4%. Such increase is connected with the necessity of additional finance of the military forces, including the modernization of equipment, preparation of military and operational costs. Increase of expenditures on defense in 2014 happened in 2014. The lowest amounts were indicated in 1993, when the expenditures on defense amounted only to 0,3% of GDP. Expenditures on defense in 2022 increases for 607,98%, and their part in the structure of expenditures increased for 33,69 points in comparison with the year 2021. According to the macro prognoses of the budget for 2023 the amount of expenditures on defense reached 18,2% of GDP or 42,3% of general amount of expenditures (Figure 5.3).

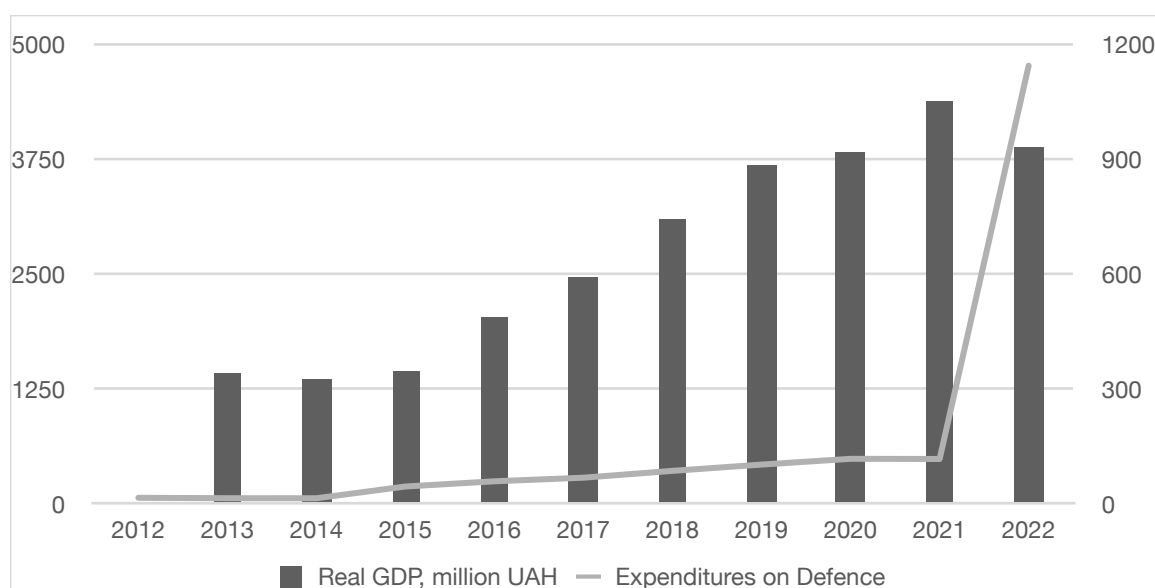


Figure 5.3. Dynamics of real GDP and expenditures on defense in 2012-2022, billion UAH

Source: developed by authors based on the data [11, 12]

Before traditionally the highest part of expenditures was the social protection, but in 2022 this part took the third place. The first one was defense, the second one - expenditures of the security and judicial branch. Other important spheres were the state functions, medical care, economic activity, but their place in the total structure has decreased because of rapid growth of the expenditures on defense.

As we can see from the Figure 5.4. the highest part in the structure of budget expenditures in 2022 took expenditures on defense, security and judiciary.

The sphere of defense is the priority one in the expenditures. It is worth noting, that since July 2023 it increased the capital expenditures, they were used for the infrastructure projects and repairments, preparation to winter [14].

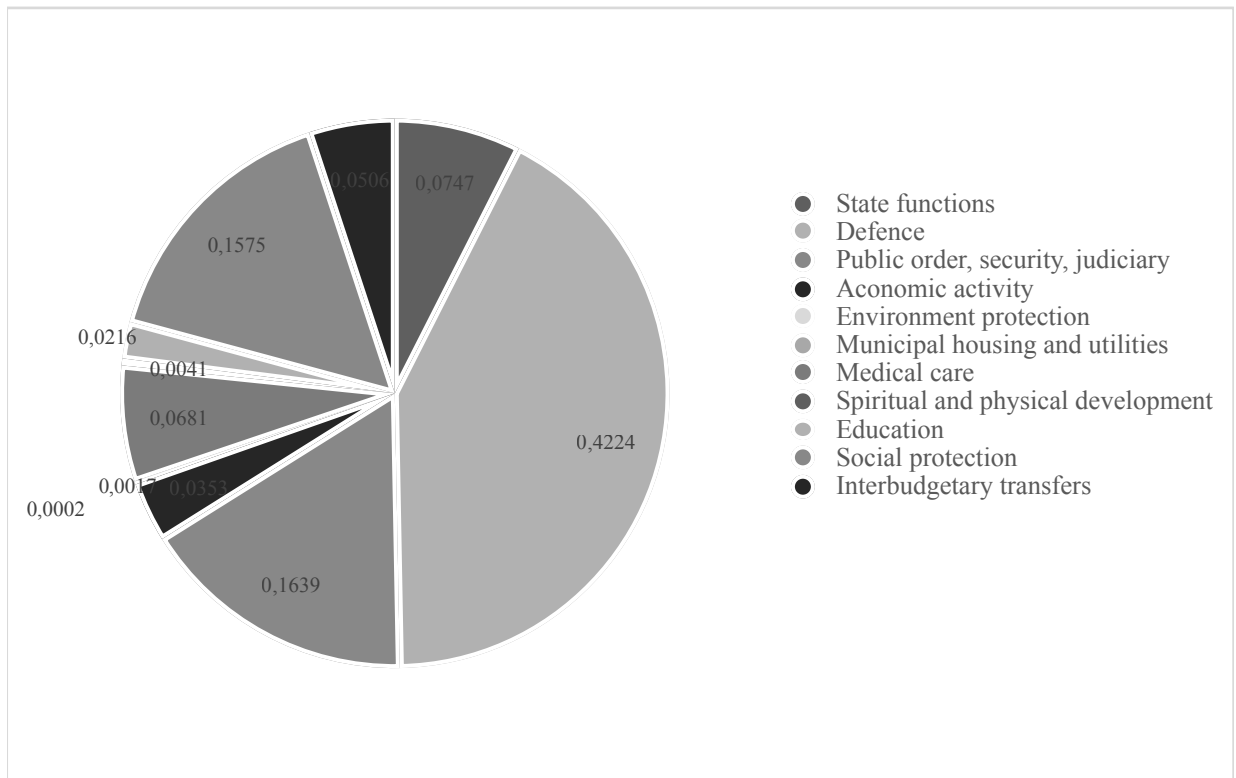


Figure 5.4. Structure of expenditures in 2022, %

Source: developed by authors based on the data [13]

War caused the heavy burden for the state budget. In these conditions it is obvious that increased the expenditures on defense, security. In the conditions of limited own resources and negative influence of war on the business in the country, international help has a crucial role, which is particularly important for providing the state functions and protection from Russia. For next year, the state budget was

planned with a focus on continuing the fight against the armed aggression and supporting the recovery and reconstruction of critical infrastructure. The revenue of the State Budget for 2023 was foreseen at UAH 1,330 billion, with adjustments made to accommodate more optimistic expectations regarding financial support from international partners. The budget deficit in 2023 has increased, and it was planned to be financed primarily through external borrowings. Overall, the Ukrainian government's approach to budgeting in these years reflects a balance between managing immediate crisis-related needs and maintaining the long-term stability and recovery of the economy.

5.3. Assessment of the sources and magnitude of income in Ukraine's state budget

It is important to pay attention, that in 2022 the income of the state budget amounted to 115,1 % of the approved by the Parliament in the beginning of the year, the excess amounted to 234 billion UAH [12]. In the conditions of war government was searching for new income.

At the same time, the amount of the biggest article of income- tax income in comparison to 2021 decreased for 14,21%. If the part of tax income in the general structure of the budget amounted to 85% in 2021, so in 2022 it accounted only 53%.

In the revenue structure, a significant portion was placed by income from foreign governments as Ukraine actively searched support on the international stage in the conditions of critical uncertainty. Revenues from official transfers by the EU, foreign governments, international financial institutions, and donor organizations increased approximately 428 times: from 0.8 billion UAH in 2021 to 342.5 billion UAH in 2022 (Figure 5.5).

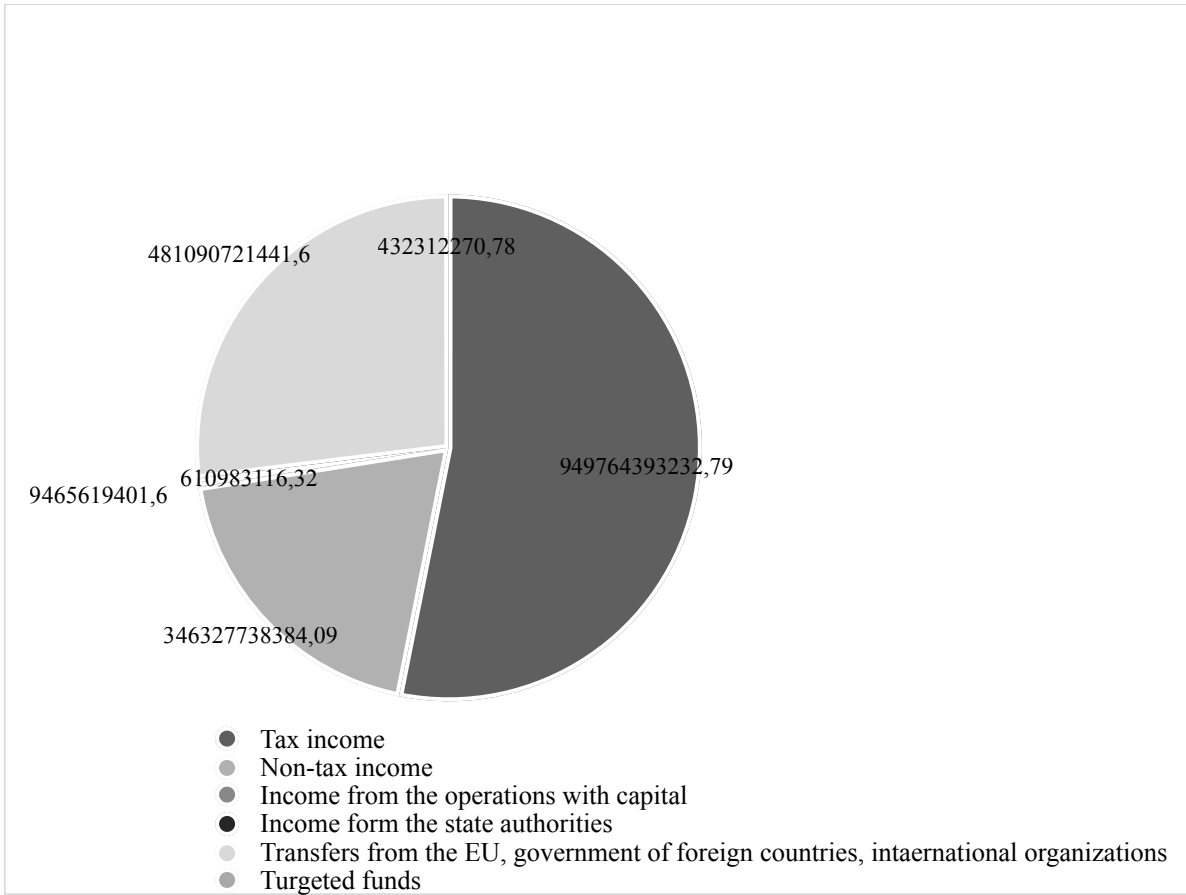


Figure 5.5. Structure of the income to the state budget of Ukraine in 2022, UAH

Source: developed by authors based on data [15]

At the same time, as we can see on Figure 5.6, the largest share of revenues in the state budget of Ukraine in 2022 was represented by personal income tax. The forecasted figure for these revenues is projected to increase to 13% in 2023 and to 17% in 2024. The primary factors influencing these optimistic calculations include the increase in the minimum wage, which is expected to raise the average salary, the anticipated gradual recovery of business activity, and the reallocation of personal income tax of military from local budgets to the special fund of the state budget. To ensure increased tax revenues to the state budget in 2024, the full amount of personal income tax from the monetary provision of military personnel is being allocated to the state budget. In 2022 and 2023, 64% of these revenues were credited to the budgets of territorial communities and 15% to regional budgets. According to the forecast calculations of the Ministry of Finance of Ukraine, in 2024, these revenues will amount to UAH 96.3 billion and will become an additional source of financing

for defense and security sector expenditures. However, this amount will not be received by local budgets [21].

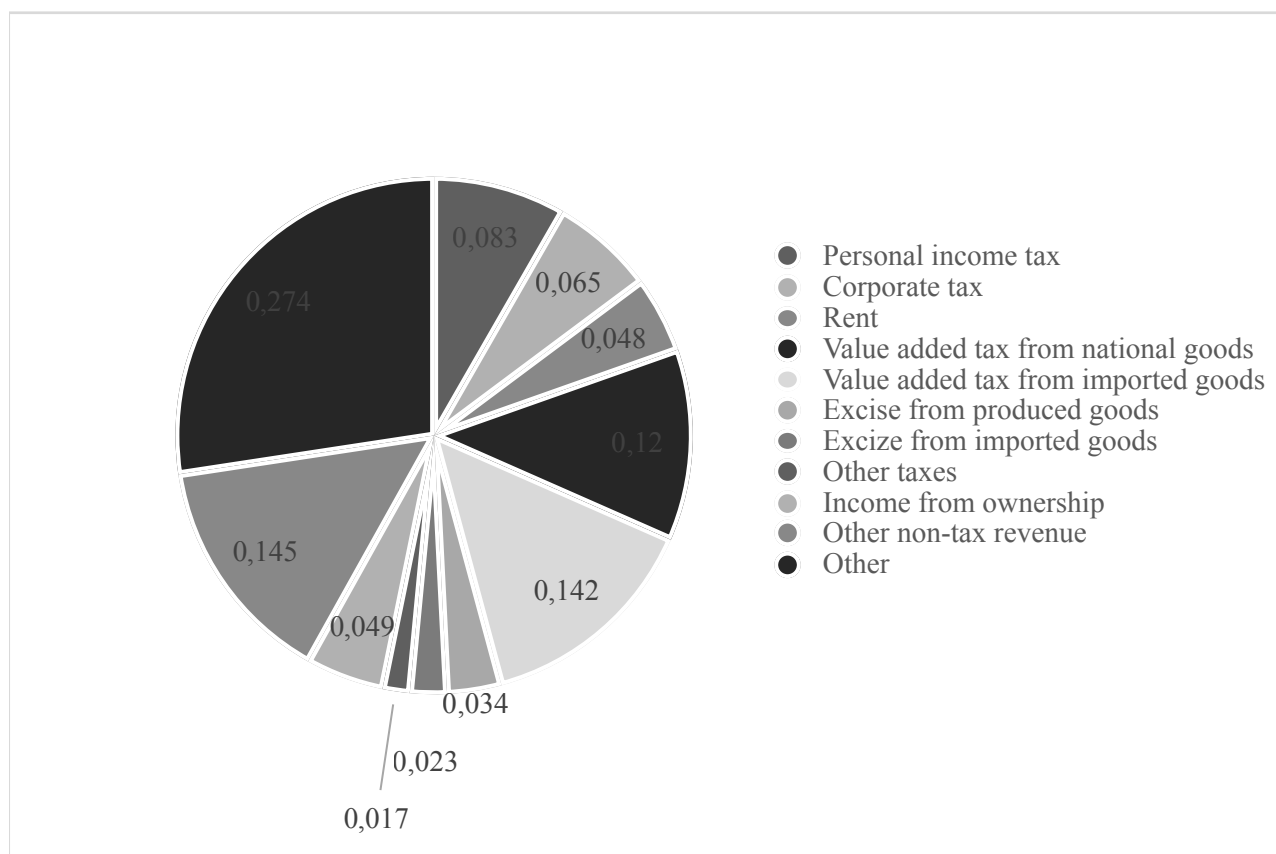


Figure 5.6. Structure of revenue of the state budget in 2022, %

Source: developed by authors based on data [15]

Although among the negative trends of the current year, it is worth noting the dramatic reduction in the collection of taxes related to the economic situation - corporate income tax (by 40.6% in real terms relative to the first half of 2021) and taxes from which taxpayers were exempted when transitioning to simplified system [20]. Therefore, the corporate profit tax, one of the key revenue sources for Ukraine's state budget, expected to decrease to 8% in 2023, but it might exceed 10% of the total state budget revenues in 2024. The corporate profit tax for 2024 is calculated to be UAH 183.7 billion [21], which represents a 66% increase from the planned indicators for 2023. This increase is attributed to the cancellation of tax exemptions, revitalization of entrepreneurial activities, and an increase in the corporate profit tax for banks.

War impacted enterprises, amount of their production, employment. 6 482 companies started the process of liquidation since March 2022 to November 2023. In 2023 in average per month 479 companies closed. But, it is important to note, that it is lower amount, that in 2021, in 2021 in average 1290 companies closed every month [16]. Enterprises are trying to adapt to the complicated conditions, they relocate. According to the data of Opendatabot 7820 businesses relocated within the territory of Ukraine since the beginning of war [17].

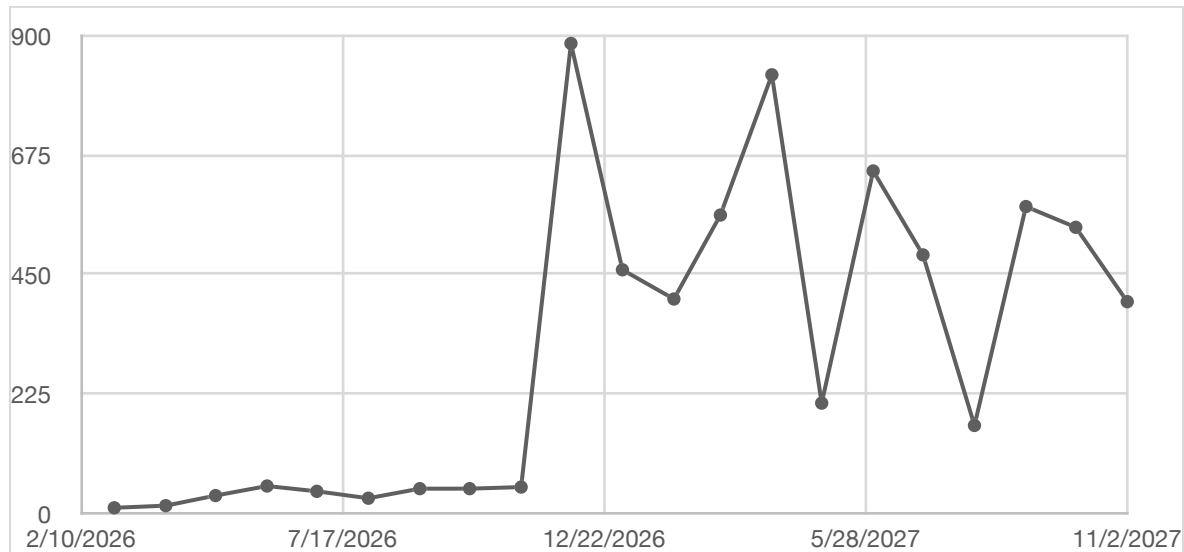


Figure 5.7. Number of companies, which started the liquidation process.

Source: developed by authors based on data [16]

According to the survey within the framework of the research "Support for Ukraine in Reconstruction and Recovery", conducted by the Kyiv School of Economics, the Centre for Innovation Development, Diya.Business, Advanter Group, in August 2023, the main obstacles to business development were the following: unpredictability of the situation in Ukraine (56.2% of respondents) and insufficient demand among the population (47.6%). It is worth paying attention, that 34,4% of respondents have noted the insufficient number of skilled workers. Among other important problems respondents mentioned lack of capital (30,70%), barriers from the regulative authorities (30,10%) and high taxes (27,9%) [18].



Figure 5.8. Problems, which interferes business to develop (Results of Business Issues Survey) (August 2023)

Source: developed by authors based on data [19]

At the same time, during the war, there was an increase in state aid in reducing tax rates for small businesses. The volume of credits provided to stimulate business development also increased. As can be observed on the figure 5.9, enterprises used the provided benefits.

Though, according to polls only 8,6% of respondents in August 2023 thought that help of the state is enough, and 40,7% of enterprises considered it to be practically absent.

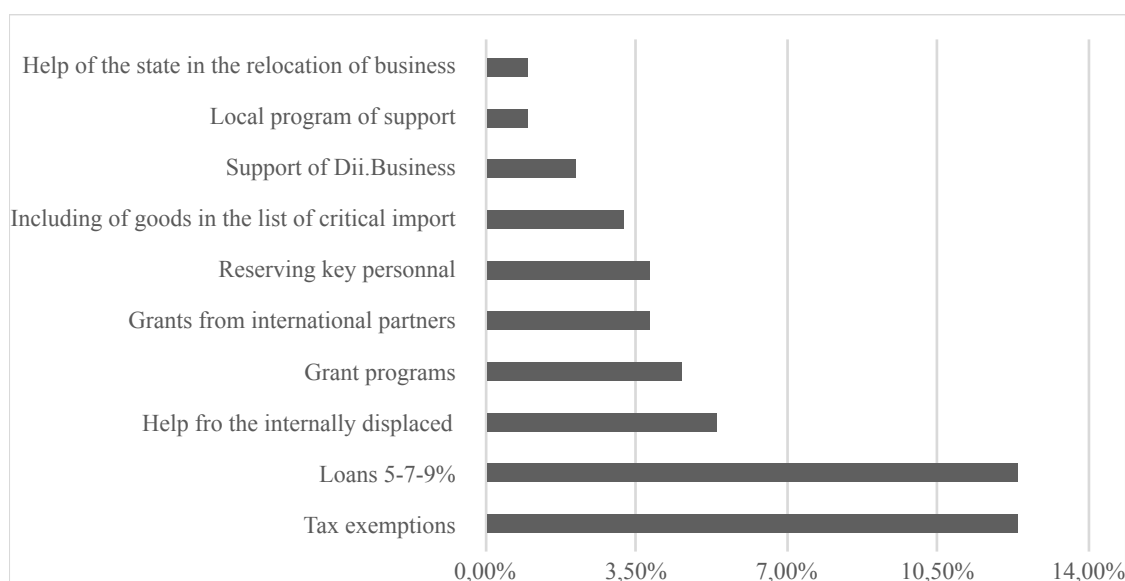


Figure 5.9. State help to business, which was used by enterprises (August 2023)

Source: developed by authors based on data [19]

The highest demand the enterprises feel in financing and informational support (Figure 5.10). In such conditions, to our opinion, it is important to attract loans of international organizations, such as EBRD, USAID, and also to increase the informational support and consultations.

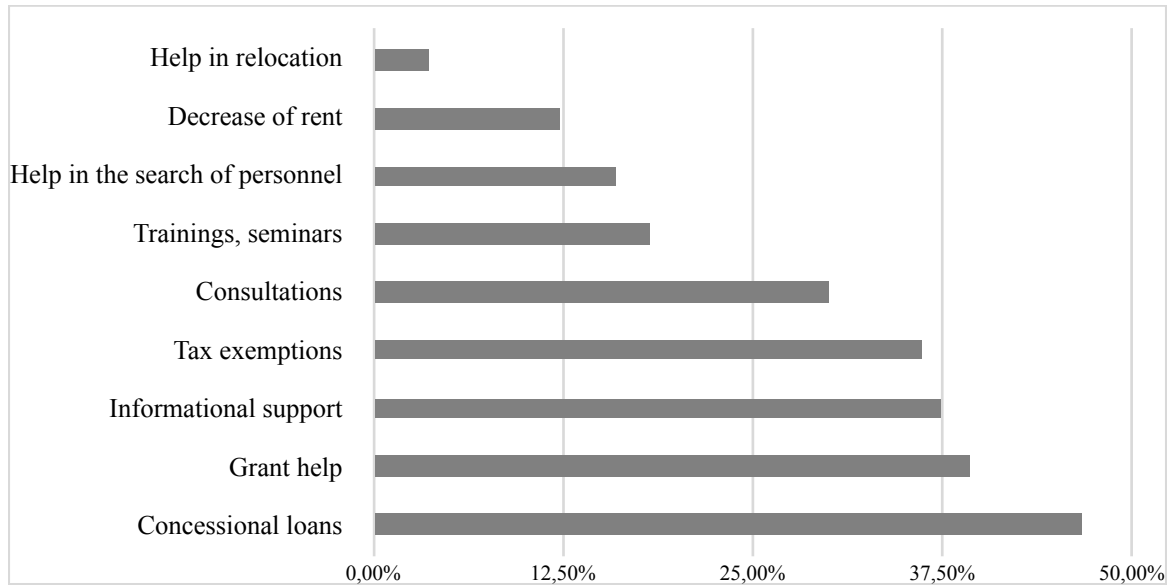


Figure 5.10. Needs of business in state support (August 2023)

Source: developed by authors based on data [19]

The positive trend is that during the war more individual entrepreneurs are starting businesses than closing them (according to data from the State Tax Service). As of the beginning of autumn 2023, there were over 2 million individual entrepreneurs operating in Ukraine. This statistic is even better than it was before the war. On average, approximately 25,000 new small businesses are registering each month. The highest increase was fixed in Kyiv, Lviv and Dnipro districts. The biggest drop in number of enterprises was observed in Eastern Ukraine [22].

The question of personnel is important. According to the polls the enterprises has cut 22% of workers since the invasion in February 2022. The wages also decreased, especially at the beginning of the war. According to surveys, in June 2022, the wages of 27% of the workforce were reduced [22].

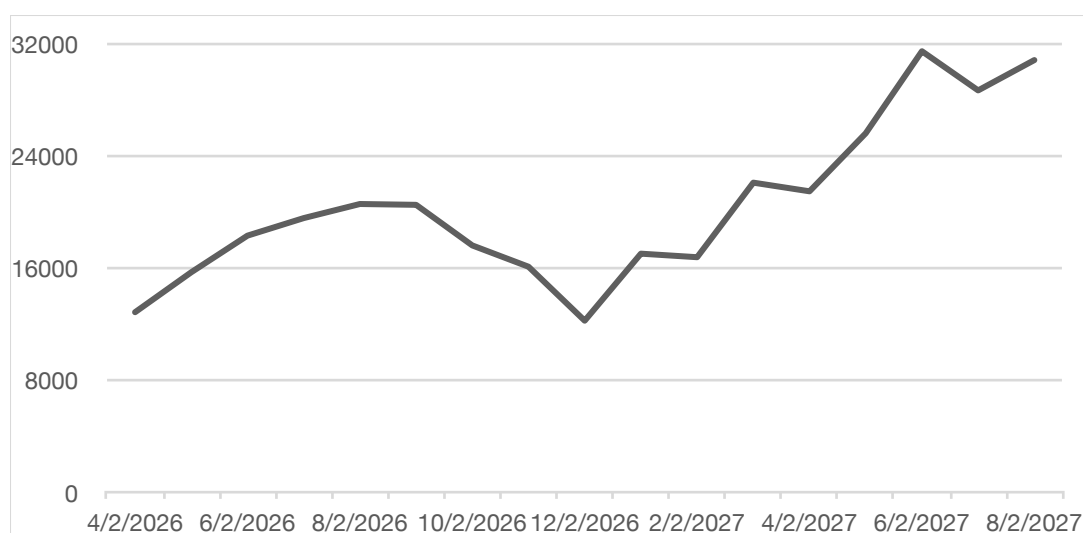


Figure 5.11. Registration of new small and medium-sized enterprises

Source: developed by authors based on data [22]

At the beginning of the full-scale invasion, unemployment rates were high. In May 2022, 33% of the surveyed population was unemployed according to the polls, and by June-August 2022, this figure had increased to 35%. However, relative economic recovery in autumn 2022 also contributed to a decrease in unemployment. According to the National Bank of Ukraine, by the end of 2022, the unemployment rate stood at 21.1%. It's worth noting that official data tends to be generally lower than survey results.

Nevertheless, the improvement in the economic situation and businesses' adaptation to challenging conditions contributed to further decline in unemployment. According to the estimated of the Ministry of Economy, the unemployment rate at the end of 2023 is expected to be around 19% [23].

According to the forecasts of the National Bank of Ukraine, the unemployment rate is expected to gradually decrease further to 16.9% in 2024 and 14.4% in 2025 [23]. However, in our opinion, it's crucial to consider all security risks as well as the impact of international aid inflows and their expected decrease, as they will significantly affect macroeconomic stability and economic recovery.

In the current conditions, another issue has raised in 2023 - labor market imbalances and a shortage of qualified workers. The main reason for this phenomenon is extensive population migration. According to UN data as of

December 19, 2023, there are approximately 6.335 million migrants residing abroad. Additionally, internal displacement within Ukraine has intensified labor market imbalances. According to IOM estimates, as of the end of September 2023, there were 3.7 million internally displaced persons in Ukraine. It's evident that the actual number may be even higher [24].

According to CES estimates, between 1.3 to 3.3 million migrants may not return to Ukraine [25]. It is obvious, the number of individuals who return will depend on the conditions and results of the war, the level of security, and the economic situation. The possibility of migrants to return is also negatively influenced by the duration of their stay abroad, as people tend to adapt to new conditions and find job placement. Hence, a long war might have an additional adverse effect on the number of people who choose to return. According to Gradus research, in October 2022, 67% of respondents-migrants wanted to return to Ukraine, while 8% wished to stay abroad (18% found it difficult to answer). By October 2023, the percentage of those willing to return decreased to 63%, and the percentage of those wanting to stay abroad increased to 18% [24].

The Ministry of Economy estimates that the Ukrainian economy will require approximately 4.5 million workers over the next 10 years. Given the economic reconstruction conditions, the demand for labor force will increase [26].

As of September 2023, the least competitive job markets in Ukraine were in the fields of manual labor, construction, architecture, agriculture, hotel and restaurant business, and service industries. This information highlights a trend where certain sectors are experiencing lower competition for jobs. Conversely, there has been a reported shortage of personnel in education, healthcare, and pharmaceuticals. On the other hand, sectors such as journalism, IT, marketing, advertising, and culture have seen a decrease in vacancies and an increase in the supply of labor [25].

The NBU consistently reports a structural imbalance in the labor market. It highlights a shortage of workers in manual professions and logistics. Simultaneously, there is low demand for workers in the humanitarian and cultural sectors, administrative and managerial roles, as well as in the IT sector. According to NBU

estimates, this imbalance negatively impacts future employment growth and contributes to high levels of unemployment.

According to the estimates of the Institute of Demography and Social Studies named after M.V. Ptukha, there are currently 1.3-1.5 million unemployed individuals in Ukraine [25]. Thus, the stimulation of business activity generally has a positive impact on economic recovery. The registration of new enterprises, their relocation and adaptation to new conditions all contribute to budget revenues. However, there remains a negative trend in high unemployment levels, which leads to a decrease in tax revenues to the budget during period of war.

With the aim to provide functioning of the economy in the beginning of full-scale invasion it were made numerous changes to the Budget Code, and adopted new laws, most of which continue to work during the war time, and even for a year after. During the war period, the simplified tax system of the small and medium-sized enterprises was changed, and some taxes were abolished, such as the land tax and environmental tax. Local authorities have received greater autonomy, particularly in terms of disclosing reports on local budget.

According to the changes at the beginning of war it was cancelled the obligatory publication of reports on local budgets. The measures and taxation rates for the small and medium-sized enterprises were decreased. For example, the 1 and 2 group of small and medium sized enterprises had the right of voluntary payment of the social contributions (joint social contribution) and it was simplified payment for the 3 group. These measures were taken to stimulate the development of small and medium size businesses and help with their movement inside the country, as far as many businesses were relocating.

For a short-term period it was canceled the excise tax on cars, motorcycles, trucks, imported from abroad. But this norm only was a short-term. There were many discussions of scientists regarding the possibility not to pay taxes for small and medium sized enterprises of 1st and 2^d groups, and decrease of taxes for the third group. In May 2023 the Verkhovna Rada of Ukraine has adopted a law to repeal tax exemptions for business. At that moment 340 thousand of business still continued to use tax privileges [29].

Since August 1, 2023, sole proprietors in the 1st and 2nd tax groups returned to paying a single tax. Additionally, the special taxation system at a 2% rate for sole proprietors was abolished; penalties were returned [30]. The only remaining exemption was the option for those in the 1st and 2nd groups to not pay the Unified Social Contribution; they pay it at their discretion.

The temporary tax exemptions for businesses were justified, but the return to the regular tax regime was necessary to provide internal revenue sources for the state and regions. Simultaneously, it is essential to create conditions for the uninterrupted operation of small and medium-sized businesses. This includes implementing a system of advisory, credit support, combined with a temporary ban on audits by regulatory bodies.

5.4. Budget deficit management and budget-balancing strategies

An important element of fiscal policy is the timely response to economic cycles, the prevention of economic crises, adherence to maximum limits for the budget deficit and public debt. Issues of medium-term and strategic budget planning hold priority importance. Formulating a long-term strategy and identifying target areas is crucial. However, given the limited budget funds, it is necessary to determine the priority areas of financing to ensure the functions of the state and the socio-economic development of the country [4]. Managing a budget deficit and developing strategies to balance a budget are crucial aspects of fiscal policy, particularly for governments aiming to maintain financial stability and promote economic growth.

In 2022, state budget revenues were exceeded by 35%, while expenditures increased even more significantly by 80.4%. This led to a considerable gap between budget expenditures and revenues, primarily due to a substantial increase in spending on defense, security, and social programs. This factor resulted in a further increase in the budget deficit. The first year of full-scale war led to the largest deficit in the last 15 years - 914,701.7 million hryvnias, which accounted for over 17% of GDP (Figure 5.13). For comparison, in 2020 and 2021, the budget deficit was 5.18% and 3.63% respectively.

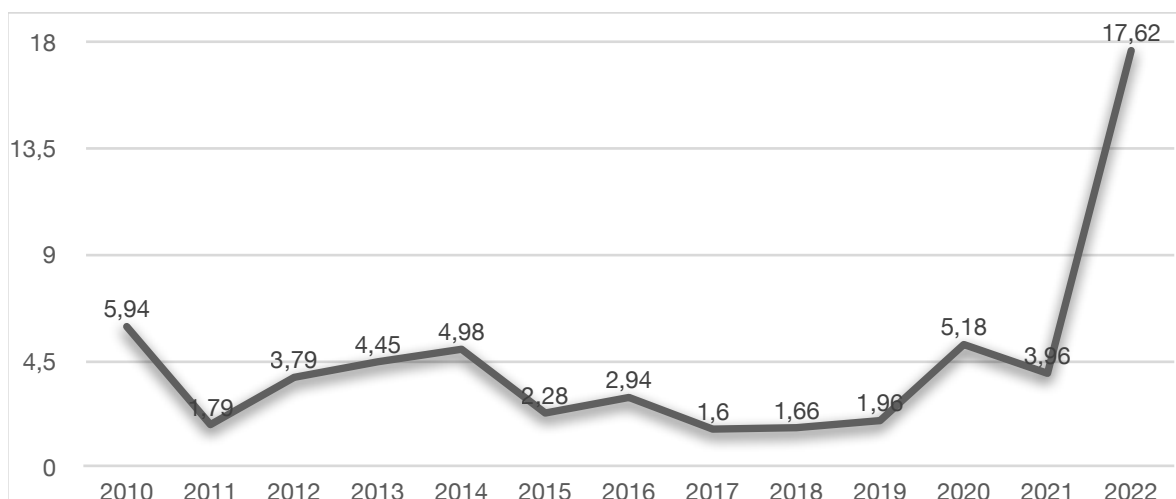


Figure 5.13. Amount of budget deficit in 2010-2022,

Source: developed by authors based on data [28]

Budget deficit is covered by the international help and issuance of state bonds. According to the estimates the deficit in 2023 was around 27% of GDP, what is higher than the previous prognoses [31]. In the project of the state budget for the year 2024 it is written, that the main part of expenditures will be devoted to expenditures on defense (21,6% of prognosed GDP) -1692,6 billion UAH, there will increase expenditures on the social protection to 469,4 billion UAH, support of the veterans of war- to 14,3 billion UAH (+7,5 billion UAH in comparison with 2023), increase of the expenditures on education, including the salaries for teachers. It is planned to increase the expenditures on the medical care to 203,4 billion UAH, and digital transformation (increase on 2,1 billion UAH to 2,5 billion UAH). Though it was planned to increase different parts of budget expenditures, the budget deficit is prognosed to decrease to 20,4% of GDP [31]. In our opinion, it is rather optimistic evaluation of the budget deficit. It should be taken into account the decrease of international help, which will influence heavily the stability of the economic system.

It is worth noting that there is planned to repay the government debt in 2024 in the amount of 606.5 billion hryvnias (internal debt - 421.6 billion hryvnias and external debt - 184.9 billion hryvnias), with debt servicing costs amounting to 420 billion hryvnias [31]. It is rather huge volume; it is second biggest amount after the defence expenditures.

The revenues of the state budget are forecasted to amount to 1 trillion 768 billion hryvnias, while the expenditures (including loans) will be around 3 trillion 355 billion hryvnias. Consequently, the state budget deficit is projected to be 1 trillion 571.5 billion hryvnias. This forecast is based on an estimated GDP growth of 4.6%, a consumer price index of 9.7% (in relation from December 2023 to December 2024), and an average exchange rate of 40.7 hryvnias per US dollar for the year [21].

It is worth noting that the identified need for international assistance to cover expenditures not related to defence and security amounts to about 41 billion hryvnias. State borrowings are planned at the volume of 2 trillion 132 billion hryvnias, including domestic borrowings of 525.9 billion hryvnias. Therefore, as we can see, there is a significant dependence on grant and credit assistance from international partners, which becomes critical in case of irregularities in aid inflows and their reduction. It's important to pay attention to the substantial volume of planned external state borrowings, which poses a negative scenario in the event of currency risks [21].

The mobilization of significant amount of financial resources to cover the deficit increased the country's debt burden and weakened fiscal stability, requiring a review of the debt policy both during and after the war. Due to high inflation, real GDP growth, and the restructuring of external and internal debts, the share of the national debt in GDP has consistently decreased since 2016. Despite the COVID-19 crisis, Ukraine managed to prevent critical debt escalation and significant financial fluctuations. But, war has changed this tendency and influenced the increase of government debt.

It was prognosed that by the end of 2023, the size of the national debt will reach approximately 6.4 trillion hryvnias, which accounts for 100.1% of the GDP. Overall, in 2023, expenditures for servicing and repaying the debt were expected to exceed 740 billion hryvnias, of which approximately half, around 326 billion hryvnias, will be paid as interest [28]. The easing of Ukraine's debt burden was made by "Memorandum of Understanding on the Suspension of Payments on State and State-Guaranteed Debt to the Group of Official Creditors of Ukraine from the G7 Countries and the Paris Club to Mitigate the Economic Effects of Russia's Aggression

against Ukraine", which will simplify the possibility of directing funds towards more priority areas for our country.

The reduction in tax revenues from some taxes has led to a decrease in the income of local communities. Simultaneously, the expenditure needs at the local level have increased, primarily in healthcare, social security, humanitarian aid, relocation, education, and housing for displaced persons. The budgetary crisis has affected all communities, especially those located in conflict zones or on occupied territories [28].

In the conditions of low credit ratings of local authorities and a lack of experience in municipal borrowing, territorial communities had limited financing opportunities. This was compounded by the financial aid from central authorities, which only approximately 50% of communities that applied could access. As a consequence of underfunding, there were cuts in expenditures for labor remuneration, communal services, and education, which in the long term pose significant risks to regional development [32].

Despite successfully managing local budgets practically deficit-free in 2022, the stability of local budgets has been disrupted, while community needs continue to grow. To simplify the budgetary processes at the local level, certain legislative changes have been introduced, such as allowing fund transfers between local budgets, suspending audit checks, abolishing the necessity of approval of expenses by local council [28].

During the war, numerous initiatives and programs were established regarding potential directions for Ukraine's development during and after the conflict. It's evident that the country's reconstruction is not possible without establishing an efficient and transparent budgetary process. Ukraine can draw upon the experiences of countries that successfully navigated the post-war reconstruction of their budgetary systems, such as Poland, Israel, Georgia, Germany, and Japan. Each strategy has its advantages and disadvantages and must be chosen based on the specific economic context, socio-political environment, and long-term goals of the country. Effective deficit management requires a careful balance between short-term fiscal needs and

long-term economic sustainability. Learning from their successes and strategies could be beneficial in shaping Ukraine's own post-war policies.

The example of Israel is usually analyzed as a case of effective state governance in the conditions of war. Israel have developed its economy despite of threats. It is well-known their focus on the development of army, medical care and education, stimulation of different innovations in the country. It is obvious, that development of the defense sector is important for the country in war, and Israel developed its own defense industry. Besides, there were used different measures in the tax system to stimulate the entrepreneurship, such as decrease of taxes, for example. Progressive system of taxation is used for the personal tax of individuals. It was made the optimization of expenditures on defense and the instrument if issuance of state bonds was used in different periods. The plan of reconstruction of Germany is widely used and researched as the example of effective usage of financial resources and relevant planning and controlling of expenditures. In Japan the war-time and post-war policy included the increase of taxes, privatization of state enterprises and limits in issuance of state bonds [28]. All the cases of reforms in different countries are important to be analyzed more detailed. It is obvious, that all conditions can be different, but we want to admit, that control of expenditures and attentive planning are crucial. At the same time the development of national business has an important role for the recovery of the economy after the war and extremely important in the conditions of war as well.

Consequently, Ukraine has the potential to both implement specific policy instruments from the experiences of the mentioned countries and to develop its unique solutions in the budgetary sphere, which will facilitate the rapid recovery of the economy.

During the war it should be formed the conception of rebuild, which will include renewal and establishment of production capacities (first of all in the defense sector), development of export, attraction of foreign investors and grantors via creation of favorable legislative base, development of budget system and formation of debt policy with the aim to decrease the debt burden.

It is obvious that the judicial system of Ukraine should be reformed. Development of digitalization helps to faster the state services and services for businesses, that is a positive element of national economy, but also needs the increase of cyber security. War needs a lot of resources, and definitely it can cause the increase of taxation, but it should be prepared and managed carefully to avoid increase of shadow economy. One of the important elements of budget system management is effective control of state budget expenditures, regulation of local budgets and keeping the priority on financing the army and development of defense industry, medical care and education.

In the conditions of war government uses bond issuance and instrument of covering the budget gaps, but it should pay attention to the servicing and restructuring mechanisms to avoid the debt crisis.

In the further post-war development of the Ukrainian economy it is crucial to pay attention to the broadening of the export potential of the country, stimulation of reprocessing branches and innovations. Development of export-oriented production will influence positively on the amount of budget income and allow to decrease the tax burden for the small and medium-sized enterprises.

High potential for the development has the defense sector, in the conditions of continuing war it is important to develop own defense sector. Considering the aggressive neighbor, it has a long-time goal, like in Israel.

It is important to use different methods to attract investors to the influenced by war regions, for example to use temporary exemption for investors investing in production from certain taxes, such as property tax and land tax, and partial exemption from income tax.

It is worth mentioning the successful example of Poland, where country divides on zones of investment activity, and on some territories tax priorities exist. In the Eastern Poland 40-70% of investments return in the way of tax incentives for some period, and the same time, the enterprises in the Western Poland do not have such priorities. That helped to stimulate economy in the particular regions. Such instruments can be used in Ukraine.

Logistics is rather important for the economic development. War have influenced on improvement of logistics and organization. Management of all connection during the war, high development of volunteer's roots have influenced positively the development of logistics. For the stimulation of export it is important to increase the international roots.

One of the important elements of budget policy should be a decrease of debt burden. It is crucial to avoid the monetization of budget, which took place in 2022, when the National Bank of Ukraine was buying the sovereign bonds. It is important to avoid the currency risk, as far as borrowing in foreign currency may have negative effect on the government debt stability in the case of devaluation of national currency. And in the conditions of war it is rather important to maintain the stability of the exchange rate. It is crucial to attract international financial resources in the form of grants or investments. Of course, this channel is limited, but there are branches in Ukraine, which can be favorable for investors even in the conditions of war, such as demining of territories or defense sector, for example.

A resultative method of attracting the financial resources can be the usage of fund raising programs, which can accumulate resources inside the country and behind it. Such attracting of resources helps to decrease the pressure on the budget. Already there is the fund raising program «United24», which attracted financial resources from more than 100 countries [37]. The particular sector on the platform is the rebuild of Ukraine.

The important condition of postwar development is the continuation of the reform of decentralization regarding the stimulation of the searches of the resource of financing, including international grants, loans and municipal borrowings. It is important the cooperation between communities inside the country and on the international level with foreign local communities.

In the context of development the state finances it is important to mention digitalization. It has also a positive effect on the decrease of corruption. Digitalization of state services has a rather positive experience and is highly appreciated by the society in the country. It is spread in the state sector, in medical care, has high usage by enterprises. Digitalization of state services has shown the increase of value and

effectiveness of administrative services for citizens. Development of the IT sector increases the export potential of the country and is one of the competitive branches of the economy. Digitalization of the defense sector is crucial in the current conditions, and has a high perspective in the future. It is also developing cybersecurity, which has become of high importance while the rapid intensifying of cyber attacks of the different branches of state authorities, banks and companies after the Russian invasion. Digitalization can be an effective instrument in the budget control process, as it can provide the society with the information about state and local budget expenditures.

After the war ends, it is crucial to implement the middle-term strategy of budget planning. The understanding of the goals of budget expenditures and its detailed planning helps to limit the ineffective usage of budget costs. Middle-term planning will allow to form the middle-term strategy, as far as strategic development is very crucial. It is important to form the list of reforms and follow it for the support of the society and development of the economy of the country. This list should include detailed information about reforms, their terms of implementation, priority, costs for implementation.

Economy of Ukraine has been highly affected by war. It is important to develop the strategy for post-war recovery now, and to make a list of reforms and changes, which can be implemented now. It is important to create the trustful judicial system. In the budget system it is crucial to create the transparent budget. The priorities for the expenditures of the budget system should be the following: defense and security, medical care, support of veterans, education, social protection.

In the postwar rebuild there is high potential for the development of the industrial sector of the economy. Industrialization is the key for the economic development and defense from Russia. Ukraine has high potential for the development of defense industry, airplane industry, pharmaceuticals, chemical industries. IT sector is a rather promising part of the economic development. Rebuild of infrastructure is crucial for the economy. And it is important to follow this with the reforms in the judicial, budget systems. Only joint efforts of the state authorities, society and international community can build the future of Ukraine.

CONCLUSIONS TO CHAPTER 5

This Chapter analyses the influence of full-scale invasion on the budget system of Ukraine.

The state budget is a fundamental tool that enables governments to allocate financial resources strategically across various sectors for social and economic development. Through the state budget, a government can allocate resources to key areas such as healthcare, education, infrastructure, defense, and social welfare. This prioritization reflects the government's policy objectives and socio-economic goals.

An important element of fiscal policy is the timely response to economic cycles, the prevention of economic crises, adherence to maximum limits for the budget deficit and public debt. Issues of medium-term and strategic budget planning hold priority importance. Formulating a long-term strategy and identifying target areas is crucial. However, given the limited budget funds, it is necessary to determine the priority areas of financing to ensure the functions of the state and the socio-economic development of the country. Managing a budget deficit and developing strategies to balance a budget are crucial aspects of fiscal policy, particularly for governments aiming to maintain financial stability and promote economic growth.

It is reasoned that immediately after the end of the war, it is necessary to resume the process of medium-term budget planning, as it is a guarantee of the stable development of the budgetary system due to the identification of priority tasks and the volumes of necessary funds for their implementation. A clear understanding of the directions of development of the budgetary system prevents the misuse of funds and the diversion of resources from priority programs. Medium-term budget planning will provide an opportunity to create a long-term development strategy for the economy, which will determine the model of economic development, the resources necessary for this, and reforms. Based on it, it is worth forming a budget strategy that will balance the budget's income and expenses for several years, with mandatory reference to the planned reforms. Such a strategy should include a list of reforms, their priorities, the cost of development and implementation, and the timing of implementation.

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CHAPTER 6. EVALUATION, MODELING, AND MANAGEMENT OF UKRAINE'S STATE DEBT DYNAMICS

6.1. The essence of government debt and its management instruments

Government debt is the normal phenomenon of the economic system. All countries of the world use the government borrowings. Though, during the centuries many questions arise regarding the influence of the government debt on the economies of countries. The opinions of scholars have varied significantly, and every economic school has its opinion about the government indebtedness.

Mercantilists considered the credit financing as one of the inflow of money to the economy as a positive phenomenon and one of the sources of national income. In contrast to mercantilists, the followers of other economic school- physiocrats- researched the sphere of production and considered the agriculture to be the sources of national income, not trade. They were proponents of the idea of economic liberalism, non-regulation of the state [1]. They thought that governmental borrowings divert resources from the productive sectors of the economy.

On the contrary to mercantilists, representatives of the classical school revealed government debt as negative phenomenon. Adam Smith in his “An Inquiry into the Nature and Causes of the Wealth of Nations” wrote, that increase of debts may cause troubles to the nations in Europe. The scientist pointed out that growth of government debt will cause the increase of taxes and this causes the outflow of capital. In other words, private capital is used on the servicing and repayment of debt instead of creation of the added value on the internal market. So, usage of debt financing influences the country negatively and may cause default. Other representative of classical school – David Ricardo had the similar opinion. He said that country is becoming purer as a result of useless expenditures of the government. Almost the only representative of the classical school, who had positive opinion on the government borrowings was Thomas Malthus, who thought about state borrowings as the way to increase the demand. He pointed out that government debt

influenced the increase of production and helped to eliminate the excess goods from the market [2].

Representatives of the historical school, for example Wagner, thought that government borrowings help to harmonize investment expenses and avoid the increase of taxes in the cases on emergency situations in the country.

The theoretical justification of government debt varied depending on the dominant concept of the role and significance of the public sector and the state as a whole. The foundation of the theories of state finances till the beginning of the 20's century was the principle of the non-deficit financing, and the usage of government indebtedness was criticized. The increased role of the state as a social institution, leading to the expansion of its socio-economic functions, demanded the growth of government spending. There arised a need for theoretical justification of the development of the public sector and government borrowings in particular. This need was fulfilled by Keynesianism, which emerged in a crisis environment and proposed the idea of government regulation of the economy [3]. Regarding the government indebtedness, Keynes economists pointed out that government debt can be used as the instrument for the stimulation of economy during the economic slowdown. They believed that during recession governments should increase their expenditures and create deficit to increase the demand and create the job places. But they also thought that government debt should be managed attentively to avoid the inflation and high debt payments. Economists indicated that government borrowings should be used appropriately to finance productive investments, which will boost economic growth and create long-term benefits for the society [4].

But when the period of wars and crises passed, it arised the necessity to develop the economic theory based on not strict governmental regulation. Such theory was the neoclassic school, representatives of which thought that market equilibrium exists only in the conditions of non-intervention of the state, absence of natural disasters and other non-economic factors. On the contrary to Keynes economists, they indicated the negative aspects of the government debt. Founder of Monetarism, Milton Friedman has made a conclusion that credit financing of government expenditures leads to increase of inflation. Further more, in the case of

usage the government borrowings the interest rates increase and it leads to displacement of private investments. In general, the representatives of Monetarism were not approving the idea of usage the state debt as the instrument of stabilization policy, as they considered the decrease of state expenditures as the main tool to influence the macroeconomic processes.

Topics of government indebtedness were also researched in the scientific works of James Buchanan. He did not agree on positive attitude to the government debt of Keynesians, and pointed out that increase of government expenditures with the usage of government borrowings made fiscal illusions. James Buchanan considered state debt as amoral thing, as far as next generation would pay for the borrowed money and it forms the debt burden.

In XX century the usage of mathematical and statistical methods for the research of government indebtedness developed, and this allowed to receive new practical results. Hansen H., Tarp F. made the research, which helped to reveal the influence of external government borrowings on the national savings in the developing countries. According to the investigation of the authors external debt influenced national savings negatively [5].

Borenstein E. with the help of econometric methods revealed the existence of negative impact of the government debt, in particular external one, on the internal investments and economic growth [6].

Burnsode C., Dollar D. also used econometric methods and could find that there was positive influence of external government borrowings on the economy of country only in the case of effective macroeconomic policy [7].

C. Macconel, S. Brue did not consider public debt as a burden. According to their opinion, government always can refinance debt, or increase taxes or arrange emission of currency to avoid the default. Economists paid attention that the internal debt is obligation to own citizens of the country, that is why national income is just redistributed inside the country. External debt they considered to be the burden for the economy, as in this case financial resources flow from the country while servicing and repaying of government debt [8].

R. Dornbusch and S. Fischer had the similar opinion: they considered the internal debt to be the wealth of the country, as far as the debt securities are bought by citizens of financial institutions inside the country. At the same time external debt belongs to foreigners, and that is why it is not the wealth of the country and influences the increase of government debt. Economists pointed out that borrowings are a burden for the further generations. At the same they made a cautious assumption, that such situation is possible and justified during wars and economic crises [9].

During the development of economic thought, the research changed from the defining whether the debt is good or bad to defining the optimal level to minimize the economic loss. World financial crises of 2008 has given a new impetus to this research. In their publication “Growth in a Time of Debt” Carmen M. Reinhart & Kenneth S. Rogoff have made a conclusion, that exceeding a government debt of 90% of GDP leads to a recession and a 0.1% decline in the economy. For some period this research was highly popular and was used for the budget planning in some countries. In 2013 T. Herndon T, M. Ash, M., & R. Pollin have analyzed the influence of debt on economy. They have found that below a debt level of 54,5% of GDP, debt has a positive effect on growth, but above this level the impact of debt is negative. But at the same time the institutional quality has positive impact on improving the economic conditions and influence of debt [10].

Nobel Prize laureates Paul Krugman and Joseph E. Stiglitz criticized the policy of austerity and its measures for reducing budget deficits and levels of debt burden. They believed that it is possible to cut expenses in the period of economic boom rather than crises, and public debt is effective instrument for stimulation of economy during the slowdown.

Followers of modern monetary theory consider government debt as accumulated budget deficits, which were formed in past and increased the financial assets, influencing the demand on goods and services. It allowed to maintain the increase of income, and influences the increase of financial assets faster, that it would be possible without deficit.

To conclude, most the enonomists aknowledge, that government debt is normal phenomena of modern financial and macroeconomic policy, but its impact depends on the phase of economic cycle, level of development of the economy, its usage. The excessive level of public debt can lead to slow down of economic growth, increase of interest rates, decrease of national savings and transfer of government debt burden to further generations.

To our opinion, it is very important to control the level of government indebtedness and its usage. In the current conditions, it is obvious, that government debt is almost the only source of covering the budget deficit in Ukraine.

In the article 2 of the Budget Code of Ukraine, the government debt is defined as the total amount of received and not paid loans (credits) on the reporting date arising from government borrowings [11]. The formation of the government debt occurs through external and internal borrowings and servicing the existing debt under conditions of repayment and maturity to finance the state budget.

Governemnt debt can be internal and external one: external government debt- it is all indebtedness to creditors inside the country (physical and legal entities of the country), and external government debt – debt of the country to foreign creditors (physical and legal entities of other countries, international organizations, government of foreign countries). Public debt is classified to direct government debt and guaranteed by state. Direct government debt is the amount of debt, which is borrowed by the government of the country, and guaranteed debt – it is total amount of indebtedness of the legal entitites of Ukraine, which are guaranteed by the state. That means that in case of non-payment by this companies, the government will take their obligations.

To our mind, it is additional problem of Ukrainian indebtedness, as government can have additional obligation and burden.

Public debt usually arises because of the lack of financial resources in the budget of the country to fulfill its main functions, such as maintaining economic stability, security of the country, carrying out international, social, ecological and other policy. In such cases the government should borrow with the aim to finance expenditures. The main reasons of the increase of the government debt can be the

following: deficit of the budget, increase of state expenditures, fiscal policy, which is concentrated on the decrease of tax burden, automatic stabilizers - cyclical decrease of tax income and increase of social payments during the economic crisis with the aim to stabilize the national currency, political business-cycles [13].

Table 6.1. Classification of public debt

Criteria	Types
Based of the creditor's location	External Internal
By the extent of coverage of government debt obligations	Capital Current
By the type of recipient of borrowed funds	Conditional Direct
By the type of currency	In national currency of creditor In the currency of the third country In international settlement units
By the type of debt obligation	Long-term bonds Medium-term bonds Short-term bonds and bills Loans to finance budget deficit

Source: developed by authors based on data [12]

It is important to pay attention to such a phenomenon as monetization of the public debt. It is used in crisis situations, such as war, global financial crisis, revolution. Monetization is usually restricted or prohibited in the developed countries with the aim to maintain the independence of the central bank and providing the stability of the national currency. Monetization means buying of government bonds by the central bank on the secondary market in big amounts. In 2022 the National Bank of Ukraine used this financing of the state budget, but in 2023 it was prohibited.

Debt management is the system of measures taken by the government to pay interest income to creditors and repay loans, make changes in terms of existing loans, and define conditions for issuing new loans. Effective debt management is crucial to ensure the solvency of the state, availability of resources for debt repayment, and the timely receiving of these resources. At practice for the effective

management in the state should be formed particular financial policy for coordination of monetary and fiscal policy in the questions of debt management, there are developed methods to decrease the debt burden in context of transit from anti-crisis to strategic management.

Management of public debt includes a range of actions for the preparation of insurance government bonds, providing guarantees, servicing and repayment of government debt. Effective public debt management is crucial for maintaining fiscal stability, ensuring the availability of funding for public projects, and avoiding fiscal crises that can have severe economic repercussions. Effective public debt management includes:

- Ensuring that the level of debt is sustainable in the long term. This involves assessing the ability to service debt without undue economic hardship or risk of default.
- Identifying and managing risks associated with public debt, such as interest rate risk, currency risk, and refinancing risk.
- Developing a strategy for borrowing that optimizes the cost-risk tradeoff. This includes deciding on the mix of domestic versus foreign borrowing, short-term versus long-term debt, and fixed-rate versus floating-rate debt.
- Managing the composition of the debt portfolio to minimize costs and risks. This might involve restructuring existing debt or altering future borrowing plans.

The debt management can be divided to strategic and operational [14]. To achieve the best result country should approve the debt strategy. Debt strategy is the system of measures for the avoiding the problems with the government debt and ensuring solvency, and for the country, which already has some problems- for their regulation and restoring solvency.

Thus, the strategy maintains the goal of the debt policy. At the same time, operational management has the aim to manage current problems with the government debt, it defines the amount and conditions of borrowings, their structure and sources, and also the mechanism of repayment. Operational management

concentrates on the problems of current liquidity and defines the main problems of managing of government debt.

Important element of public debt management is its structure and schedules of repayment. In the developed countries the main part of government borrowings is made on the internal markets, as far as the big amounts of external debt, especially short-term can lead to the external financial risks.

Shigeto Kitano's research shows, that external government debt is one of the factors of currency crisis. In the case, when government accumulates high levels of external government debt and do not use measures to decrease it, even in the conditions of high level of international reserves, there arises a risks of currency crisis in the country [15].

In general, management of government debt is the process of development and implementation of the strategy of government debt management with the aim to receive the necessary funds at desired level of cost and risk. To our mind, the main elements of management of government borrowings should include [16]:

1. Borrowings operations, including: development of debt management strategy, creation a government debt program with the defining the optimal structure, cost of borrowings, establishing official norms, developing effective cooperation with creditors, creation the country-borrowing image.
2. Usage of government debt, which includes: mandatory goal-oriented usage of borrowed costs, control on usage of state borrowings, formation of regular reports about the usage of government debt.
3. Servicing and repayment of government indebtedness: formation of the schedules of repayments and control over their effectiveness, monitoring of the process of interest and principal payments, compiling the reports and summary information.

The important element of the management of state borrowings is planning its amounts and schedules of repayments with the aim to avoid picks of payments for the state budget. Also, it is important to evaluate the current economic situation in the country, including the economic growth, export, import, amount of international reserves.

The necessary element is usage of the system of indicators for the quick analysis of indebtedness, for example, such as indicator of servicing of government debt, relation of current amount of external government debt to export, relation of government debt to GDP, relation of international reserves to short-term debt.

Besides, important element of government debt management is creation of the program of the distribution of resources for particular spheres and industries with detailed planning. Usage of borrowings can have a positive impact on the rebuild of economy of Ukraine after war, but important questions are the amount of state indebtedness and control of its usage. So, it can be active usage the credits of the World Bank, which have targeted and be directed into those sectors of economy, which are not enough attractive for private investors, for example, priority usage can be the development of infrastructure.

In general methods of government debt management can include: conversion, consolidation, unification, exchange under regressive terms, prolongment of repayment, debt cancellation, and debt buyback [17].

Conversion – it is the change of interest rate of loans, usually decline. Consolidation- it is the change of the period of debt obligation, it can be used together with conversion. Also it can be combined several obligations into one – this is called unification. This method can be used together with changing of the period of obligations -consolidation. Exchange under regressive terms- it is change of the previous debt obligations for the new one. Prolongment of payment- it means change of the date of payment for a more distance date in future. On the contrary to consolidation, prolongment of payment also considers stop of interest payments for some period. Usage of these methods in complex or partly is called the restructuring of the government debt. In this case the government do not refuse to pay, it just eases its servicing – a kind of compromise between creditor and borrower. But in the case, when the country does not want to go for compromise, it can announce its default. Another variant of managing the government debt is its buy back. The country can bay back its own bonds on the secondary market. It is the most convenient in the crisis situations, when their price decreases because of unfavorable conditions.

Another indirect methods of public debt management include the economic growth and fiscal consolidation. Economic growth helps to service the government debt and decrease the debt burden. Fiscal consolidation includes decrease of state expenditures and increase of taxes. The usage of this instrument is disputable in the economic literature as it influences business activity and the effects on the debt burden are low and need a long period of time (it can be considered the case of Greece).

The Public Debt Management Agency, which was established in 2020 in the structure of the Ministry of Finance in Ukraine, has the following functions: management of government debt and guaranteed government debt, including the management of risks, connected with it, providing external and internal borrowings within the middle-term strategy of government debt management, emission of government bonds, repayment and servicing of the government debt [18]. Repayment means fulfilling debt obligations towards the creditor by paying the principal amount of the debt, while servicing involves paying interest according to the terms of the loan agreement or issuance of debt securities. Effective management of government debt is one of the key factors of macroeconomic stability. It influences the budget expenditures, the level of international reserves, level of interest rates and investment climate. That is why it is rather important to provide debt management within strategy. In Ukraine it was approved the Middle-term strategy of government debt management for the year 2022-2024, but because of the beginning of war the need of financing increased, so the usage of Strategy decreased.

Regarding the evaluation of government indebtedness, the general amount of government debt is less informative, that its relation to GDP, relation of external government debt to export of goods and services, relation of the amount of the annual debt payments to the currency income from the export of goods and services. These indicators help to understand how big is the burden of the public debt for the economy.

After the war important element for rebuild and stabilization of the economy will be the adoption of the system of indicators for debt usage control and following the rules. We depend highly on creditors, which has the political desire to help. But it

is obvious, that in future creditors will be more demanding, it can be seen on the programs of IMF. Ukraine will need more controlled and balanced approach to borrowing. Therefore, it will become important to adhere to a medium or long-term debt strategy with established debt indicators that will be appropriate to Ukraine and for creditors.

There is no rule for determining whether a government debt is practically sustainable or not. Analyzing the sustainability of debt involves forecasting and assessing fiscal, macroeconomic, and financial variables over the long-term period. A significant but complicated task is evaluating liabilities of government and creating meaningful scenarios. In practice, to prognose how debt will accumulate is quite hard. Review of the International Monetary Fund's (IMF) reports for countries with advanced economies under Article IV showed that in most cases, the increase in government debt during the global crisis of 2008 was not anticipated, even under the most extreme shock scenarios [19]. Debt sustainability means that debt must be serviced at any time. For this, governments must be both solvent and liquid.

According to the Article 18 of the Budget Code of Ukraine, the total amount of government debt cannot exceed 60% of GDP. If the amount is expected to be higher, it is submitted request to the Parliament of Ukraine to deviate from the norm and also plan of actions to resolve the situation.

There are many indicators of evaluation of the debt sustainability. Most of them are developed by the international financial organizations.

International Organization of Supreme Audit Institutions – INTOSAI has proposed the three types of indicators, which are used for analysis of the government debt [20]. Every type has its own peculiarities and they are considered in the complex (Table 6.2). By usage of these indicators, governments and audit institutions can effectively monitor and evaluate the risks and sustainability of public debt. This helps in making informed decisions about debt management, fiscal policies, and economic planning.

Table 6.2. Indicators of evaluation the government indebtedness according to the INTOSAI methodology

Indicators of vulnerability	Financial indicators	Indicators of autonomy
Debt/ internal budget revenues	Interest rates and yield curve	Fiscal coherence indicator
Debt servicing/ internal budget revenues	Average payment terms and maturity period	Butler index
Present value of debt servicing/ internal budget revenues	Debt repayment schedule	Short-term balance of payment indicator
Interest payments/ gross domestic product	Losses in the risk scenarios	Autonomous fiscal position indicator
Interest payments on external debt/ internal budget revenues	Credit ratings	Currency availability indicators
External debt/export	Sovereign risk indexes	
Net international reserves/ external debt		
Amortization of debt/ external debt payments		

Source: developed by authors based on data [21]

Among the indicators, which international organizations use for the evaluation the level of government debt, can be considered the following [16]:

- Debt indicators, including: debt maturity, repayment schedules, interest rate sensitivity, share of foreign currency debt;
- Indicators, which relate to the international reserves. They are necessary, as help to evaluate the possibility to avoid the crisis of liquidity. Relation between the international reserves and short-term debt is the key parameter of the evaluation of the vulnerability of the country with the limited access to the capital markets;
- Indicators of financial stability, which reflect the evaluation of financial sector. They include: capitalization of financial institutions, quality of assets, profitability and liquidity, rates and quality of credit growth. These indicators allow to analyze sensitivity of financial system to market risks, changes of interest rates and exchange rates.

After the article of Blankart (1990), the most widely used in economic literature indicator for the evaluation of debt is the relation of government debt to GDP and its tendencies [22]. This indicator allows to evaluate the level of government debt burden in relation to the economic activity in the country. In this case, resources of GDP are enough for financing the government debt, however it is not the absolute truth. At the same time, this indicator is used as the most popular for the evaluating the level of government debt of the country. Some of other similar indicators have the goal to evaluate the relation of interest payments or amount of debt to different indicators of the income of the country. Others are based on the determining the structure of the indebtedness, which involves external and internal obligations, share of the obligations with the fixed, variable and real rates, the amount of short-term, medium-term and long-term indebtedness. These are important indicators for the evaluation of debt and solvency, they provide information about the deterioration or improvement of the situation [16].

Between the international organizations there is no clear consensus on establishing the minimum acceptable levels for the various indicators.

The Table 6.3 has the information about limits of indicators for the level of government indebtedness for the countries, which were developed by two international organizations.

Table 6.3. The maximum limits of the vulnerability indicators of government debt

Vulnerability indicators	International Monetary Fund	Debt Relief International
Debt servicing/ Budget revenues	25%-35%	28%-63%
Present value of debt/ Budget revenues	200%-300%	88%-127%
Interest payments / budget revenues	7%-10%	4.6%-6.8%
Debt/GDP	25%-30%	20%-25%
Debt / Budget revenue	90%-150%	92%-167%

Source: developed by authors based on data [16, 23]

C. Wyplosz in his article «Debt Sustainability Assessment: Mission Impossible» is evaluating the procedures of assessing debt sustainability, proposed by the International Monetary Fund. Author argues, that considering the current conditions, it is impossible to evaluate if the debt is stable, as far as the prognoses of the government debt are sensitive to the considerations regarding growth, results of the budget year and interest rates. Fundamental reason is that the debt sustainability is a perspective concept with the very big horizons with the stable variables, which are based on the assumptions and the previous patterns [24].

In Ukrainian economic literature it is often used the term of debt security, which includes several indicators, which are responsible for the stable level of debt and solvency of the country as a whole.

In the table 6.4. there are mentioned the main indicators, which are calculated for the assessment of the debt security

Table 6.4. Indicators of debt security of the country

Debt indicators	Description	Optimal level	Limited value
Relation of government debt to GDP	Characterizes the total amount of debt indebtedness	20%	>60%
Weighted average yield of government securities on the primary market adjusted for inflation expectations, in percentage points	Shows the level of expenditures, connected with the servicing of internal government debt	4%	>11%
Spread Emerging Markets Index Plus Ukraine	Difference between the yields of the Emerging Markets Index and the yields of Ukrainian government bonds	200	>1000
Ratio of official international reserves to gross external debt, in percentages	It shows the ability of the country to pay for its obligations to foreign creditors	50%	<20%

Source: developed by authors based on data [25, 26, 27]

So, there is a significant amount of researches on the international organizations regarding the evaluation of the government debt and limits of government indebtedness. It is obvious, that estimates of the limits of possible

amounts of government indebtedness vary. But, to our opinion, the important element, which influences the limits of the public debt, which country can service, is the economic situation. Developed countries, which have the stable economic growth, can service the higher amounts of the government debt. Though, historically, countries tend to borrow more in the periods of economic crisis, which leads to increase of government debt.

6.2. An examination of government debt and analysis of debt sustainability indicators in Ukraine

Since the moment of proclaiming the independence of Ukraine in 1991, the management of government debt was made by different methods. The government debt of Ukraine during the period of 1991-2000 was characterized by the higher amount of external borrowings and the increasing of government indebtedness. After the 10 years of independence it was accumulated 14,1 billion USD (10,3 billion USD of external debt and 3,8 billion USD of internal debt).

The main goal of usage the government borrowings was the coverage of budget deficit. Firstly, the document, which regulated the process of government borrowings was issued in 1995 [28]. The history of cooperation with the international financial organizations started in 1994. During the 1990s because of ineffective usage of loans, taken by companies, which were guaranteed by the state, there was observed the increase of guaranteed government debt. According to the data of the Accounting Chamber, as of January 1, 2000, the total amount of overdue debt on guaranteed government obligations amounted to 1,03 billion US dollars. The ineffective policy of the government debt management caused the situation, that the total amount of government indebtedness exceeded the legally allowed level, and the total amount of international reserves was significantly lower than the interest rate payments. This situation caused the necessity of debt restructuring and total change of debt policy. In fact, it was a technical default, which caused a decrease of credit rating. Effective measures of restructuring and debt policy, which became more cautious, influenced the increase of trust to Ukrainian financial market. In 2008 the global financial crisis

came, and it caused the decrease of possibilities to borrow. Since 2007 to 2013 the international reserves dropped from 31,5 to 20,4 billion US dollars. In this period government used actively the borrowing from the International Monetary Fund and World Bank. During the year 2008-2013 the total amount of state and guaranteed government debt increased more than 300%- from 17,6 billion US dollars at 31.12.2007 to 73,2 billion US dollars in 2013.

The amount of government debt to GDP also increased during the years 2014-2015 (Figure 6.1.)

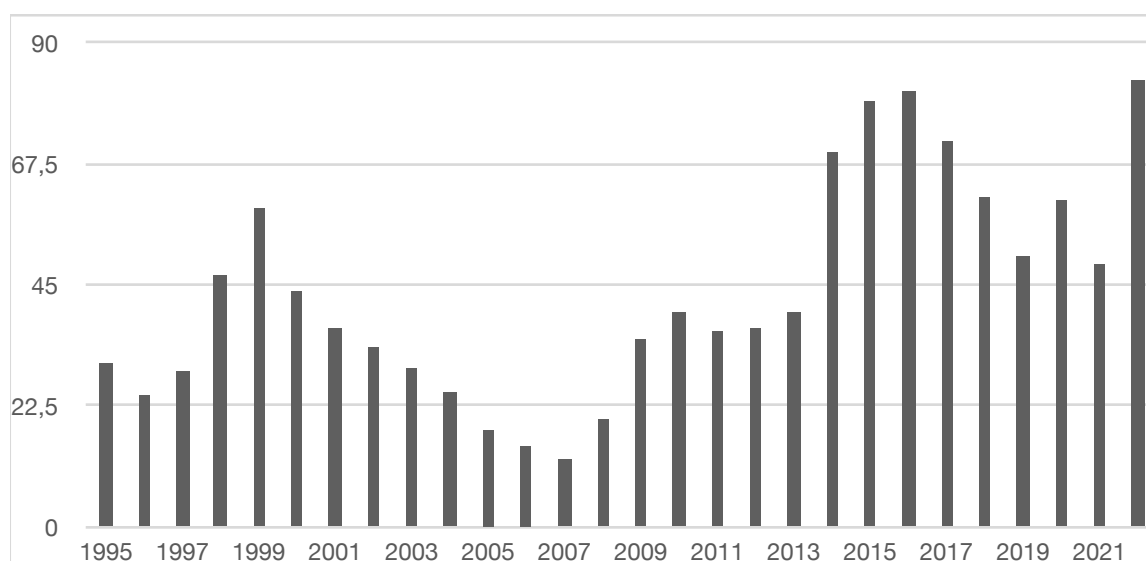


Figure 6.1. Central Government Debt (Percent of GDP), %

Source: developed by authors based on data [29]

The tendency of increase of government indebtedness after the financial crisis was observed in many countries in the world, especially in Greece, Spain, Italy, where the debt burden deepened the consequences of financial crisis.

In Ukraine the borrowing on international markets after the global financial crises causes the government debt spiral, when the new borrowings were used to pay for the previous one. Economic situation after the first invasion of Russia in 2014 was characterized by the increase of government indebtedness, and that also was one of the factors which was influencing the economy negatively. The reasons of the increase of government debt in 2014-2015 were the following:

- political crisis, annexation of Crimea and long-term conflict of the East of country;

- deep economic recession, which was caused by the changes of economic relations and damage of infrastructure and industrial enterprises on the East of the country;
- financing the budget deficit via government borrowings. The increase of government debt was caused by the growth of expenditures on the defense industry and servicing the existing debt;
- the necessity of support of state banks and companies, including “Naftogas Ukraine”;
- devaluation of the national currency.

Important is the fact that the central bank was buying the internal government bonds, what is negative, as far as led to inflational processes. So, in 2017 the total amount of the internal government borrowings in assets of the National Bank of Ukraine was 360,6 billion US dollars [16].

In 2015 it was made a restructuring of the government debt, and further management of government indebtedness was more effective, as a result the government debt to GDP relation decreased. The Russian invasion in 2022 caused a massive increase of government indebtedness to 83,12 % of GDP [30].

Increase of debt in relation to GDP is a negative tendency, as far as it indicates about fast accumulation of unpaid borrowings and inability to cover the growing needs for the debt servicing by the country’s economic development. While the war continues, the rate of increase in the national debt is likely to exceed the pace of economic growth. However, active debt management and the faster restoration of economic activity in areas where it is possible are crucial for a rapid post-war recovery. Past experience has shown that after crisis periods, when the debt burden approaches 100%, with the support of creditors and effective government action, a return to the path of growth is entirely possible.

As of October 31, 2023 the state and state-guaranteed debt of Ukraine amounted to 136,35 billion US dollars. It is worth paying attention, that the external government debt predominated in the structure of government indebtedness – it amounted 68,04% of total sum of government debt [31]. On the Figure 6.2. there is presented internal and external government and state guaranteed debt for the last 5 years (since 31 of December 2018 till 31 of October 2023). It is easy to observe the

tendency of increasing the government indebtedness, both internal and external one, after the Russian invasion in 2022.

Important element for the evaluation of the government indebtedness also there is analysis of the currency structure. Since, the substantial portion of the state debt is denominated in foreign currency, it may impact the stability of the national currency and become one of the factors contributing to a currency crisis.

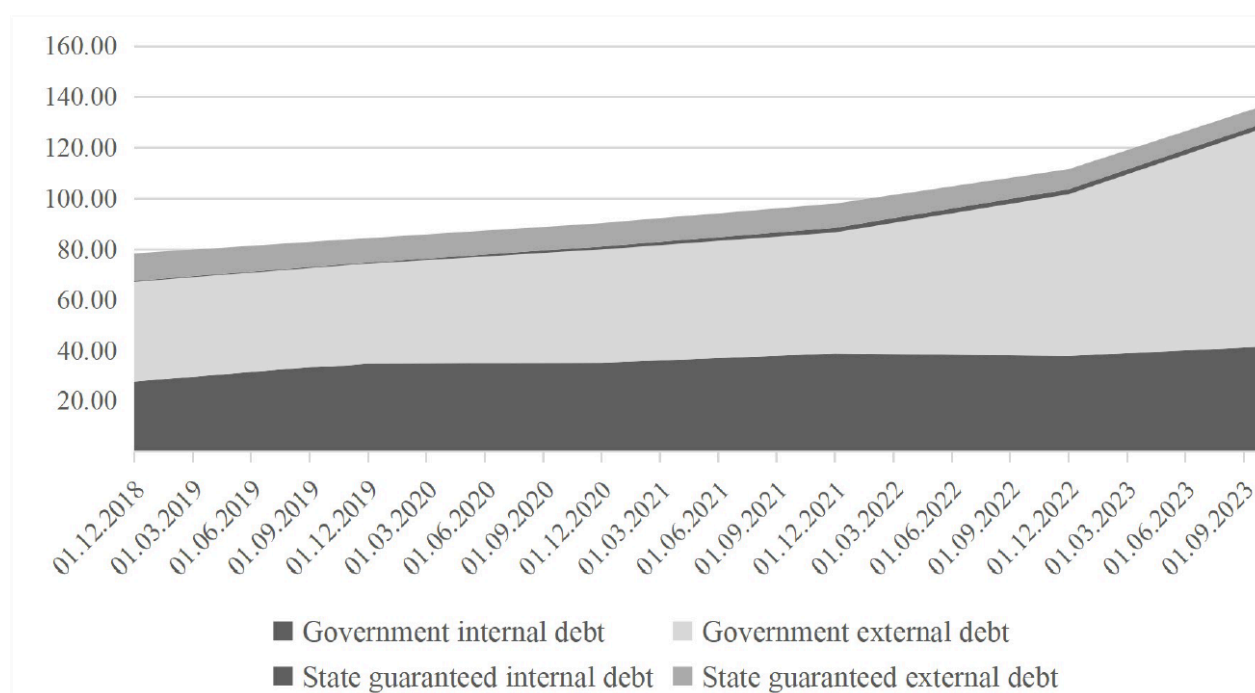


Figure 6.2. Government and state-guaranteed debt, billion US dollars

Source: developed by authors based on data [31, 33]

As shown in Figure 6.3, as of October 31, 2023, the majority of the debt was denominated in euros and US dollars (30.35% and 25.85%, respectively). Borrowings in the national currency accounted for 29.33%, which is less than one-third of all the borrowings.

Solvency of the state on its external borrowings depends on the currency income. Currency inflows to the government sector are recorded on the balance of payments. The positive balance in the Central Bank Sector indicates resources that replenish the Ministry of Finance's foreign exchange account, thereby enabling it to service external debt. In 2022 the currency income to the sector of state government was high. The main positive impact had the inflow from the grants and loans from the

international partners, which were used to finance the most important expenditures of the country, including social and humanitarian sector: that is the payment of salaries, social benefits, pensions, and financial aid for internally displaced persons. These inflows were caused by the increased financial needs of the Ukrainian government budget as a result of the war.

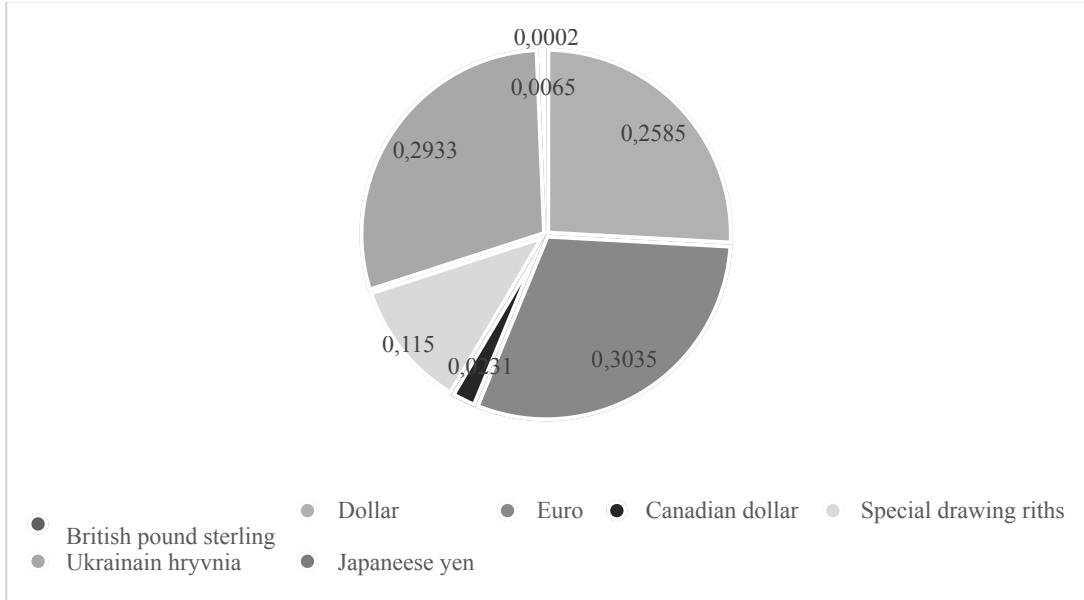


Figure 6.3. Government and state guaranteed debt in the currencies of payment, % (as October, 31, 2023)

Source: developed by authors based on data [31, 34]

Increase of debt burden in 2014-2015 was caused also because of the high depreciation of national currency, so, it is important to pay attention to the relation of the exchange rate of hryvnia to US dollar and the government debt. Relation of this indicators is very high, what is obvious as far as a great part of government debt in Ukraine is accumulated in the foreign currency and of course, its negative tendency.

During 2022 government and state guaranteed debt in the national currency increased rapidly. It was caused also by the devaluation of the national currency. Big part of debt in the foreign currency is dangerous as far as devaluation increases the debt burden. It already has happened in the years 2014-2015. That is why while transfer to the floating exchange rate it is important to replace external debt in foreign currency into the debt in national currency.

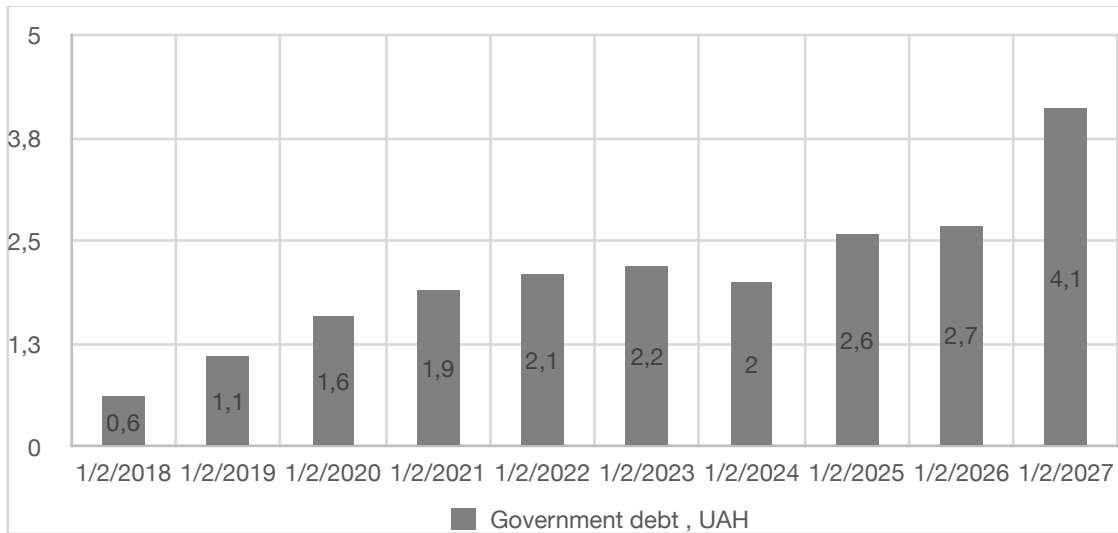


Figure 6.4. Dynamics of the government debt and exchange rate

Source: developed by authors based on data [31, 34]

The main source of the government debt is the budget deficit.

According to the Maastricht Treaty, the acceptable budget deficit level for a country that is a member of the EU is 3% of GDP. A budget deficit exceeding 3% of GDP leads to decline of investment activity and increase of inflation. Article 14 of the Budget Code of Ukraine says that the deficit of the state budget cannot exceed 3% of the projected nominal GDP of Ukraine for the corresponding year. However, for the years 2021, 2022, and 2023 this rule was cancelled.

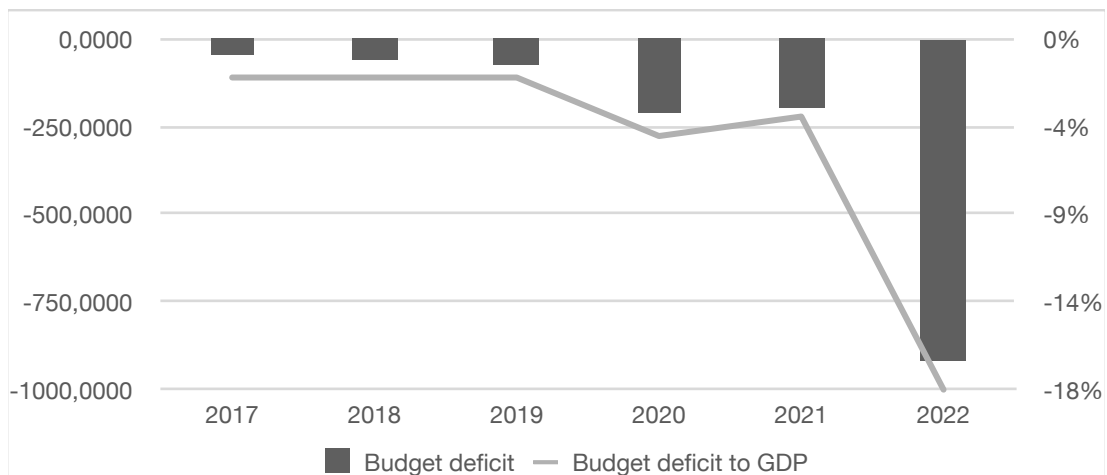


Figure. 6.5. Dynamics of the budget deficit to GDP, billion UAH

Source: developed by authors based on data [32]

The analysis of the state of the budget deficit in Ukraine showed that it exceeded 3% of GDP over the last three years. In 2022, due to a decrease in revenues and an increase in expenditures on defense, the budget deficit increased even further. The Budget Law for 2023 prognosed a further increase in the budget deficit to 20.3% of GDP.

After the active phase of the war ends, there will be a gradual fiscal consolidation. However, during these years, the national debt will continue to increase in absolute terms. Nevertheless, in the case of rapid post-war recovery, the economy's size will grow at rates comparable to the increase in external debts. As a result, the debt as a percentage of GDP may remain at a stable level.

The internal source of the servicing and repayment of the government debt is the budget income, most of their part is formed by the tax revenues. It is worth noting that the tax revenues decreased in 2022 due to the damage of enterprises and losing a great part of territory after Russian invasion. But it is also important to pay attention that enterprises in Ukraine were relocating and adapting to conditions. It is worth noting that the amount of tax income in 2022 was almost the same as in 2020 (in this year decrease was caused by pandemic).

In recent years, the ratio of tax revenues to GDP, or the tax burden, has decreased. In 2022, due to tax reliefs provided by the government to help businesses to survive during the war, Ukraine's tax burden reached its lowest level in recent years, standing at 18.3%. Expanding the country's own revenue base is crucial to prevent further growth of the national debt. Therefore, one of the requirements of the International Monetary Fund within the framework of the Extended Fund Facility program is to increase tax revenues and cancel similar business reliefs after the active phase of the war.

So, after analyzing the dynamics of the government debt, it can be concluded, that the main factors of the increase of government debt are deficit of budget, depreciation of national currency. In the time of war it is important to concentrate on the development of national enterprises, stimulation the business activity, which can increase the tax income and stimulate economic growth. It is important to attract government debt in the national currency for the minimizing the currency risks. In

the current conditions of increasing the debt burden it is crucial to attract grant financing and credits with low rates.

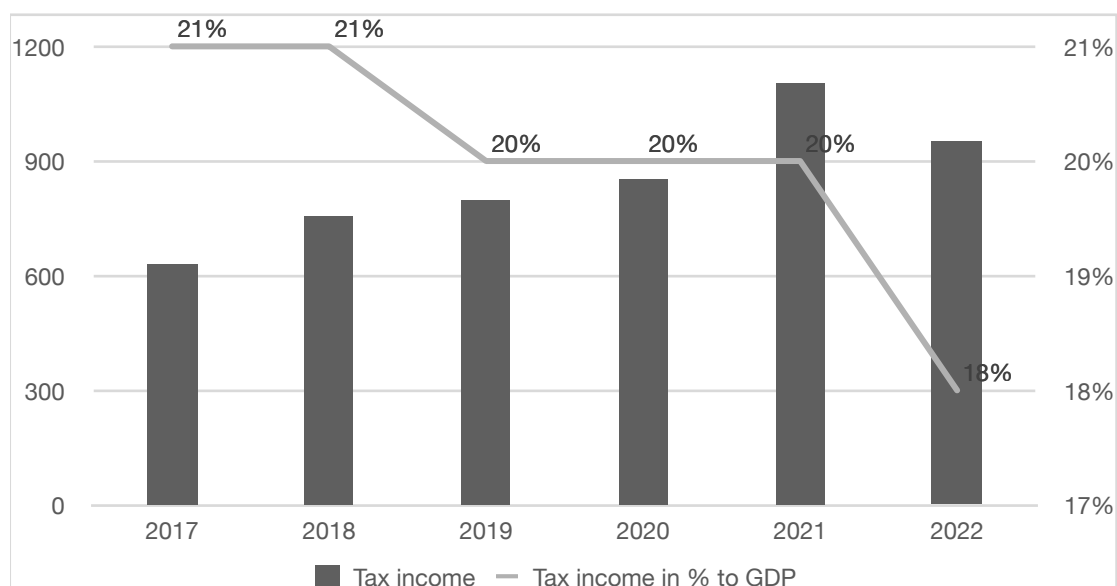


Figure 6.6. Dynamics of the tax income to the budget, billion UAH

Source: developed by authors based on data [32]

Ukraine has a history of cooperation with the International Monetary Fund and the World Bank. Since 1993 it was approved 149 projects of the World Bank in Ukraine. It is worth to pay attention that credits of the World bank are a cheaper instrument, than government bonds and have long period of payment, which allows them to be used more effectively. In economic literature scientists usually criticize the credits of the International Monetary Funds, but the cooperation with the World Bank is considered more positive as far as they are goal-oriented. To our mind they can be rather effective in the period of war and reconstruction, as far as can be used for the rebuild of infrastructure, improvement of state services, development of medicine and education [16]. Since the Russian invasion on February 2022 World Bank approved new 19 projects for Ukraine (Table 6.3).

Table 6.3. Projects approved by the World Bank after the Russian invasion

Project Title	Commitment amount	Status	Approval date
AF2 to Ukraine Emergency COVID-19 Response and Vaccination project	91.39	Active	March 7, 2022
Financing of Recovery from Economic Emergency Ukraine Supplemental Development Policy Loan	489.25	Closed	March 7, 2022
Public Expenditures for Administrative Capacity Endurance (PEACE) in Ukraine	23395.90	Active	June 7, 2022
Additional Financing for PEACE in Ukraine	1300.00	Active	June 26, 2022
Second Additional Financing for Public Expenditures for Administrative Capacity Endurance (PEACE) in Ukraine	4500.00	Active	August 2, 2022
Third Additional Financing for Public Expenditures for Administrative Capacity Endurance (PEACE) in Ukraine	529.90	Active	September 30, 2022
Health Enhancement And Lifesaving (HEAL) Ukraine Project	123.50	Active	December 20, 2022
Fourth Additional Financing for Public Expenditures for Administrative Capacity Endurance (PEACE) in Ukraine	500.00	Active	December 20, 2022
Repairing Essential Logistics Infrastructure & Network Connectivity (RELINC) Project	50.00	Active	February 8, 2023
Ukraine Procurement System Enhancement Project	0.15	Active	February 9, 2023
Restoration Project of Winterization and Energy Resources	200.00	Active	April 11, 2023
Fifth Additional Financing for Public Expenditures for Administrative Capacity Endurance (PEACE) in UKRAINE	500.00	Active	June 16, 2023
Ukraine Relief and Recovery Development Policy Loan	1500.00	Active	June 29, 2023
Additional Financing for the Second Power Transmission Project	39.18	Active	July 27, 2023
Strengthening the Partial Credit Guarantee (PCG) Fund for small farmers in Ukraine (Strengthening the PCGF in Agriculture Project)	0.00	Active	July 28, 2023
Housing Repair for People's Empowerment Project (HOPE)	70.00	Active	August 30, 2023
Ukraine Agriculture Recovery Inclusive Support Emergency (ARISE) Project	550.00	Active	October 30, 2023
Investing in Social Protection for Inclusion, Resilience, and Efficiency (INSPIRE) Project	1200.00	Active	November 30, 2023
Sixth Additional Financing for Public Expenditures for Administrative Capacity Endurance (PEACE) in Ukraine	1346.00	Active	December 14, 2023

Source: developed by authors based on data [33]

For an understanding of the perspectives in the dynamics of the national debt and debt burden, it's important to analyze the cost of government borrowings. As the cost of external debt is presently not determined by the market and interest rates and terms are concessional, forecasting these rates might be done mainly through expert methods. However, it's possible to statistically examine and forecast rates for internal debt. According to data of the Ministry of Finance, during the wartime period, the cost of internal debt increased, unlike external debt. Over 90% of the internal debt consists of government domestic bonds. The rising interest rates pose risks for the government as servicing this debt becomes increasingly challenging. Moreover, it is important to pay attention to the attraction of internal debt in the current conditions.

In 2022 it was observed the negative policy of the National Bank of Ukraine to buy the government domestic bonds. According to the economic theory and previous examples of such policies in different countries, especially in the war period or after it, it can lead to inflation. This instrument is rather negative, but the National Bank of Ukraine used it as a result of high demand of the Government of Ukraine for resources to finance the military and social expenditures of the country.

Government have decided to prevent such monetization in 2023 and the National Bank of Ukraine have not bought government domestic bonds in 2023. Meanwhile, the banking system, a major holder of government domestic bonds, operates in a situation of excess liquidity and thus has the potential to increase purchases of government bonds. State bodies and the central bank are actively working in this direction. Also increased the purchases of government bonds by the citizens.

Over the past 10 years, interest rates in the Ukrainian market have been quite unstable. The central bank rate reached its peak in 2015 when it amounted 30% and remained at this level for about six months. In 2020, due to the pandemic and economic slowdown, the central bank rate was at a low level of 6%. In 2021, as the economy recovered after the pandemic and global energy prices increased, the central bank rate gradually increased to mitigate inflationary pressures. Prior to the full-scale invasion of Russia, it was 10%. During the early stages of the war, it was maintained at this level, but in June 2022, the National Bank sharply raised it to 25%. It was done

to stabilize the markets and decrease inflation. In 2023, decreasing inflation and an improved economic situation allowed a gradual reduction of central bank rate. By December 2023, it had already decreased to 15%.

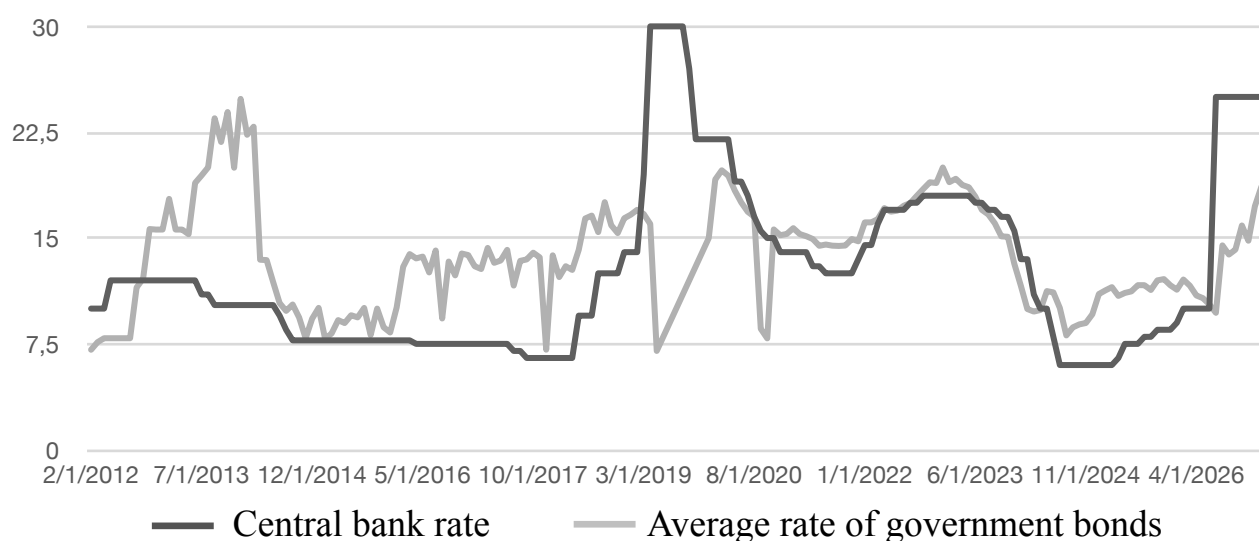


Figure 6.7. Dynamics of the central bank rate and average rate of the government domestic bonds, %

Source: developed by authors based on data [32]

The yield on domestic government bonds has been quite volatile, with the highest growth during the global financial crisis of 2008-2009. Since the introduction of the inflation targeting regime in 2016, there has been a correlation between the central bank rate and the yield of government bonds, and also it was observed smoothing of fluctuations in bond yields. The government bond instrument is one of the components of the transmission mechanism, the development of which is one of the key tasks of monetary policy. Following the increase in the central bank rate to 25% in 2022, there was an observed rise in the rates for government bonds

It is obvious, that high profitability of government bonds increases the demand for them on the market, and commercial banks and citizen were more willingly to buy the government domestic bonds. But it is important to mention, that it caused the additional burden for the Ministry of finance, as far as it has to pay more for government obligation in future and that is an additional burden in the war time.

It is important to pay attention to the debt servicing and repayment. As we can see from the Figure 6.8. in 2024 and 2025 will be expected the high peaks of debt

repayment and services. Of course, it makes additional burden for the state finances in the conditions of war. It is obvious, that internal government borrowings are often issued lately for the short-term period, as this instrument is more popular on the internal market among the main investors of state bonds- banks and citizens in the conditions of high risks. But, taking into consideration the possible decrease of financing from the international sources in 2024 and further years it is dangerous for the debt stability.

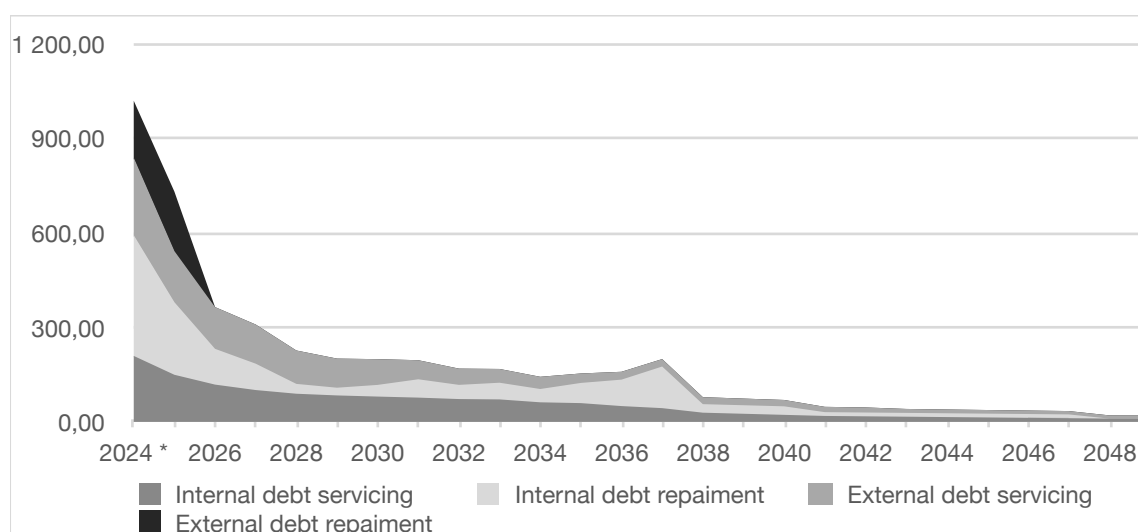


Figure 6.8. Amounts of debt servicing and repayment in the years 2024-2049, billion UAH

Source: developed by authors based on data [34]

There is high dependence on the international help and in the case of its decrease that will cause the huge impact on the economic stability and recovery, on the budget expenditures and possibility to repay debt. It is obvious that it also will highly influence the exchange rate stability, which in the conditions of big part of external government debt in the structure of government indebtedness it is also an additional risk for the debt stability.

Most of the resources received as international aid is in the form of loans and guarantees (Figure 6.9). It can be observed, that amount of resources is fluctuating. In the conditions, when there is a lack of resources to cover the budget expenditures, the Ministry of Finance tended to borrow more on the internal markets.

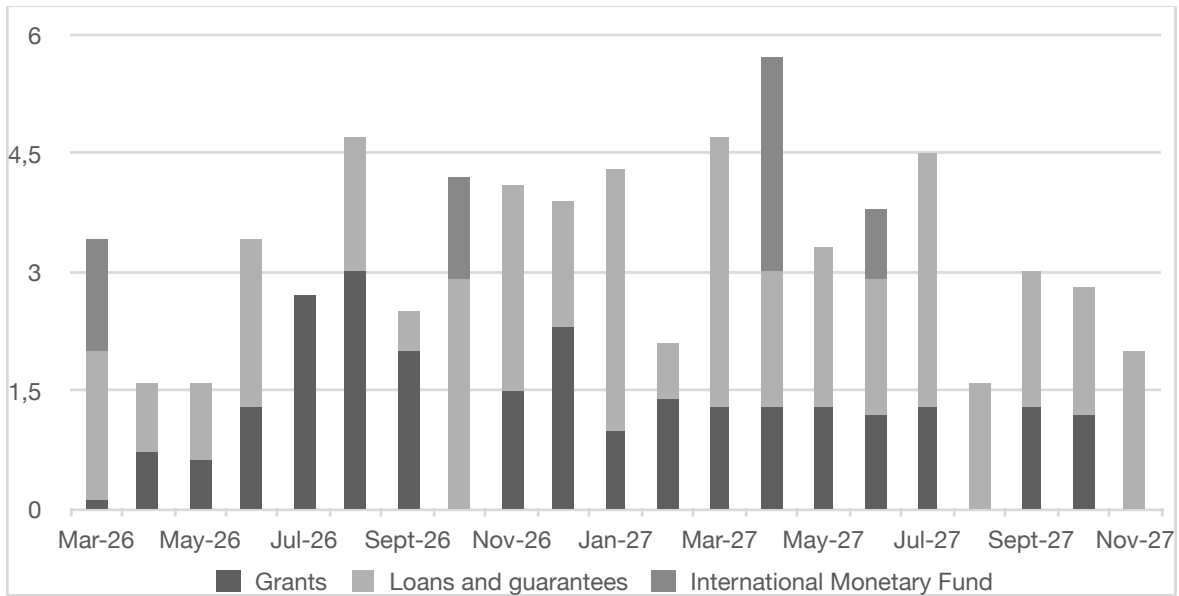


Figure 6.9. International financial help from the beginning of full-scale invasion, billion dollars

Source: developed by authors based on data [35]

This high dependence on the international financing is rather hard for economy. It is obvious, that in conditions of possible decrease of financing it is important to search for own resources and pay more attention to the development of business activity. Raising of taxes, which is one of the options, can be rather hard for business and society and influence negatively the economic activity. Another option of the internal borrowing in the form of state bonds will cause the further increase of the government debt, which again will be the burden for the state budget.

The simplest method of empirically testing of debt sustainability is through econometric tests. Professor of Econometrics at Adnan Menderes University Ismet Gotser in his study, uses a test for stationarity to assess the sustainability of both external debt and the current account balance and budget balance [36, 37].

Another example of applying econometric methods is found in Demir's study, where debt sustainability is also assessed through stationarity. This research aims to analyze the sustainability of external debt in transition economies of Southeast Europe (some of which are developing countries) using a unit root test after wavelet transformation. Therefore, the unit root test was applied to the variable of gross external debt and the ratio of gross external debt to Gross Domestic Product (GDP) of

countries to investigate their stationarity. The time period of analysis varies for each country; however, overall, quarterly data from the 2000s until the second quarter of 2020 were used. The data were initially checked for linearity, and for non-linear data, unit root tests WKSS (unit root test by Capetanios, Shin, and Snell after wavelet transformation) and FWKSS (WKSS test with Fourier transformation) were applied.

The author notes that in order to achieve stability in terms of the gross external debt to GDP ratio, countries should aim for growth by directing external debt into investments. Consequently, the denominator of this indicator will increase, leading to stability. In other words, countries should develop a growth-oriented policy. For this purpose, transitioning economies should attract foreign direct investments into their countries. Within the context of a growth-oriented policy, they should undertake structural reforms that facilitate the production of capital-intensive goods based on advanced technologies.

In this section, the stationarity of time series describing the debt burden is tested using an econometric unit root test. Three indicators have been selected for analysis: the ratio of government debt to GDP to analyze the stability of government debt, as well as the ratio of external debt to GDP and the ratio of external debt to exports to analyze the stability of gross external debt. The variables were chosen based on research by other authors as described above. First, let's consider the government debt-to-GDP ratio, which represents the debt burden. The dynamics of the government debt-to-current GDP, meaning the sum of GDP for the last four quarters, are presented in Figure 6.10.

It was conducted a test for the presence of a unit root. The test indicates that a structural break occurred in the fourth quarter of 2022, when the debt burden reached its lowest point in the last decade due to active debt management. After this period, it sharply increased due to a decline in GDP and rapid accumulation of new debts. Additionally, the test results suggest that the time series of the debt burden is non-stationary, indicating that the debt is not stable.

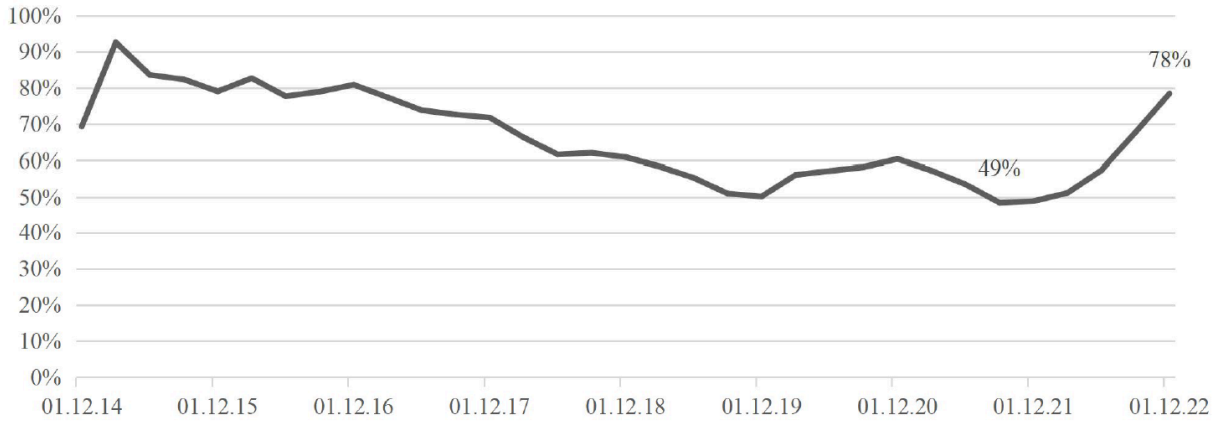


Figure 6.10. Dynamics of relation the government debt to GDP

Source: developed by authors based on data [32]

Thus, using the test for stationarity, it was found that Ukraine's national debt is not stable. It's also essential analyze the stability of external debt since its stability is more vulnerable and poses a greater risk to Ukraine. External debt should also be examined in relation to GDP (Figure 6.11).

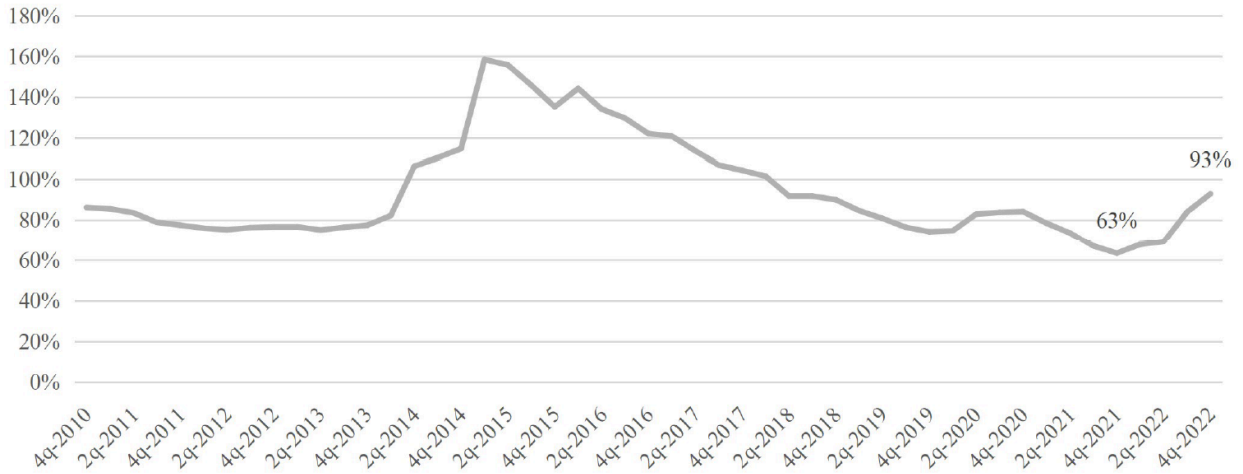


Figure 6.11. Dynamics of relation of external government debt to GDP

Source: developed by authors based on data [32]

Similarly as with the national debt-to-GDP ratio, Ukraine reached a record low level of debt burden at the end of 2021 in the last 10 years. Unfortunately, this trend changed in 2022 due to the war. Just like the time series of external debt in

absolute terms, the time series of the ratio of external debt to GDP is non-stationary, indicating that the external debt burden is unstable.

The structural rupture occurred at the beginning of 2014 when the external debt burden began to increase sharply and exceeded a record level by 150%, with the further decrease through debt restructuring and GDP growth. In the context of gross external debt, the debt-to-export ratio can also be considered since export is the primary source of foreign currency inflows into the country.



Figure 6.12. Dynamics of relation the external debt to export

Source: developed by authors based on data [32]

Similarly to the debt-to-GDP ratio, the debt-to-export ratio is not stationary, indicating that external debt is not stable based on this indicator as well.

Therefore, as a result of econometric analysis for the presence of a unit root with a structural break, it was found that the government debt is unstable according to all indicators: as a ratio to GDP, as gross external debt which includes both public and private external debt in relation to GDP, and in relation to export. The first year of full-scale war was marked by a significant decline in GDP, export, and active government borrowings to fill the budget, which led to these outcomes.

In March 2023, the IMF approved a new support program for Ukraine through the Extended Fund Facility (EFF) mechanism. This program is medium-term (4 years) and includes providing Ukraine with assistance amounting to \$15.6 billion (11.6 billion SDR) and has the aim to maintain economic and financial stability and restore debt sustainability. The final goal is Ukraine's post-war recovery and its

accession to the European Union. The approval of the Extended Fund Facility mechanism became a long-awaited step from the Fund because, following two transfers under emergency financing totaling approximately \$2.7 billion, it became evident that Ukraine required more stable and predictable assistance. The agreement with IMF became a catalizator of further international support, as far as it signalizes about the reliability of Ukraine as a borrower.

Usually, in the report on financial assistance, an analysis of the recipient country's debt sustainability is provided. Unlike in the previous versions in March and October 2022, the latest debt sustainability analysis clearly indicated the absence of such stability and the necessity for substantial funding to restore it [38].

According to the analysis of IMF from the 31 of March 2023, in the case of absence the active management of government debt, it is un stable as in basis scenario to restructuring and to pessimistic scenario of restructuring. But in order to restore the debt sustainability it has made arrangement about the special financial support, including the debt cancellation. So, both in the basic and pessimistic scenarios the government debt as evaluated as not stable in the perspective.

The previous Debt Sustainability Analysis (DSA), which followed Ukraine's request for program monitoring with the IMF's Executive Board in December 2022, identified that the macroeconomic situation in Ukraine somewhat stabilized in the second half of the year following a significant war shock [39]. The baseline scenario projected stabilization in 2023 as the economy adjusted to war. However, it also predicted that activity would remain subdued against the backdrop of lower harvests, depressed consumer sentiment, and attacks on energy infrastructure.

The December DSA emphasized an extremely high level of uncertainty regarding both the duration of the war and the extent and pace of recovery. It included multiple probable scenarios foreseeing vastly different trajectories for debt and gross financing needs (GFN). Therefore, the December 2022 Debt Sustainability Analysis highlighted that the provided macroeconomic forecasts and assumptions about funding were preliminary. However, they were sufficient to contain further escalation in the trajectory of debt burden.

Taking into consideration the exceptionally high uncertainty regarding Ukraine's macroeconomic prospects, the Debt Sustainability Analysis (DSA) accompanying Ukraine's request for EFF includes two possible medium-term scenarios — baseline and pessimistic, both of which rely on the same results of 2022.

Despite the war continuance influence the economy hardly, activity has somewhat stabilized in the third and fourth quarters, and the estimated economic contraction for the year 2022 stood at 30.3% (previously, the IMF expected a decline of 33%). Inflation remained high in 2022, with the GDP deflator at 28.7% (IMF's forecast was 28.5%). The disbursed and prospective official external financing amounted to a significant \$32 billion USD, slightly below expectations by \$0.5 billion USD, with over 40% received in the form of grants.

However, considering the extraordinary fiscal pressure because of defense and social needs, the primary deficit amounted 13.4% of GDP, which was an improvement compared to the previous forecast of 17.9%. The total volume of the national debt at the end of 2022 reached 82.1% of GDP. This represents the highest level in Ukrainian history and also among neighbouring countries.

The suspension of servicing Ukraine's external state debt has been implemented since August 2022, following an agreement with official bilateral and private holders of Eurobonds and GDP warrants.

The baseline scenario does not involve an fast reconstruction program similar to the Marshall Plan. Assumptions regarding external financing for 2023 remain largely unchanged, estimated at around \$42 billion USD, with defined financial commitments sufficient to meet external financing needs for the year.

The baseline scenario reflects the finishing of the agreed suspension of debt service with bilateral official creditors (with resumption of payments in early 2024) and private bondholders (with resumption of payments in August 2024). In the medium term (2024–2027), further official financing of over \$80 billion USD is expected, with annual amounts decreasing gradually over time. Approximately 80% of Ukraine's external financing is expected to come in the form of concessional loans, with the 20% in grants.

In the long term, the baseline scenario predicts relatively smaller official financing flows of \$8-9 billion USD per year, including a return to market financing in the long-term forecast (starting from 2029).

Without additional financial support on appropriate terms, including debt restructuring, Ukraine's debt is considered unsustainable under both the baseline and pessimistic scenarios. The baseline Debt Sustainability Analysis (DSA) before restructuring forecasts a debt increases to over 105% of GDP by 2024 due to the projected primary deficit taking into consideration the high defense expenditures. Then, it prognoses a gradual decline to 78% of GDP by 2033 as the country recovers from the war. The medium-term modules of the model indicate high sovereign stress risks, notably an extensive fan chart indicating considerable uncertainty regarding this forecast and GFN stress tests revealing consistently high financing needs, especially in the nearest perspective.

Under the pessimistic DSA, the debt trajectory worsens significantly compared to the baseline, and the vulnerabilities identified through the fan chart and GFN tests deteriorate further.

According to the baseline scenario of the Debt Sustainability Analysis (DSA) published by the IMF in March 2023, the sustainability of debt could be restored in perspective through adequate restructuring and guarantees for highly concessional lending during and after the program. For Ukraine, illustrative modeling suggests that the sustainability of external debt in the medium term can be achieved if average gross financing needs will maintain at around 8-9% of GDP in the post-program period (from 2028 to 2033), and the debt-to-GDP ratio decreases to 60-65% of GDP.

The IMF staff anticipates that this could be achieved under the following conditions: official bilateral creditors agreement to extend the debt service suspension throughout the program period, with an obligation to restructure up to the amounts required in the baseline scenario and final debt restructuring based on updated data when the high uncertainty ends (or approximately when the proposed Fund-supported program ends); commitment from the Ukrainian government to seek comparable agreements with private external commercial creditors; as well as reliable and

specific assurances from donors regarding support on adequate financial terms in both the baseline and pessimistic scenarios.

The debt sustainability analysis, conducted together with the approval of the Extended Fund Facility by the IMF, also includes a pessimistic scenario, which is necessary due to the high level of uncertainty. This scenario anticipates a more prolonged and intense conflict compared to the baseline scenario, slowing the return of migrants, and causing further damage to infrastructure. Due to sustained high defense needs, the budget deficit will be higher in 2023–2024 and then gradually improve more progressively. Expectations suggest that imbalances in the currency market will persist longer due to ongoing export constraints, leading to a higher nominal devaluation, although the extent of real depreciation of the national currency will be mitigated by relatively higher inflation.

Further recovery will be slower than in the baseline scenario, considering more significant damage to Ukrainian capital, slower return of migrants, and poorer business indicators, resulting in production levels remaining significantly lower than pre-war levels.

In the pessimistic scenario, the cumulative financing deficit reaches approximately \$140 billion, which is roughly \$25 billion higher compared to the baseline forecast for the years 2023–2027, which will demand additional measures to ensure debt sustainability. The full additional financing under this adverse scenario is expected to come in the form of highly concessional loans (approaching grant-like conditions). Furthermore, considering the existence of exceptional financing amounting to \$7.1 billion per year over a 5-year period post-program completion, this scenario also identifies the need for a combination of additional grants during the program period, financing on highly concessional terms aligned with assurances received, and further debt management to provide its sustainability. This will reduce the overall government debt to approximately 60% of GDP at the end of the 10-year forecast and achieve a manageable level of gross financing needs at 8-9% of GDP annually in the post-program period, thereby contributing to the sustainability of debt on a prospective basis.

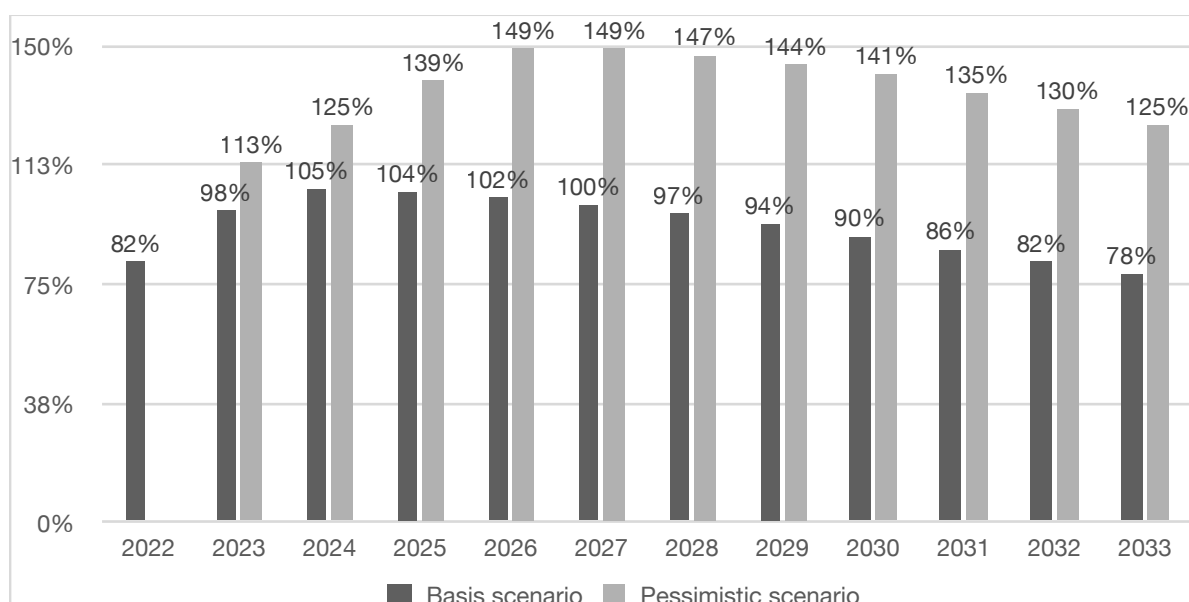


Figure 6.13. Prognosis of the government debt to GDP ratio according to the baseline and pessimistic scenario of the March 2023 Analysis of IMF

Source: developed by authors based on data [38, 39]

Former NBU Governor Kyrylo Shevchenko highlighted that one of the challenges in sustaining the economy amid administrative constraints is the dollarization and withdrawal of savings from the financial system. When inflation rises and rates on government domestic loan bonds (OVDP) are fixed, owners of hryvnia-denominated savings face losses. To avoid these losses, they might seek to withdraw such capital and invest in foreign currency, thereby exacerbating inflationary and devaluation pressures. The solution to this issue primarily involves raising OVDP rates, which, in turn, would lead to an increase in rates on hryvnia deposits. The Ministry of Finance has aligned government bonds with attractive market financial instruments. It can be said that the main adjustment of bond rates has already occurred. Therefore, the internal debt cost in 2023 was set at around 17.5% for short-term securities and approximately 20% for medium-term ones [40].

In general, the economic situation in Ukraine depends heavily on the international financing of the countries and international financial organizations. Mechanism of extended financing is a kind of guarantee to receive the grant and concessive financing. However, as long as the war continues, it is impossible to avoid a primary budget deficit, high inflation, and interest rates. At the same time, Ministry

of Finance already has agreements about the debt restructuring. Till the creditors are eager to prolong the payment for loans and debt securities, it will be possible to avoid default. Important element for the current situation in these conditions is also a political stability.

Attracting of the internal debt decreases the risks of insolvency. Nowadays, the inflow of foreign currency into the country is complicated, as key export industries like agriculture and metallurgy are affected by the war. External financing in foreign currency may carry additional liquidity or insolvency risk. Servicing debt in the national currency is easier – default on debt in the national currency is generally considered unlikely because, unlike foreign currency, the national currency can be printed as needed. Of course, considering the independence of the Central Bank, such a scenario is unacceptable both for us and our international partners and National Bank make all the efforts to avoid such a scenario. Though, in 2022 the National Bank of Ukraine was buying the government obligations, which led to the monetization of the budget. In 2023 National Bank avoided usage of this instrument. However, this scenario carries lower risks than declaring default.

In history happened many defaults, and it is obvious, that countries that countries restore access to international markets, but the rates are not favorable. According to investigation of the Bank of England, losses for the countries, which have not made the deals about the restructuring are three time higher, than for those which had the possibility to make such agreements [16]. In case of Ukraine default can influence rather negatively the economic and financial stability of the country. It is important to avoid it and restructure the government indebtedness.

Before war commercial banks were the main creditors on the internal market – their part among the owners of government bonds was the highest. The banking system in Ukraine has operated and continues to operate in conditions of excessive liquidity, though this liquidity is unevenly distributed across the system (with inflows to state bank current accounts due to military payouts, but outflows of client funds from small and medium-sized private banks) [16]. Due to tighter lending conditions and a decline in economic activity, the volume of new loans continues to decrease.

A potential scenario involves a gradual slowdown in banking operations – reducing the growth rates of both liabilities and assets. However, such a scenario would be negative for the economy. An alternative scenario involves replacing credit assets with government securities. The National Bank and the Ministry of Finance are already working on involving commercial banks in the purchase of government bonds, they increased the yield and announced the possibility on forming up to 50% of mandatory reserves in government bonds.

This decision is advantageous for the state as a borrower, banks as investors, the population as agents trying to protect their savings from depreciation (as banks will continue to increase deposit rates to attract more resources for purchasing government bonds at even higher rates), and also for the National Bank, which, in these challenging conditions, is making efforts to achieve its main goal – targeting inflation, and 2023 was rather successful in stabilizing the economic conditions.

The main risk for the sustainability of government debt- continuing war. With every month and year national and foreign resources are becoming exhausted, and budget deficit continues to accumulate together with debt. So, the main task for citizens is to support the army and for the state – to use the attracted resources appropriately.

It is important to analyze the cost of attracting debt and its servicing. These indicators are reflected in yields on bonds. For a country in wartime, it's impossible to attract debt on market terms while maintaining an acceptable credit risk for creditors. However, statistics show an increase in the volume of debt, both domestic and external, with the external debt growing more significantly. It means that Ministry of Finance can attract capital. Of course, the rates have grown since the beginning of war.

Ukraine continues to raise funding for its needs, which have sharply increased during the period of war.

It is important to mention, that the costs of external government borrowings even decreased (Figure 6.14). Taking into consideration the rapid increase of the amount of external government borrowings, such decrease in interest rates proves very favorable conditions of borrowing.

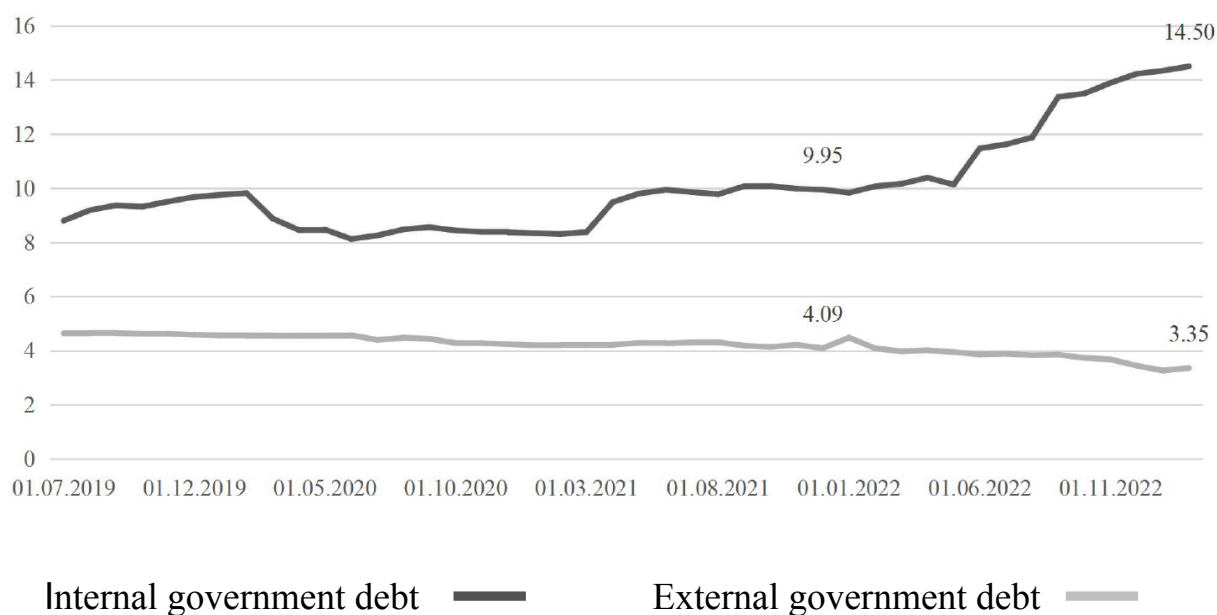


Figure 6.14. Dynamics of average rate on the government debt, %

Source: developed by authors based on data [24, 32]

The cost of domestic government debt has significantly increased during the war, unlike external debt. The internal state debt consists of internal government bonds by 99.9%, and the increase in rates for domestic government bonds has caused such a surge in the internal debt rate. External partners demonstrated a greater willingness to finance the Ukrainian budget almost for free, though it required higher rates to mobilize internal resources. Perhaps if the government had actively promoted government bonds for the public before the full-scale war began, the situation would have been different. In the beginning of war, when feelings of patriotism and the necessity to help the state in its struggle intensified, there was a positive trend in the population's purchase of military government bonds.

Beside the National Bank of Ukraine, which significantly supported the budget in the first year of full-scale war- bought a big part of government internal debt bonds, and committed not to use this instrument in future, major holders of government securities are commercial banks. And because of their activity that the Ministry of Finance was forced to raise rates for new bonds. At the beginning of the war, banks were already in a situation of excess liquidity, and the government needed to attract more financing, while the National Bank aimed to enhance the transmission

mechanism's efficiency. Therefore, increasing rates for government bonds was a necessary step to stabilize the situation in the financial market. Overall, the fact that rates increased was considered normal given the high inflation present in 2022. The decrease in the average rate for external debt was the result of effective work by the Ukrainian government and the National Bank, along with support from international partners.

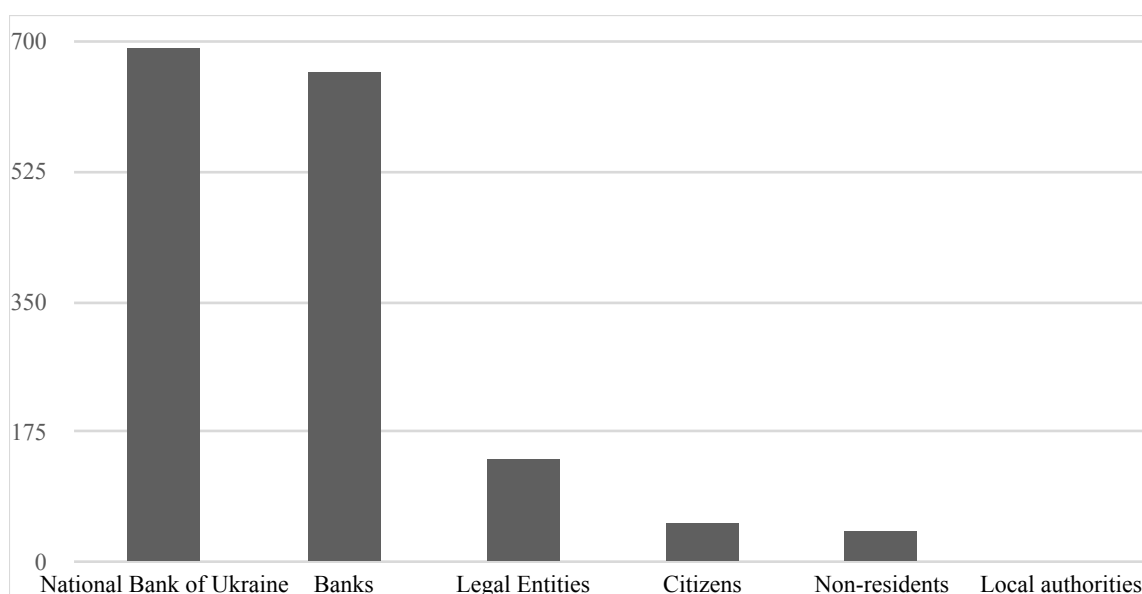


Figure. 6.15. Dynamics of the amount of State internal bonds according to the holder, billion UAH (as on 29.12.2023)

Source: developed by authors based on data [32, 24]

However, it is important to mention that the increase of the government bonds interest rates has a negative effect of the debt sustainability. It increases the amount of servicing payments and becomes an additional burden in the time of war.

It is important to note that information regarding the cost of borrowing is not entirely transparent, especially concerning external borrowings. While the National Bank provides comprehensive information on the rates for government domestic bonds (OVDP) and their yields on the secondary market through daily statistics, data regarding external debt is very limited. In particular, the statistics on the average rate of the debt was taken from the hidden sheets of the monthly information reference on government debt from the Ministry of Finance. These rates are provided for the total volume of external debt without any breakdown by sources. Consequently, there

is virtually no ability to calculate the terms of each new loan unless this data has been disclosed through mass media channels.

Such restricted access to the information about the cost of borrowings is explained by the political component of this process. Unlike domestic debt, where bonds serve as the primary instrument—market tools with transparent conditions, external debt consists of loans from international financial organizations (half of the external national debt), funding from foreign governments and foreign commercial banks and only around 30% -external government bonds.

Predictability of debt repayments is a crucial element for debt sustainability. To minimize interest rate risk, it's necessary to attract as much funding as possible at a fixed rate, not the floating one.

According to the Debt Management Program for 2023 [42], it was planned to attract the government borrowings to finance the budget deficit for 58% at a fixed rate and the rest at floating rates. The structure of the overall debt continues to shift towards floating rates.

After the fixed rate the highest one is the credits of IMF. IMF loans are considered concessional, as their interest rates are lower than market rates. Their repayment terms typically do not exceed 5 years. Ukraine has obtained funding from the IMF under various programs: Stand-by Agreements (1995, 2008, 2010, 2014, 2018, 2020), Rapid Financing Instrument (2022), and Extended Fund Facility (1998, 2017-2020, 2023). The IMF rates are not fixed but calculated based on the Special Drawing Rights (SDR) basket, involving a combination of currency values, interest rates on financial instruments for each currency in the basket, the exchange rate of each currency against the SDR, and depend on the type of financing, outstanding amount, and loan repayment terms.

The interest rate on the current program can reach 7.5% given the current level of global interest rates. According to the analytical agency EIU, interest rates in the American market reached their peaks in 2023, and their decrease in future can be expected; however, on average, they will still remain higher than the average value of the last 10 years. The interest rate on the extended financing program is floating and can constantly change. Due to the increase of global interest rates and the expansion

of IMF lending, the interest rate applied to the outstanding balance of all IMF loans to Ukraine has increased and currently fluctuates within the range of 6-7%. In 2020, the Ministry of Finance stated that the average interest rate on IMF loans for Ukraine remained around 2.5%.

To conclude, the government debt increased during the war due to the rise in rates of domestic government bonds, yet the average rate on external debt even decreased. Meanwhile, there is an increase in the interest rate risk due to the attraction of financing at floating rates, mainly through the IMF rate. According to analysts' forecasts, global interest rates will reach their peak in 2023-2024, which, given the favorable terms of the loans obtained, will reduce the interest rate risk for Ukraine.

The government debt is considered in the current period as unstable. External government borrowings prevail in the structure of government debt. It exposes the country to the currency risk. Of course, it is positive that interest rates on the external borrowings are rather high and in the period of war they are crucial, but it is important to consider the possibilities of the devaluation of national currency, which highly relates on the international help and war conditions. At the same time, it is worth mentioning that rates for internal government bonds increased with the increase of the central bank rate in June 2022. Of course, that made them more favorable and attractive for national investors- banks and citizens, and helped to stop the process of buying government bonds by the central bank of Ukraine. But it is important to remember, that it makes additional burden for the Ministry of Finance in terms of servicing government debt. In the current conditions, to our mind, it is important to restructure the government debt. In 2022 it was made agreement of postponing the payments regarding the external government bonds. Other agreement, for example, with the government of countries on the borrowed loans are needed. In the current conditions government debt becomes a burden for the economy and the state budget, which already has a big deficit and it is expected in the future as well.

Moratorium of payment the external debt of official creditors, which was assigned in 2022, will continue to 2027. At the same time the government debt of private creditors will expire in August 2024, and International Monetary Fund on its

Consultation and Second Review under Extended Fund Facility Arrangement recommended further restructuring of the external government debt to commercial creditors in first half of 2024 [43].

According to the analysis of the International Monetary Fund, economic indicators in Ukraine have improved and show strength. IMF forecast the economic growth to be 3-4 percent in the year 2024. But, taking into consideration the continuance of war and high risks, IMF recommended to increase the own sources of income and implement the National Revenue Strategy [43].

It is obvious that it should be increased the own sources of financing, taking into consideration the possible decrease of international help. But, as we mentioned earlier, the sharp increase of taxes can have negative impact on business activity and stimulate migration. The changes should be implemented carefully and gradually.

6.3. Modeling the cost of government debt

To build the model, monthly data from January 2016 to March 2023 were used, including the central bank rate, weighted average yield on government bonds, average rates on loans and deposits, as well as the spread between interest rates on hryvnia and foreign currency deposits. As far as the inflation targeting regime was implemented in 2015, the effect of changes in the base rate started influencing other financial market rates through the transmission mechanism from 2016. Before, the rates were relatively weakly correlated. The first step in determining the model's specification involves checking the time series for stationarity. All-time series, except for the new deposit rate, are stationary in the first differences, while the deposit rate is stationary in the second differences.

So, for the analysis of rates on the financial market of Ukraine, particularly the yields on government bonds, a VAR model specification was selected. It is a convenient tool for analyzing multiple variables simultaneously, especially their interactions. As the variables have different orders of integration, using a VECM model would be inappropriate. Through tests to determine the optimal number of lags and to reduce noise in analyzing impulse response functions, it was decided to use

three lags in the model. During the specification selection process with the usage of the Granger causality test, it was determined that all variables are endogenous. At this stage, the model was checked for adequacy. The primary indicator of adequacy for the VAR model is that the residuals are white noise. The model residuals were generated and tested for stationarity in levels. According to the test, the residuals have white noise characteristics.

It's also important to check for serial autocorrelation in the residuals. To do this, an autocorrelation test was conducted on the residuals, which indicated that there are no significant signs of autocorrelation. A test for the normality of the residuals' distribution revealed that the distribution is not normal. However, such a result was quite expected since, when working with a relatively small sample, as is often the case with Ukrainian data, a normal distribution is usually not observed. Therefore, this result will not significantly affect further work with the model.

The main outcome of the VAR model is not the estimated coefficients but rather indicators of their interaction—impulse response functions and variance decompositions. First, let's analyze the impulse response functions (Figure 6.16).

From the figure it is evident that the rates of return on government bonds increase in response to the increase in the policy rate in the second period. Following this, the change in bond yields is volatile, indicating that the primary reaction to the rise in the policy rate is observed specifically in the second period. In general, the dynamics of the OVDP rate stabilize within a year. Analyzing the change in bond rates in response to commercial bank rates might not be entirely accurate since OVDP rates should be the first to react to the change in the policy rate, and this effect is transmitted to commercial rates. Therefore, the government bond market represents the second link in the transmission

The variable notation is the following:

D(BOND_RATE) – change of weighted average yield on bonds, issued on the primary market, D(DEPO_RATE,2) – change in the increase of average interest rate on deposits, D(DEPO_DIFF) – change of the difference between rates in hryvnia and currency deposits, D(KEY_RATE) – increase of central bank rate, D(LOAN_RATE) – increase of average rate on new loans for the non-financial organizations.

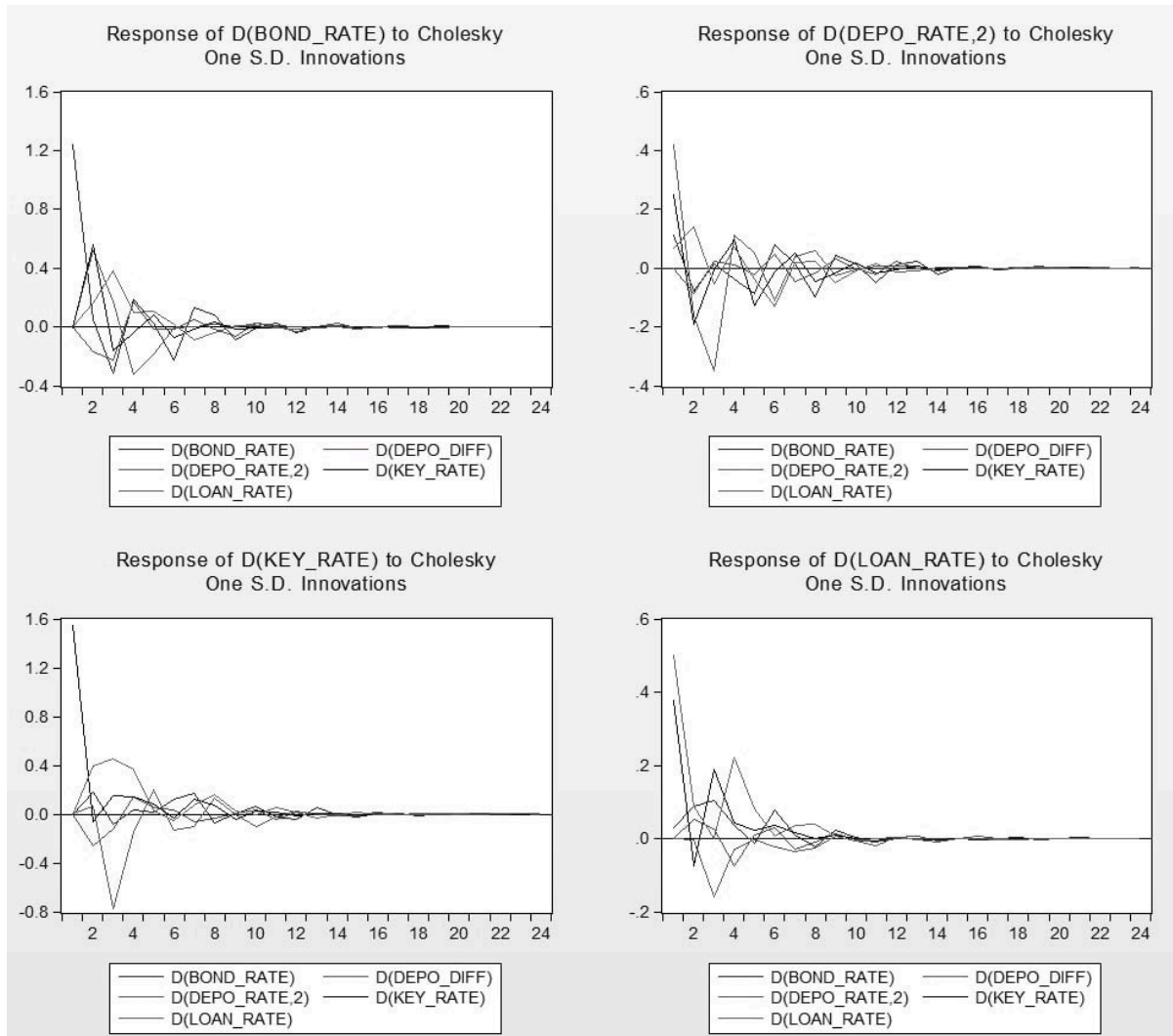


Figure 6.16. Impulse response functions

Source: composed by authors based on the results, received in EViews 12

The loan rates respond to changes in the central bank rate with a one-month lag. However, in the second period following the increase in the yield of government bonds, the credit rates slightly decrease. Nonetheless, in the third period—within a month after the rise in bond yields—they rise again. Commercial banks need some time to go through decision-making processes for changing their interest rates in response to changes in the central bank rate. However, the increase in loan rates just a month after the policy rate hike indicates a swift reaction by banks. Deposit rates, on the other hand, change in response to change in loan rates.

As a result of existing liquidity within the banking sector, commercial banks are not immediately forced to seek new funding for lending or purchasing bonds. Consequently, the full effect of the change in the policy rate is transferred to deposit rates approximately after six months. Then, through the transmission mechanism,

higher rates help to limit inflation. However, this model does not consider the reaction of inflation, as the focus of the research is on the cost of debt or bond yields.

Further it was conducted the analysis of Cholesky decomposition. The sequence of variables was the following: central bank rate, government bond yield, lending rate, deposit rate, exchange rate risk. From the decomposition of the bond yield, it can be observed that it is relatively independent. However, the factors examined here influence 40% of its variation over two years. The most significant impact is initially driven by changes in the central bank rate, followed by substantial influence from shifts in deposit rates.

Deposit rates doesn't suppose to have influence on the government bond yields, as they are placed further down the transmission mechanism than bond rates. However, such a result might indicate that these rates share a similar pattern of movement or dynamics.

Almost 10% of influence on the change in government bond yields comes from the loan rate, which aligns with the impulse response function analysis. However, this contradicts theory because changes in loan rates should also be a derivative of changes in bond rates. This suggests that the increase in government bond yields occurs approximately with the same lag as the rise in loan rates. The change in loan rates is more influenced by the change of the central bank rate (by a third) rather than changes in government bond rates (by 5%).

Thus, the capital market does not fully play its role efficiently in the transmission mechanism due to the government tries to avoid high debt servicing costs, as well as the presence of a more attractive instrument for commercial banks - NBU deposit certificates. Therefore, to enhance the efficiency of the capital market link, it is worth to align debt financing policy to be more market-oriented and respond more promptly to changes in the policy rate. In conditions of excess liquidity, commercial banks compete relatively weakly for clients, hence their response to changes in the central bank rate and the profitability of government bonds is slow and weak. So, interest rates on loans showed an adequate response to the change in the central bank rate in June 2022, with a lag of about a year. However, the interest rate

on loans has a weaker impact (around 10%) on deposit rates compared to the change in the central bank rate (around 20%).

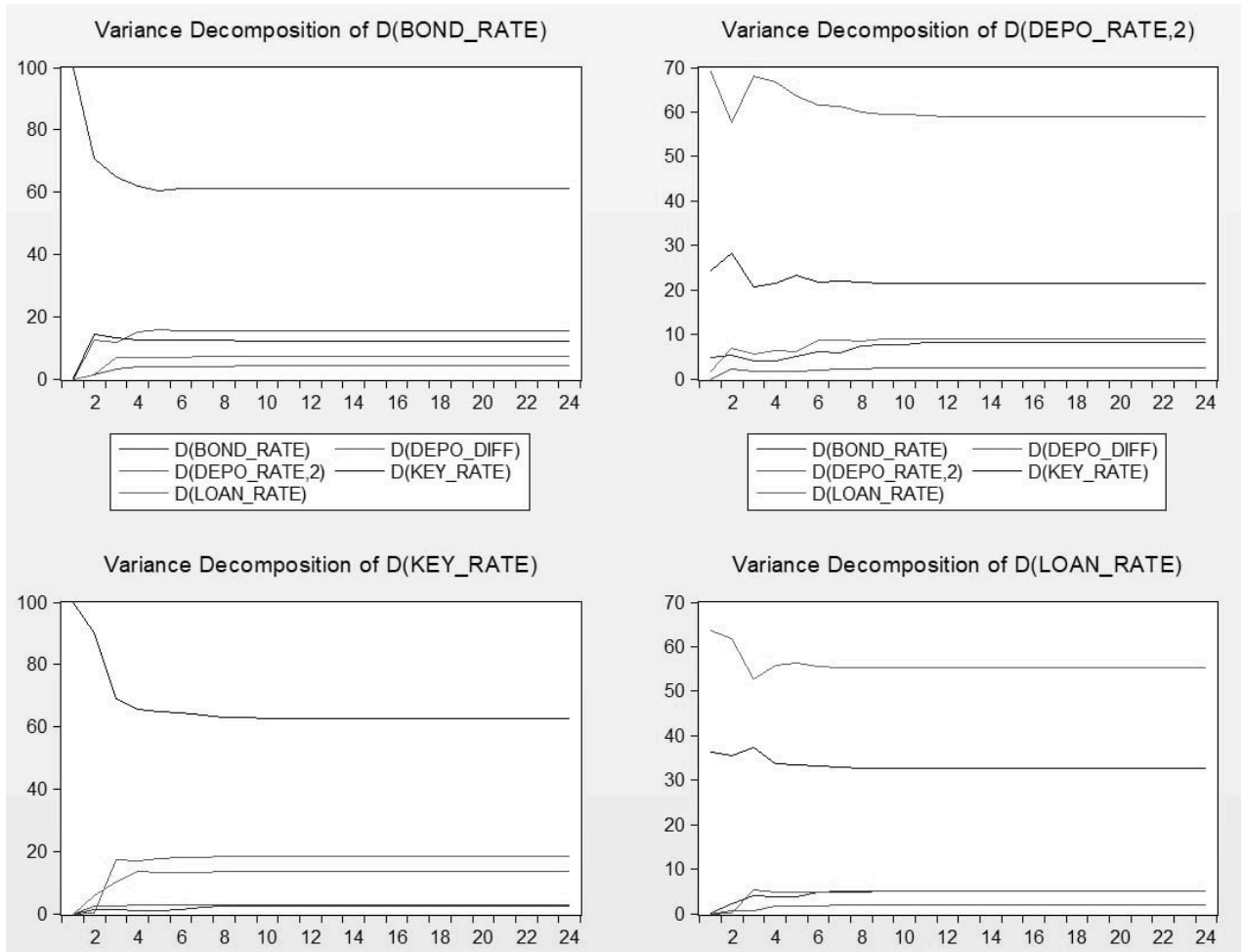


Figure 6.17. Decomposition of variance in market interest rates

Source: composed by authors based on the results, received in EViews 12

The transmission of shock from changes in financial conditions is almost entirely realized within 10-12 months. Overall, the analysis demonstrates the following interaction mechanism: when the central bank rate increases, the government immediately raises the profitability of government bonds (OVDP). However, afterward, this profitability may temporarily decrease to attract cheaper resources to the budget until market rates respond to the change in the central bank rate, and investors are willing to invest funds at current interest rates. However, within one or two quarters, interest rates in the financial market, including the profitability of government bonds, increase in response to the rise in the central bank rate.

The analysis indicates that the capital market, as part of the transmission mechanism, is not entirely efficient. This is because the issuer of bonds has the aim to reduce the debt burden and thus does not immediately fully transfer the effect of changes in the central bank rate to the yield of securities. Moreover, loan rates respond to changes in OVDP rates rather weak. There is also the presence of instruments like deposit certificates, whose yields are more closely linked to the central bank rate. Therefore, there is probability that these certificates contribute more to the increase in commercial bank rates than government bonds. Hence, to increase the attractiveness of OVDP, it would be better to link their yield more strongly to the central bank rate.

In this research various elements of the Ukrainian financial market were analyzed, including the central bank rate, rates for new loans, rates for government bonds (OVDP), foreign exchange risk, and rates for new deposits. A Vector Autoregressive Model (VAR) was used for analysis as it was considered the most suitable, as far as time series have the different integration orders. The findings revealed that the yield on bonds reacts moderately to changes in the policy rate, and loan rates are almost unaffected by changes in OVDP yields. This trend indicates an insufficient link of OVDP yields to the central bank rate, resulting in a delayed response in OVDP rate changes. The central bank rate influences deposit rates moderately, which, through the transmission mechanism, further restrain inflation.

The model results, specifically the weak impact of OVDP rates on loan rates, align with the fact that the banking system experiences excess liquidity. If the National Bank of Ukraine aims to increase the efficiency of the transmission mechanism, it's crucial to absorb this liquidity and promote the creation of the market with reliable borrowers where banks compete for clients. A vital element for establishing such a market is the protection of creditors' rights, which requires improvement through legislative and judicial efforts. In 2020, the NBU and IMF initiated discussions on the necessary infrastructure to safeguard creditors' rights, focusing on ideas like establishing a separate judicial institution or chamber. However, these ideas have not yet materialized.

Additionally, it's important to make OVDP more accessible to businesses and the public. This process takes time as the willingness to finance the government arises not only from the yield level of bonds but also from the trust in the government. Nevertheless, considering that the yield on OVDP is higher than that of deposits, this instrument could become quite competitive in the retail financial market.

6.4. Strategies for enhancing the management of Ukraine's public debt

In the first year of the war, a significant number of measures was already taken in the direction of fundraising, including external grant-based and concessional funding, expanding cooperation with the IMF, and with the governments of various countries.

It should be noted, that during the war, debt management had a different character. The emphasis shifted to the volume of financing rather than its terms because the country's survival depended on the amount of funding available. However we should remember, that the government debts should be repaid, and it is important the conditions of borrowings.

In this context, it is important to analyze how the debt policy aligns with the Medium-Term Strategy for Public Debt Management for 2021-2024, which was adopted before the full-scale war began. The primary objectives of the Strategy were the following: increasing the share of the government debt in the national currency; extending the average term to repayment and maintaining the smooth schedule of government debt repayment; attracting the long-term concessional financing; continuing the development of relationship with investors and further improvement of the debt management policy.

Increasing the share of debt in the national currency is crucial for minimizing the currency risk. Indeed, in 2021, this goal was pursued as the share of debt in the local currency increased from 35% in 2020 to 37%. However, the war made its changes, and due to limited financial resources in the domestic market, a larger

portion of funds was sourced externally, meaning they were acquired in foreign currency.

Thus, it can be noted the non-fulfillment of the first goal of the public debt management strategy till now. According to the Budget Law for 2023, external and internal borrowing amount at a ratio of 95% to 5%, indicating a further decline in the share of domestic currency in the debt structure. This trend is highly negative as it implies that in the event of hryvnia devaluation, both the debt volume and the debt burden would increase sharply. For instance, projecting a rise in the dollar exchange rate to 40 hryvnias per dollar by 2024 would increase the debt burden by 5 percentage points.

Following the IMF's requirements for EFF, maintaining a fixed exchange rate in the short term was optimal. However, the next step involves a gradual transition to a floating exchange rate regime and adopting a classical inflation targeting framework. As a result, the fixed exchange rate was changed to managed floating in October 2023. The reaction of the market and citizens was positive, and it was even observed some revaluation of the currency. But in the terms of high dependence on international financing and on the conditions and outcomes of war, the currency risk is high. In this context, it becomes important to attract more government borrowings in the national currency.

National Bank of Ukraine has already launched certain administrative incentives in the form of the possibility to form 50% of reserves using specific issuances of government bonds since January 2023. This has reflected in the amounts raised for the budget through placements of domestic government bonds in the primary market: in the fourth quarter of 2022, 52 billion UAH was raised, while in the first quarter of 2023, it increased twofold to 111 billion UAH. Certainly, another factor that boosted demand for government bonds was the increase in their yields: in the fourth quarter of 2022, the average yield was 16%, rising to 19% in the first quarter of 2023. In December 2023 the yields decreased to 16,5%-18,5% following the decrease of central bank rate.

Up until April, there was present a factor that somewhat restrained banks' demand for bonds. It was the availability of more lucrative deposit certificates with a

rate of 23%. However, currently, the National Bank has lowered the rate on standard overnight deposit certificates. Thus, the National Bank of Ukraine has the aim to stimulate an increase in deposit rates for the public. As for the reduction in the overnight certificate rates, this helps to make government bonds more competitive in the financial market. These actions had indeed bolstered banks' demand for government bonds.

Regarding the second goal of managing the government debt, extending the average maturity and ensuring a uniform repayment schedule, it has been successfully achieved. By the end of 2020, the average maturity was 8.07 years, while as of March 2023, it stands at 10.48 years. The primary extension of the average maturity occurred in 2022, due to the war, predominantly through the extension of external debt.

Because of the uncertainty regarding the duration of war and the post-war recovery period when the country won't have available funds to repay debts, attracting long-term financing became a necessary condition. Due to the high risks involved, the Ukrainian government indeed made efforts to attract long-term financing from international partners. However, compared to 2020, the payment schedule for the state debt has become less evenly.

Even more relevant is the path of restructuring the debt obligations, which has already been partially implemented and is planned to continue. External creditors need to understand that the capacity for servicing debt, both for the government and businesses, is limited. Hence, restructuring is more advantageous for all parties involved than insolvency and default.

The most crucial problem in the context of debt management remains its currency structure. During the war, the share of foreign currency debt increased, and further growth is anticipated in next periods. This increase creates currency risks that grow when transitioning to a floating exchange rate regime. To minimize these risks, it is necessary to attract more funding in the local currency on the domestic market. The primary targets should be commercial banks, as well as individuals and legal entities. The NBU is actively working towards stimulating commercial banks to invest in government bonds.

From a purely economic standpoint, post-war recovery can signify a return to pre-war levels of GDP and employment. It is worth considering post-war economic recovery as an achievement of socio-economic well-being, including food security, healthcare, housing, education, and a social security system for all citizens of the country. This involves developing an economic strategy with the aim to rebuild infrastructure, create jobs, open markets, run legal and regulatory reforms, establish the foundation for international trade and attracting investments.

Researchers note that financial assistance can be effective and crucial for post-conflict economic recovery. When properly managed, aid does not undermine growth or competitiveness; on the contrary, it can be a significant factor in sustaining a country's development and high-level growth. This requires external partners to provide timely and predictable aid disbursements, as well as expedited and deeper debt relief. Simultaneously, governments of countries in recovery periods should use the resources provided to restore and reform institutional capacities [44].

The significant impact of the Marshall Plan on Western Europe indicated the importance of targeted international aid for restoring production capacities and fostering stable economic growth. The assistance accounted for approximately 1% of the gross national product of the United States annually during the period from 1948 to 1952. The Marshall Plan aided in the restoration of production capacities in Western European countries, improved internal price stability.

According to the estimations, the recovery of economy after the Second World War was faster, than after the First World War. Recovery of production in Western Europe happened during the 3 years and export returned to pre-war levels in 4 years. At the same time, it is worth noting, that the level of consumption was much slower in recovery and showed the pre-war results only in 1950s and the per capita GDP achieved the pre-war levels only in the mid of 1950s.

Those countries, where the war did not take place, including USA, Canada, neutral European countries had rapid economic growth within two years after the Second World War [45].

Jacek Prokop and Eva Baranovska-Prokop have researched the impact of foreign borrowing on the example of Poland. Foreign borrowings are considered

beneficial for a country if they help to develop investments that generate more value than the overall debt incurred. The authors examined a simplified version of a macroeconomic model to analyze Poland's use of external borrowing in the 1970s, during the post-war recovery period of Central and Eastern Europe.

For the first time after World War II, Poland, the leading country in the socialist bloc, opened its doors to Western economies, increasing external trade and borrowing to finance the import of modern technologies and investments. The study's findings affirmed the position that using external sources to finance economic growth in Poland was quite effective. The impact of external loans on GDP was positive and exceeded the cost of the debt [46].

Another reason for the importance of post-war economic recovery is the reduction of the risk of repeating conflicts. Key factors directly increase this risk include low per capita income, weak economic growth, socio-economic inequality, lack of employment opportunities, and significant valuable natural resources.

Policies for economic recovery should aim at rapidly expanding employment, reducing social inequality where it threatens stability, and creating a stable fiscal foundation for the state.

John Eriksson, and other economists analyzed the World Bank's impact on post-conflict reconstruction in countries. This influence manifested in various forms, ranging from comprehensive packages of credit and non-credit services to more modest strategic support, and targeted focus on specific aspects of recovery, such as economic stabilization or transitioning to a market economy.

The projects of World Bank for post-conflict reconstruction typically encompassed all sectors of the economy. Out of the \$6.2 billion in loan volumes, the majority, 32.7 percent, was allocated to support so-called multi-sector projects. This included borrowings aimed at stabilizing the macroeconomic situation, loans for technical assistance, and overall reconstruction or emergency recovery projects, incorporating several economic and social components with the aim to provide rapid assistance for the most pressing needs. Out of nearly \$2 billion in multi-sector lending, more than half were loans for structural reform or budgetary support.

Multi-sector projects also included a demining project carried out in Bosnia and Herzegovina. Nearly 10 percent out of \$6.2 billion were allocated for funding agricultural projects, while 9 percent was designated for transportation projects (reconstruction of highways). The urban development sector received 8.5 percent of post-conflict reconstruction aid, with the largest of these loans of \$175 million was given for the reconstruction of Beirut.

The authors emphasize that a swift transition to macroeconomic stability in post-conflict conditions is crucial for economic recovery. Stability in this case was determined by the current level of inflation. The assistance of World Bank in rebuilding physical infrastructure, including political and institutional aspects, was the strongest area of activity, while fiscal and other structural economic reforms did not have significant positive impacts as they were untimely. Each case was considered individually, and loan programs were developed considering the scale of destruction and the required funding [47].

War deeply impacts economic development, including significant damage in infrastructure, loss of human capital, investments, resources, and social dynamics. Countries without war typically have more favorable conditions for economic development, benefitting from the absence of the mentioned problems. However, with a series of measures and international support, post-war economies can recover and eventually achieve sustainable development. Post-war economies often receive significant international aid and cooperation in the form of humanitarian assistance, funds for reconstruction, and technical support. International organizations, donor countries, and non-governmental organizations play a crucial role in supporting post-war recovery and development

The proposed measures can be important for the economic development in the peaceful times and in the post-war period. With the aim of economic development, the following measures should be taken:

- Strengthening political stability through reforming and fortifying the rule of law, ensuring the independence of the judicial system, and reducing corruption. Since political stability is a fundamental requirement for economic growth, the Ukrainian government should prioritize this step. It will contribute to creating a more

transparent and secure environment for businesses, investors, and the public. During a state of war, discussing the stability of the political situation might be challenging, but it doesn't imply delaying legal institution reform in Ukraine.

- Encouraging foreign investment can provide access to new capital, technologies, and entry into new markets, subsequently promoting the development of the Ukrainian economy. The Ukrainian government should focus on creating a business-friendly environment that encourages foreign investment by simplifying legislation, reducing taxes, and providing incentives for foreign investors.

In July 2022, the platform "Advantage Ukraine" was introduced, which proposed an investment range including various sectors: defense, metallurgy, industrial complex, pharmaceuticals, logistics and infrastructure, energy, natural resources, furniture and wood processing, innovations and technologies, etc. The overall investment potential amounts to over 2,500 potential projects for implementation. The Ukrainian government promises to incentivize investments by returning 30% of investments in CAPEX, abolishing value-added tax and duties on imported equipment, granting a 10-year corporate income tax exemption, as well as implementing a special taxation system for IT businesses [48, 49].

1. Support of small and medium-sized enterprises (SMEs) is crucial for creating new jobs and stimulating economic growth. Ukrainian government should prioritize policies and incentives that encourage the development of SMEs. Such policies may include simplifying regulations, reducing bureaucracy, and providing financial and technical assistance.

In 2020, the Ukrainian government introduced a support program for small and medium-sized enterprises in response to the Covid-19 pandemic and its consequences. The reform aimed to ensure access to financing, markets, and infrastructure development for such businesses. One of the programs included in the initiative was the provision of loans at interest rates of 5-7-9% annually, which were optimized following the introduction of martial law [50, 51].

In 2021, the Ministry of Digital Transformation developed the platform "Diya.Business," which joined projects aimed at supporting entrepreneurs from the arising of an idea to the management of existing businesses. Currently, the online

portal also has a dedicated section specifically focused on supporting businesses during the war [51].

2. Supporting the diversification of export is crucial because Ukraine's economy traditionally relies on the export of raw materials such as grains or metals, which do not bring significant added value. This diversification could contribute to the growth of the gross domestic product and accelerate economic growth. According to the World Bank data as of 2021, Ukraine ranked 52nd out of 168 countries in terms of value-added industry [52].

Ukraine has traditionally been considered a raw materials supplier. However, to realize its export potential, the country faces several obstacles: lack of investment in a favorable business environment; structural issues, such as over-reliance on raw material exports and industries with low added value; trade barriers and logistical challenges that have intensified since February 24, 2022.

Ukraine should implement export promotion strategies to identify and support promising sectors with export potential. Emphasizing on research and development, technology transfer, and innovation will increase productivity and competitiveness. Simplifying trade procedures, implementing electronic customs systems, reducing administrative burdens, and improving border management will increase trade flows, reduce costs, and facilitate business operations.

There is high potential and need for the development of defense industry, aerospace industry, chemical, pharmaceutical, reprocessing food industry, clothing. Military needs stimulate the development of defense industry, but in the current conditions, further fast development is crucial. In the time of war there is an increase of demand on military production, clothing, pharmaceutical products and it stimulates the development of these branches, as we already have observed. Agricultural sector can be an important source of growth of food industry. As far as many enterprises were incurred or destroyed imported products have flown the market. But support of national enterprises is crucial and it will allow to propose to the cheaper products, than foreign one.

Big potential has the IT industry, which is the current leader of the export of services. Global changes and national risks have influenced this sector in 2023, but it

demonstrated rapid growth before the war and even in 2022. IT market has a big supply of skilled labor, who is competitive on the global and regional markets.

In the current conditions an important solution for economic growth can be also stimulation of business activity of small and medium-sized enterprises, as they are more flexible, can adapt faster to external conditions and change location.

1. Development of human capital through investments in education and healthcare can contribute to long-term economic growth by enhancing labor productivity. As of December 15, 2023, over 6 million refugees from Ukraine had been registered for temporary protection in Europe, according to the United Nations High Commissioner for Refugees [53]. The majority of those who have fled are women of working age and children. A recent UNHCR survey indicated that about 40% of Ukrainian refugees were either employed or self-employed [54]. Many Ukrainian refugees are likely to return to Ukraine after the war ends according to polls. The high level of uncertainty surrounding the future course of the conflict complicates assessing and quantifying the number of refugees who will definitively return and those who will remain in the countries where they currently reside.

The Ukrainian government should prioritize the return of its citizens to the country by enhancing access to quality education, healthcare, and professional training. It should also create programs for accessible housing for those who have lost their homes and generate new job opportunities to overcome unemployment.

2. Improving infrastructure will help create the foundation for economic growth, foster sustainable development, and enhance the country's global competitiveness. The Ukrainian government should focus on developing new infrastructure and supporting existing infrastructure by studying the experiences of European countries. This includes investing in transportation, digital infrastructure, renewable energy infrastructure, and establishing public-private partnerships to finance infrastructure development.

While aiming to enhance Ukraine's infrastructure, several issues need resolution. Among them are differences between Ukrainian railways and in the European Union, the ongoing conflict within Ukraine's territory causing continual

damage to the country's infrastructure, and the need for revitalization and modernization of routes.

3. Digitalization in Ukraine has big potential for the economic development and improving governance. Continuing to invest in digital infrastructure, fostering technical education and promoting entrepreneurship, Ukraine can position itself as regional digital leader. Ukraine uses technical education and IT talents for digitalization, which can stimulate economic growth, increases effectiveness and develops innovations during the war. It has been made a great progress in digitalization of state services, implementation of tax declarations, registration of business and public procurement. Digital platform “Diia” is a centralized platform for electronic services, which has the aim to facilitate interaction between citizen, business and government [55].

4. Ukrainian economy was highly affected by its dependence from the import of energy resources (for example, of import of gas from Russia), it has negative influence, especially in 2022. Expanding renewable energy production can strengthen energy security and foster Ukrainian energy integration with the European Union. Since the war continues international partners and Ukrainian leaders can define the projects, which will develop the energy grid through the expansion of storage capacity and joining with the system of European Union. The repairment, which are made for solving the problems of current destruction of Ukrainian electric grids, can be the basis for long-term reconstruction and development of energy sector. Coordination of donors and experience of countries and international organizations will be very important for the renewable energy sector of Ukraine [56].

Monitoring and evaluation of the progress should be crucial, as far as corruption is one of the important concerns for the society and international partners [57]. During the last years there were taken different measures to fight corruption. The special legislation regarding increasing of anti-corruption measures was adopted, there were created specialized anti-corruption institutions and increased the independence of judicial system. National anti-corruption Bureau and Specialized Anti-Corruption Prosecutor's Office are the key institutions, responsible for the investigation and prosecuting corruption cases. In 2016 the platform of electronic

state procurement Prozorro was launched, the main aim of the platform has become the decrease of corruption and simplify the state procurement. The system has shown its effectiveness in wide usage [58]. In 2015 Cabinet of Ministers of Ukraine has approved the creation of the National Agency for Prevention of Corruption, which is responsible for ensuring integrity, developing regulatory acts on the anti-corruption policy, and also coordinates international cooperation in forming and realization of anti-corruption policy [59, 60]. Also, Ukraine has asked for international assistance and cooperation in fighting corruption. Partnership with such organizations and International Monetary Fund and European Union provides support and governance in the initiatives to fight the corruption. Monitoring and evaluation of program implementation effectiveness are crucial for achieving the defined goals in development and reconstruction. It is important, that in the current conditions' society has a strong desire to changes.

There are numerous effective ways to utilize government borrowings, particularly external borrowings, for post-war reconstruction. These may include the rebuilding of infrastructure, implementation of social projects and institutional reforms, development and execution of demining projects, and the reconstruction of housing and urban areas. Emphasis should also be placed on developing local capacities and fostering cooperation with local partners while reducing bureaucratic procedures.

It is essential to understand that post-war reconstruction demands substantial time, resources, and effort, requiring the combined efforts of both the government and society, as well as support from international partners. Grants and external government borrowings can play a significant role in post-war economic development by providing necessary resources for reconstruction and stimulating economic growth. However, it is equally important to manage the risks associated with government debt, including currency risks and the potential for an unsustainable debt burden. Strategic investment in infrastructure, businesses, and citizens is essential for fostering development and rebuilding efforts.

CONCLUSIONS TO CHAPTER 6

Effective usage of borrowed resources can become a factor in economic growth, while unwarranted increases in debt levels may have a destabilizing effect on the economy and create risks to a country's economic security. In the absence of a comprehensive system for regulating the formation, repayment, and servicing of public debt at the legislative level, and without clearly defined directions of debt policy, recent years in Ukraine have seen a rapid increase in the volumes of gross public debt. Consequently, this situation poses a threat to the economic and financial security of our country. The volumes of public borrowings, their dynamics, and structure directly or indirectly influence all spheres of the state's financial and economic activities, which is why statistical analysis of the structure and volumes of the country's debt burden acquires special importance in the process of managing financial security. One of the main summarizing indicators of the state of indebtedness is the ratio of the total volume of public debt to Gross Domestic Product (GDP). This ratio enables an assessment of the level of debt burden on the state's economy and also reflects its ability to settle with creditors based on its economic potential.

The main areas of effective management of the public debt are determined in order to reduce financial risks and increase the stability of public finances. In particular, diversification of funding sources and attracting funds from various sources, including international financial markets and bilateral loans, improving the efficiency of domestic debt and developing the domestic financial market for attracting funds at the domestic level are important. It is also necessary to increase transparency and accountability in debt management to increase the confidence of investors and the public.

It is obvious, that in conditions of rapid increase of government indebtedness after the full-scale invasion in 2022 effective debt management in future should include the debt restructuring. At the same time it is worth mentioning that control over use of borrowed resources is crucial.

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CONCLUSIONS

In light of the profound transformations occurring in the Ukrainian economy, this study of financial policy, the analysis of individual instruments, and the effectiveness of their implementation become particularly relevant. The thorough analysis and systematic use of econometric tools presented in this work define the key aspects and trends of contemporary state regulation of socio-economic processes. Therefore, the main directions and prospects for forming an effective financial policy strategy aimed at achieving macroeconomic stability and sustainable economic growth are outlined. Below are conclusions that distinguish the main vectors of this study and define strategic recommendations for the development of Ukraine's financial policy.

The consideration and implementation of a balanced financial policy in Ukraine are crucial for achieving macroeconomic stability and sustainable economic growth. The integration of econometric modeling with practical aspects of the decision-making process should aid in forming effective strategies that meet the needs of the modern Ukrainian economy. Ensuring stability, transparency, and accountability in financial policy implementation is key to achieving macroeconomic stability and sustainable economic development.

The proposed study examines the theoretical and methodological foundations of macroeconomic stability and its vital component – financial stability. It lists the endogenous and exogenous factors influencing financial stability, defines parameters of macroeconomic and macro-financial stability, and substantiates guidelines for effective management of the national economy. It also considers the activities of the Financial Stability Council of Ukraine, the "Strategy for the Development of the Financial Sector of Ukraine," and the proposed "Post-War Macroeconomic Architecture for Ukraine".

It is determined that monetary and fiscal policy are important instruments of state regulation of socio-economic processes. However, in conditions of macroeconomic instability, the coordination and consistency of these financial policy directions become particularly important. Monetary policy, focused on controlling the

money supply and interest rates, and fiscal policy, affecting government expenditures and tax rates, must interact to ensure stable economic growth. Harmonizing these policies helps avoid economic imbalances, reduces inflation and unemployment, and promotes efficient resource use. Such a coordinated approach helps achieve common goals and stimulates economic recovery and development.

It is substantiated that the financial policies of the state are crucial for fostering sustainable development. These policies have a significant impact on various aspects such as economic stability, social protection, investment in environmentally sustainable technologies, and other vital components of sustainability. Through fiscal policy, the government regulates expenditures and revenues to finance programs that promote sustainable development, such as ensuring quality education, supporting energy efficiency, and developing infrastructure. Proper management of public finances is key to ensuring efficient resource allocation, contributing to sustainable economic growth and social well-being.

The National Bank of Ukraine and the National Commission on Securities and Stock Market are actively working on the introduction of principles of sustainable development and sustainable financing in Ukraine. These institutions are focused on integrating environmental, social, and governance criteria into financial services and corporate governance. The NBU presented a Sustainable Financing Development Policy up to 2025, which includes guiding principles and an action plan, while the National Commission on Securities and Stock Market developed an ESG supplement to the Corporate Governance Code. Thus, the financial market regulators of Ukraine are actively implementing the best international ESG support practices into their activities and creating a new institutional environment for all market participants to ensure sustainable economic growth of Ukraine.

It is determined that under favorable and stable macroeconomic conditions, a gradual liberalization of financial markets and a return to an inflation targeting regime with a floating exchange rate are anticipated. The necessity of continuing technological development of financial services as a prerequisite for further expansion of financial inclusion and ensuring cybersecurity is also substantiated. Important measures also include the restoration of financial infrastructure in de-

occupied territories, ensuring accessibility and inclusiveness of the financial sector. Additionally, for Ukraine, the development of financial markets is a crucial task, as they play a significant role in determining the level of interest rates and credit conditions, which affects the size of investments, expenditures of enterprises and citizens, and the overall economic development of the country. The development of financial markets entails creating effective financial instruments, such as stocks, bonds, derivatives, and others, allowing for the attraction of more capital and creating favorable conditions for doing business in Ukraine. Furthermore, the creation of financial instruments will help reduce risk for investors and enable the attraction of funds for long-term investments in Ukraine. Directions for the development of financial markets include the advancement of the banking system, securities market, stock market, insurance market, pension market, and derivatives market. Successful development of financial markets in Ukraine can enhance the effectiveness of monetary policy and positively impact the development of the real sector of the economy.

Moreover, the analysis of the impact of inflationary expectations underscores the importance of the National Bank of Ukraine's communication with economic entities at various levels. The regulator must prioritize communication as a critical aspect of its operations. Effective communication with diverse audiences, including the public, financial services consumers, academic community, media, economic and financial organizations, domestic and international experts, as well as international organizations and other external partners, is essential for the NBU to attain success. The importance of not only ensuring price stability during periods of macroeconomic destabilization but also supporting the uninterrupted functioning of the financial system and the economy as a whole is substantiated. At the same time, the necessity of returning to the fundamental postulates of inflation targeting with a floating exchange rate and the absence of fiscal dominance by the government in the post-war period is proven. Meanwhile, important monetary and institutional measures remain the support the stability of the banking system, reducing risks associated with an increase in the number of insolvent banks, decreasing the level of shadow economy,

and promoting the stimulation of the economy, particularly through the development of entrepreneurship and innovative sectors.

It has been determined that trust and dialogue with the regulator play a significant role in shaping inflationary expectations. Accordingly, for the stabilization of these processes, communication from the National Bank of Ukraine with various target audiences is important. Thus, the NBU's communication policy is a fundamental element of macroeconomic management and stability, contributing to ensuring transparency, predictability, and effectiveness of monetary policy.

The National Bank of Ukraine conducts a very effective monetary and macroprudential policy that allows for the management of dollarization levels. The experience of other countries shows that macroeconomic stability must be a key goal, without which any additional measures aimed at de-dollarization will not be fully realized. Deepening the financial market should be a primary strategy for de-dollarizing the economy. Facilitating access to and promoting hryvnia instruments, particularly hryvnia deposits and bonds, should be a priority for the NBU and the Ministry of Finance. Ensuring macroeconomic stability will maintain dollarization at a relatively low level, but it is necessary to anticipate reducing incentives for dollarization for banks, the population, and businesses.

Based on the conducted analysis and modeling, the influence of currency policy on the country's trade competitiveness has been systematized. The necessity for Ukraine to return to a floating currency exchange rate after the end of the war is substantiated. At the beginning of the full-scale invasion in February 2022, the NBU was compelled to fix the exchange rate to avoid panic and support the country's economy and financial activity. Such actions yielded positive results in the initial months of the war. However, in the long-term perspective, fixing the exchange rate could lead to a deepening of the country's economic problems. A floating national currency exchange rate more flexibly responds to market conditions, which can contribute to enhancing the competitiveness of exports and attracting foreign investments.

It is argued that resuming the process of medium-term budget planning immediately after the war is essential. This planning serves as a guarantee for the

stable development of the budgetary system by identifying priority tasks and determining the required funds for their implementation. A clear understanding of the direction of development of the budgetary system prevents the misuse of funds and the diversion of resources from priority programs. Medium-term budget planning will provide an opportunity to create a long-term development strategy for the economy, which will determine the model of economic development, the resources necessary for this, and reforms. Consequently, it is worth forming a budget strategy that will balance the budget's income and expenses for several years, with mandatory reference to the planned reforms. Such a strategy should include a list of reforms, their priorities, the cost of development and implementation, and the timing of implementation.

After the end of the war, it is recommended that economic policy be reoriented towards actively engaging investors, fostering export-oriented production, and developing strategically significant competitive industries. Additionally, it is crucial to restore budgetary reforms, including decentralization, medium-term planning, program-targeted methods, expenditure reviews, and the implementation of digital services and fiscal rules. Efforts should also be made to reduce the debt burden while providing social protection to populations affected by the conflict. In the post-war period, government investment in infrastructure and public services will serve as a catalyst for economic activities, job creation, and sustained economic growth.

Determining the main directions for effective management of public debt is vital for reducing financial risks and increasing the stability of state finances. Particularly important are diversifying funding sources and attracting funds from various sources, including international financial markets and bilateral loans, increasing the efficiency of domestic debt, and developing the domestic financial market to attract funds at the domestic level. Additionally, it's crucial to enhance transparency and accountability in debt management to build trust among investors and the public.

The National Bank of Ukraine and the National Securities and Stock Market Commission are actively working on implementing principles of sustainable development and sustainable financing in Ukraine. These institutions are focused on

integrating environmental, social, and governance (ESG) criteria into financial services and corporate governance. The National Bank of Ukraine has presented the Sustainable Finance Development Policy up to 2025, which includes guiding principles and an action plan, while the National Securities and Stock Market Commission has developed an ESG appendix to the Corporate Governance Code. Consequently, Ukraine's financial market regulators are actively incorporating best international practices in support of ESG into their operations and creating a new institutional environment for all market participants to ensure sustainable economic growth in Ukraine.

Ensuring sustainable economic development requires forming a comprehensive approach to financial policy, aimed at achieving a balance between economic growth, social justice, and ecological sustainability. State regulation in Ukraine in the context of sustainable development requires a system of measures for stabilizing the macroeconomic environment, implementing structural reforms, stimulating investment, developing financial markets, and actively supporting small and medium-sized enterprises. The realization of these directions requires coordinated efforts of the government, private sector, and international partners to achieve common long-term goals.

Thus, ensuring Ukraine's economic recovery and further sustainable growth is determined by the effectiveness of the use of appropriate fiscal and monetary instruments, the development of the national financial infrastructure, the corresponding institutional environment, proper performance of the financial system in redistributing financial resources among economic entities, and the financial system's resilience to external and internal unpredictable and adverse events.

Appendix A

Detailed information about variable models

Variable code	Name	Units	Source
<i>Endogenous variables</i>			
CPI	Consumer price index, to December of previous year	%	NBU
ER_MARKET	Exchange rate UAH to USD on the market	UAH/USD	NBU
KEY_R	Policy rate of NBU	%	NBU
DD	A fraction of deposits of residents in foreign currency		Own calculations based on NBU
LD	A fraction of loans of residents in foreign currency		Own calculations based on NBU
<i>Exogenous variables</i>			
PCPI	Weighted CPI of countries main trade partners: China, Poland, Turkey, Spain, Italy, Netherlands, Egypt, India, Germany, Romania, the USA, Slovakia, Hungary, Austria, Chzech Republic	%	inflation.eu, Trading Economics
INR_RESERV	International reserves	mln USD	NBU, ARIMA(5,1,6)
ER_OFF	Official exchange rate of UAH to USD	UAH/USD	NBU
DEBT_TO_GDP	Government debt to real GDP		NBU, Ministry of Finance, ARIMA(4,1,4)
NX	Net export	mln USD	NBU
GDP_GAP	GDP gap		Kalman filter based on NBU data
CPI_TARGET	Inflation target	%	NBU
NR	Neutral real discount rate	%	NBU, ARIMA(7,1,7)
DUMMY1	Generated binary variable, where 1 - absolute change of policy rate ≥ 0.19 , and 0 - absolute change of policy rate < 0.19		Own estimations
DUMMY2	Generated binary variable, where 1 - absolute change of exchange rate ≥ 0.06 , and 0 - absolute change of exchange rate < 0.06		Own estimations
CREDIT_TO_BUSINESS	Loans to the corporate sector	mln UAH	NBU, ARIMA (4,1,7)
DEPOSIT_RATE_DIFFERENTIAL	Spread between deposit rates in UAH and USD	%	NBU, ARIMA(1,1,6) for FX deposit rates, ARIMA(7,1,6) for hryvnia deposit rates
ER_MARKET_VOL	Volatility of exchange rate of UAH to USD		GARCH(1,1)
CPI_MARKET_VOL	Volatility of consumer price index		GARCH(1,1)

Appendix B

Verification of the system of simulative equations

Table B.1. The two-stage method of least squares

System: SSE8
 Estimation Method: Two-Stage Least Squares
 Date: 03/19/23 Time: 17:31
 Sample: 2015Q4 2022Q2
 Included observations: 27
 Total system (balanced) observations 135

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-4.154091	0.970271	-4.281372	0.0000
C(2)	-0.815918	0.148122	-5.508404	0.0000
C(3)	92.60416	3.850814	24.04795	0.0000
C(4)	1.847918	0.178898	10.32947	0.0000
C(5)	0.204946	0.038692	5.296921	0.0000
C(33)	-8.94E-06	0.000204	-0.043894	0.9651
C(6)	-0.234080	25.47318	-0.009189	0.9927
C(7)	-0.015231	0.331898	-0.045889	0.9635
C(8)	-0.007201	0.288353	-0.024974	0.9801
C(9)	0.802201	7.218682	0.111128	0.9117
C(10)	0.074020	1.067584	0.069334	0.9449
C(11)	0.160934	1.417627	0.113524	0.9098
C(12)	2.340948	0.869386	2.692645	0.0083
C(13)	0.767366	0.061219	12.53468	0.0000
C(14)	-3.702291	2.399116	-1.543190	0.1259
C(15)	0.138309	0.049480	2.795240	0.0062
C(16)	3.385150	0.895644	3.779570	0.0003
C(17)	0.408324	0.335569	1.216809	0.2265
C(18)	-0.844149	0.298577	-2.827246	0.0057
C(19)	-2.634852	101.1690	-0.026044	0.9793
C(20)	0.633054	11.38985	0.055580	0.9558
C(21)	0.045851	6.775272	0.006767	0.9946
C(22)	0.000511	0.020767	0.024603	0.9804
C(23)	9.86E-05	0.004287	0.023003	0.9817
C(24)	0.202278	7.617781	0.026553	0.9789
C(25)	0.003259	0.141103	0.023098	0.9816
C(26)	-0.112654	3.649669	-0.030867	0.9754
C(27)	0.787783	14.56185	0.054099	0.9570
C(28)	0.445954	18.63743	0.023928	0.9810
C(29)	0.009617	8.084845	0.001190	0.9991
C(30)	-7.62E-05	0.006615	-0.011515	0.9908
C(31)	0.000732	0.038783	0.018874	0.9850
C(32)	0.002219	0.136250	0.016288	0.9870
Determinant residual covariance		7.19E-11		

Source: calculated by the authors in EViews 12

Table B.2. Three-stage method of least squares

System: SSE8

Estimation Method: Three-Stage Least Squares

Date: 03/19/23 Time: 17:33

Sample: 2015Q4 2022Q2

Included observations: 27

Total system (balanced) observations 135

Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-4.165846	1.514289	-2.751024	0.0070
C(2)	-0.904671	0.227588	-3.975040	0.0001
C(3)	91.21181	6.039389	15.10282	0.0000
C(4)	1.826626	0.280003	6.523603	0.0000
C(5)	0.216834	0.059858	3.622486	0.0005
C(33)	-8.05E-06	2.88E-06	-2.794303	0.0062
C(6)	-0.193996	0.367475	-0.527916	0.5987
C(7)	-0.016384	0.004769	-3.435629	0.0009
C(8)	-0.009309	0.004077	-2.283167	0.0245
C(9)	0.780609	0.103642	7.531809	0.0000
C(10)	0.077316	0.015503	4.987151	0.0000
C(11)	0.158378	0.020542	7.710105	0.0000
C(12)	2.156365	0.929662	2.319515	0.0224
C(13)	0.784688	0.064967	12.07834	0.0000
C(14)	-4.270203	2.520206	-1.694386	0.0932
C(15)	0.164261	0.052750	3.113972	0.0024
C(16)	3.084925	0.943777	3.268703	0.0015
C(17)	0.477325	0.353069	1.351932	0.1794
C(18)	-0.803648	0.314396	-2.556165	0.0121
C(19)	-2.979338	0.771512	-3.861686	0.0002
C(20)	0.633471	0.086963	7.284347	0.0000
C(21)	0.075885	0.052339	1.449866	0.1502
C(22)	0.000492	0.000158	3.119646	0.0024
C(23)	8.97E-05	3.27E-05	2.739415	0.0073
C(24)	0.227553	0.058089	3.917305	0.0002
C(25)	0.003396	0.001080	3.145266	0.0022
C(26)	-0.119471	0.019980	-5.979550	0.0000
C(27)	0.748079	0.078952	9.475118	0.0000
C(28)	0.499404	0.101194	4.935099	0.0000
C(29)	-0.014925	0.044350	-0.336518	0.7372
C(30)	-6.95E-05	3.59E-05	-1.932065	0.0561
C(31)	0.000812	0.000213	3.817736	0.0002
C(32)	0.002510	0.000741	3.386772	0.0010
Determinant residual covariance		5.95E-11		

Source: calculated by the authors in EViews 12

Table B.3. Portmanteau systematic residual tests for autocorrelation

System Residual Portmanteau Tests for Autocorrelations
 Null Hypothesis: no residual autocorrelations up to lag h
 Date: 03/19/23 Time: 17:33
 Sample: 2015Q4 2022Q2
 Included observations: 27

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	40.25742	0.0274	41.80578	0.0189	25
2	61.08003	0.1355	64.29421	0.0842	50
3	89.50491	0.1212	96.27220	0.0496	75
4	119.4984	0.0894	131.4820	0.0190	100
5	141.7683	0.1450	158.8132	0.0221	125
6	166.5389	0.1685	190.6611	0.0139	150
7	188.4166	0.2312	220.1960	0.0116	175
8	205.3860	0.3820	244.3104	0.0177	200
9	222.1669	0.5409	269.4817	0.0226	225
10	237.2407	0.7091	293.4225	0.0308	250
11	252.5445	0.8305	319.2476	0.0342	275
12	264.7845	0.9293	341.2797	0.0504	300

*The test is valid only for lags larger than the System lag order.

df is degrees of freedom for (approximate) chi-square distribution

*df and Prob. may not be valid for models with lagged endogenous ...

Source: calculated by the authors in EViews 12

Appendix C

System Dynamics model of Banking Sector and Monetary Policy

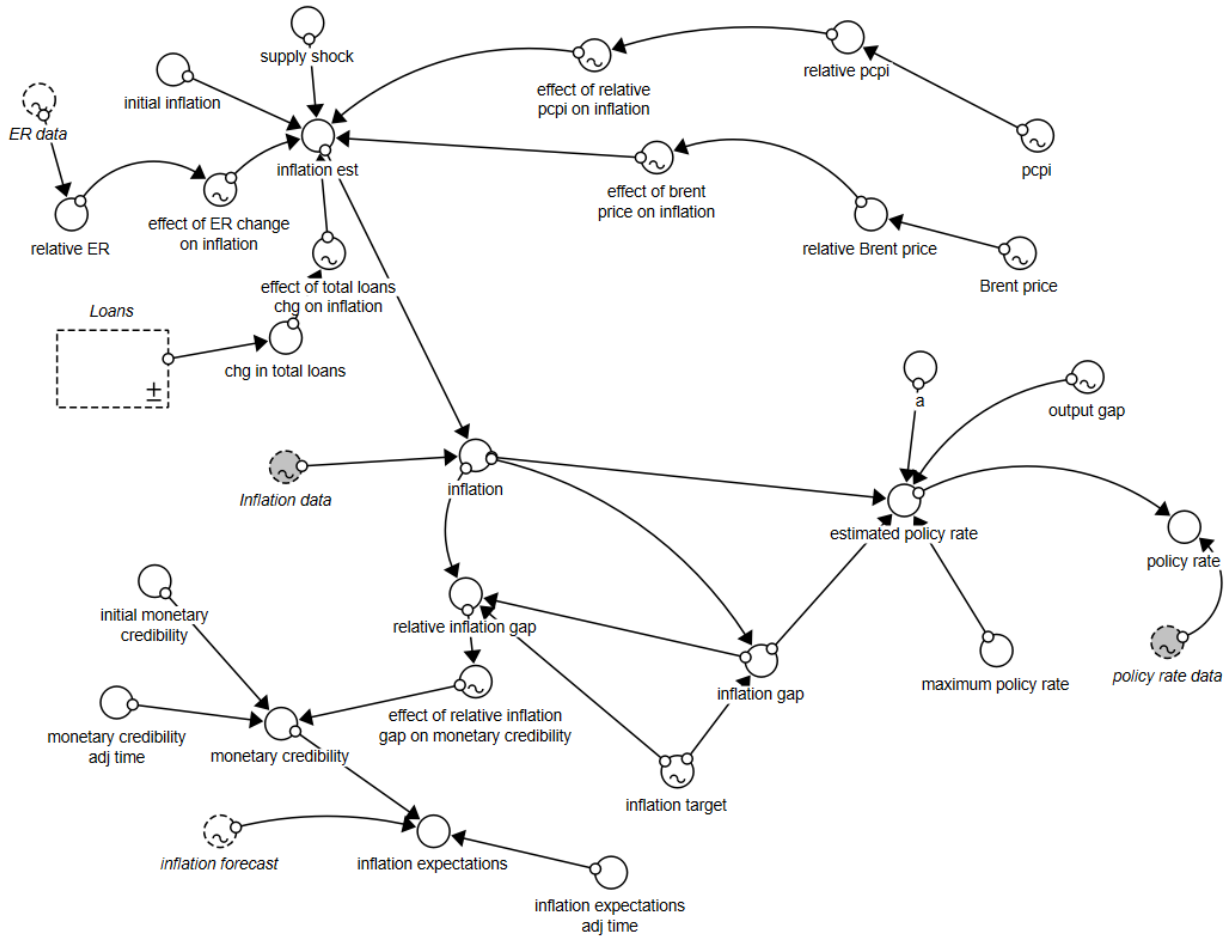


Figure C. 1. Monetary Policy module

Source: developed by author in Stella Architect

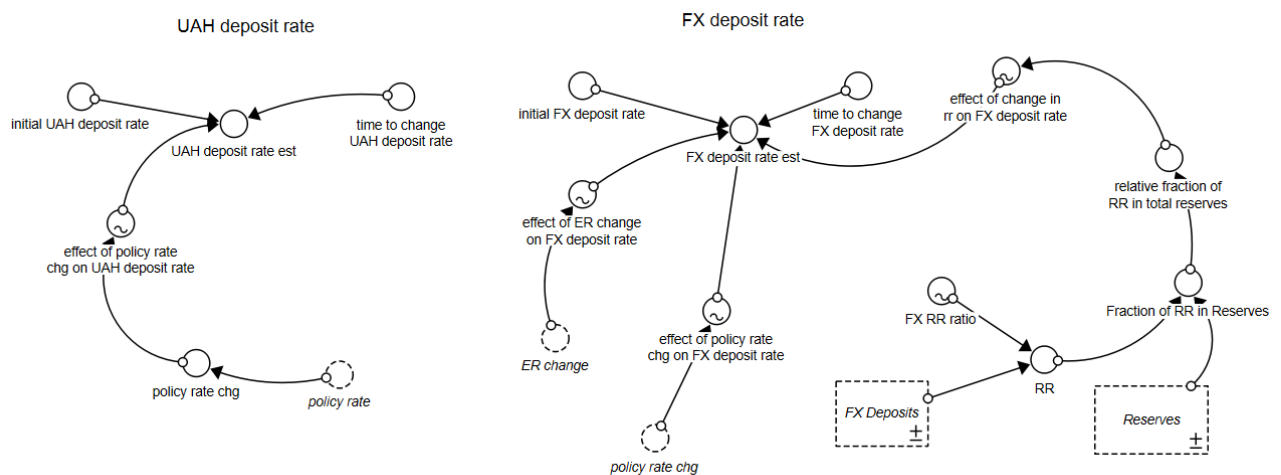


Figure C. 2. Deposit rates module

Source: developed by author in Stella Architect

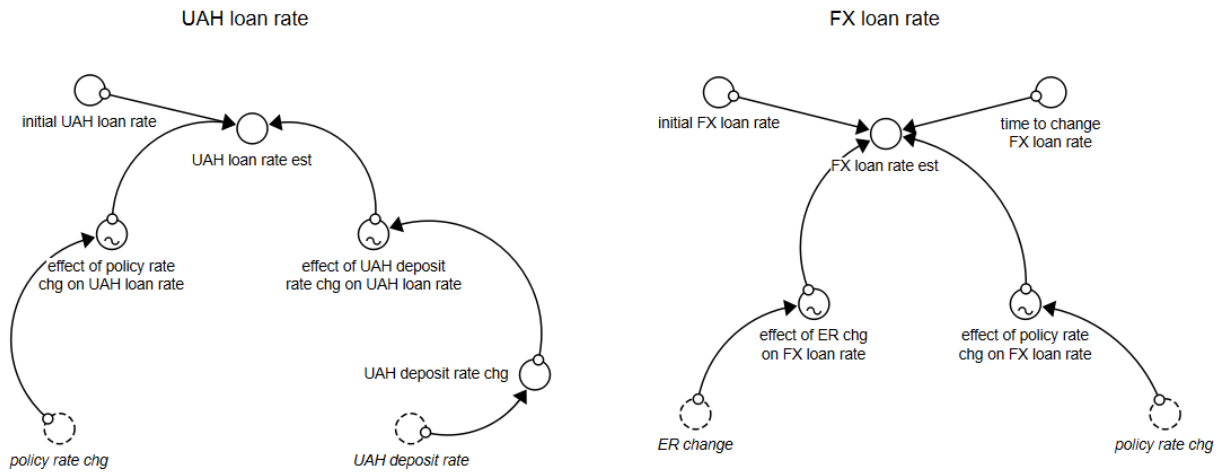


Figure C. 3. Loan rates module

Source: developed by author in Stella Architect

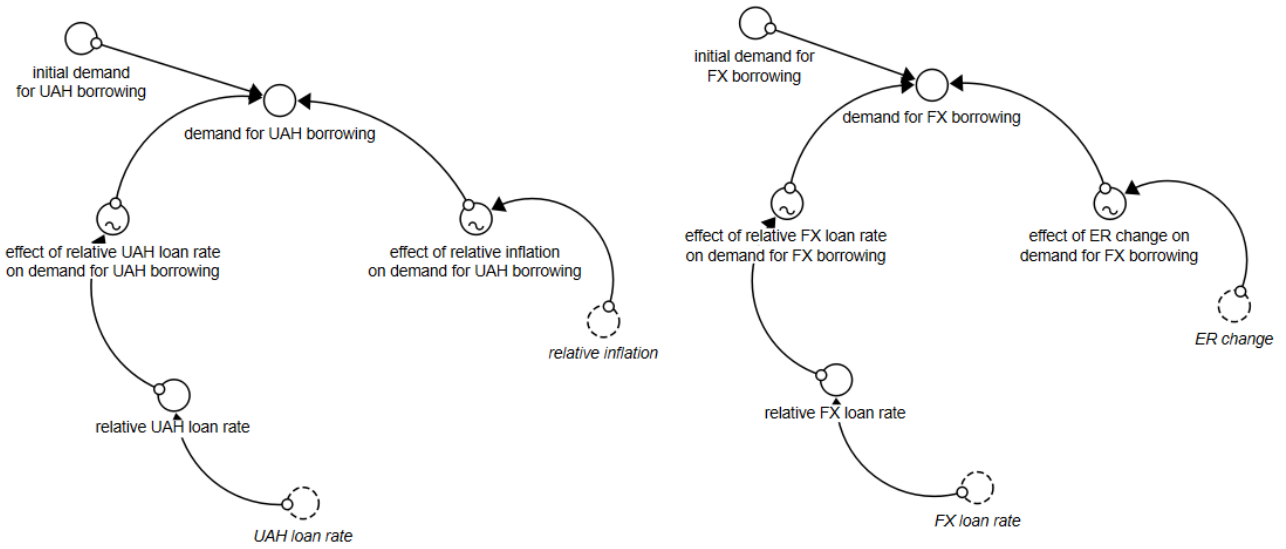


Figure C. 4. Customers demand for loans module

Source: developed by author in Stella Architect

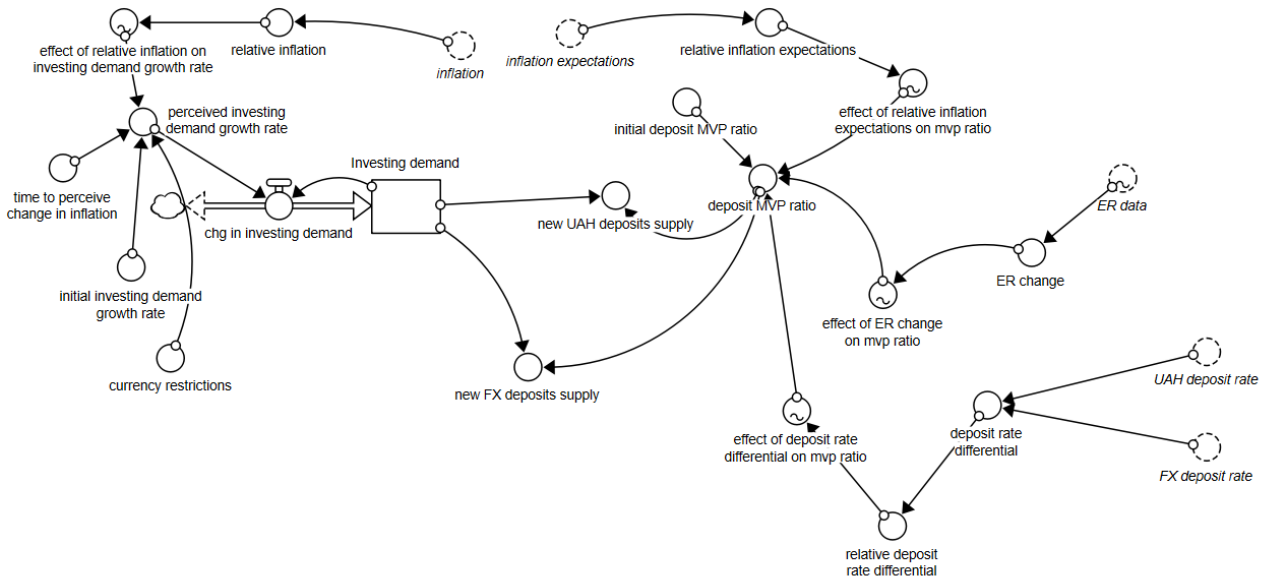


Figure C. 5. Customers demand for deposits module

Source: developed by author in Stella Architect

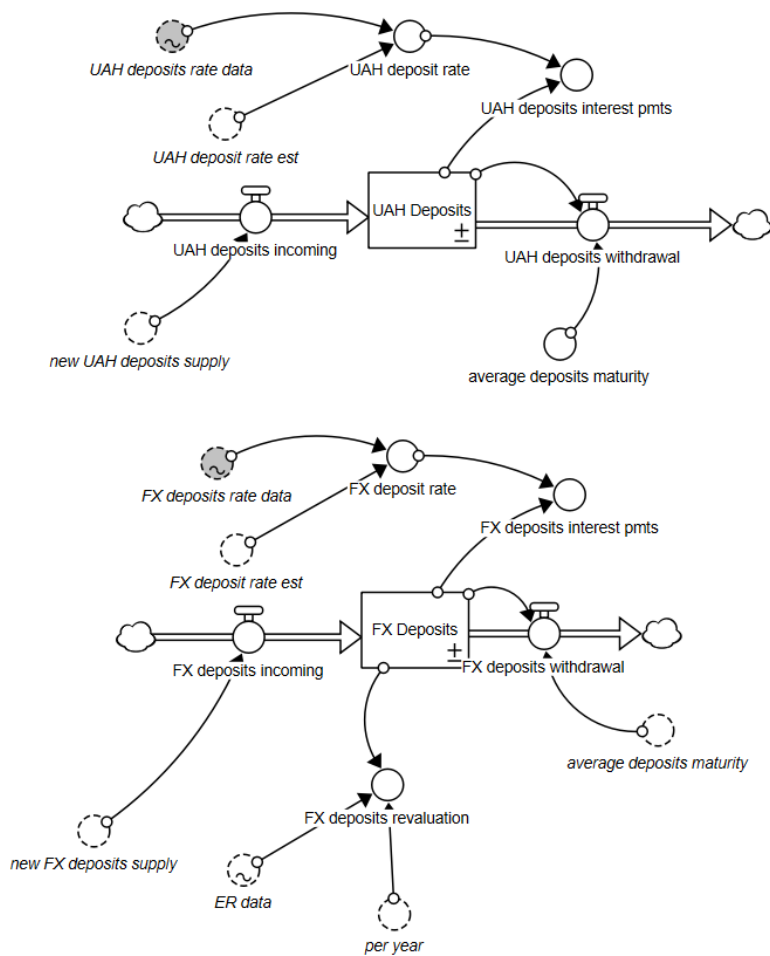


Figure C. 6. Deposits module

Source: developed by author in Stella Architect

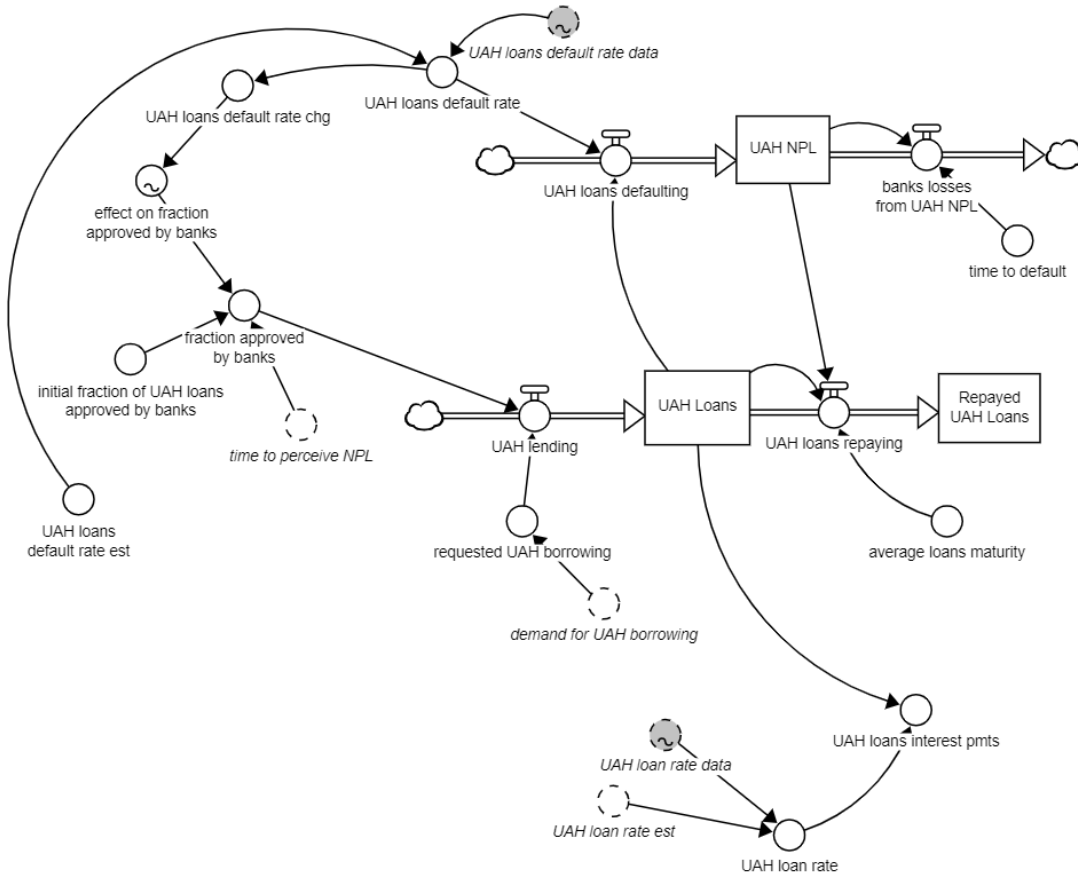


Figure C. 7. Hryvnia loans module

Source: developed by author in Stella Architect

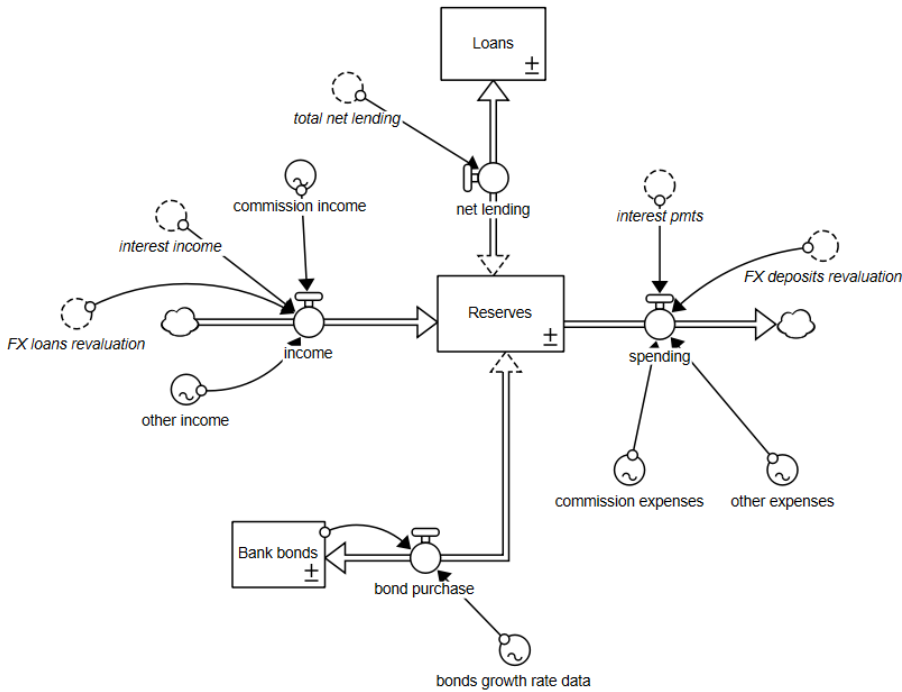


Figure C. 8. Banks' Assets module

Source: developed by author in Stella Architect

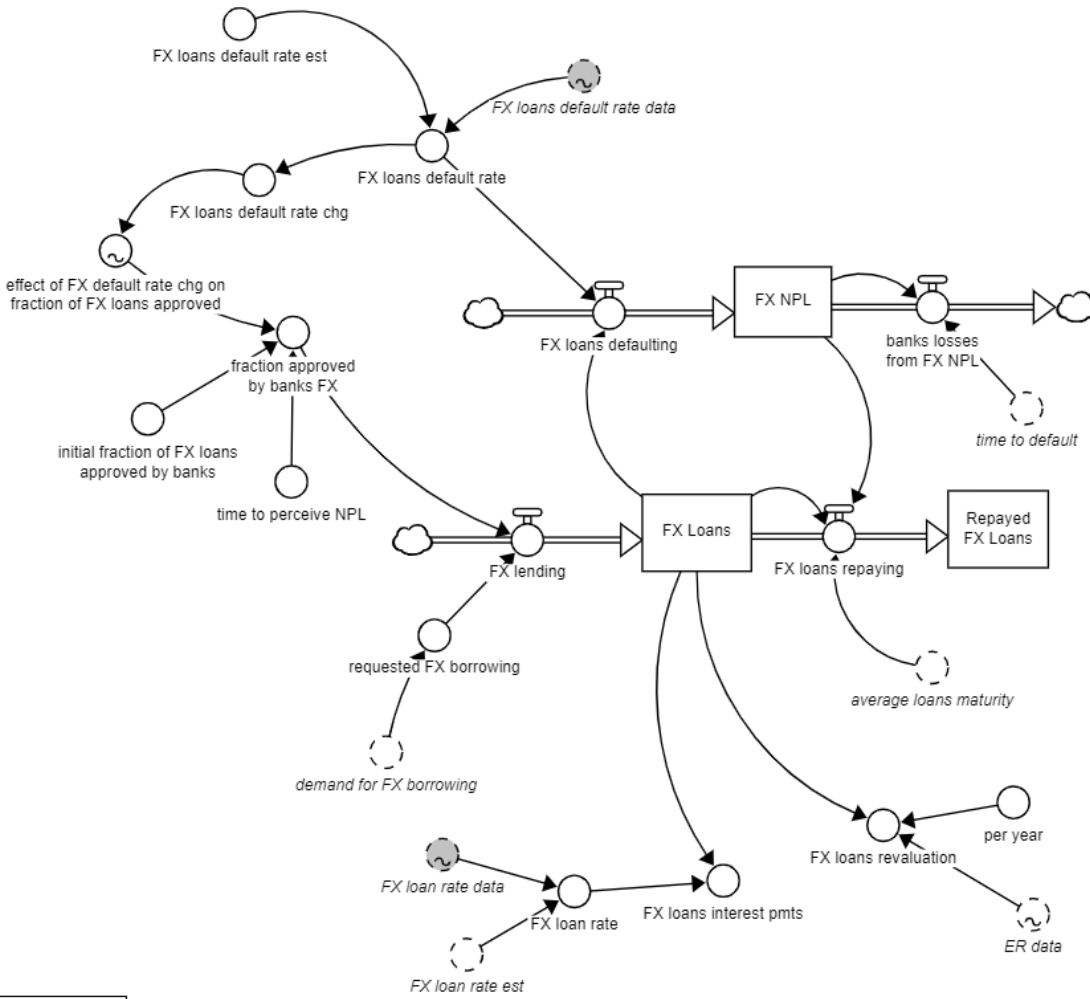


Figure C. 9. FX loans module

Source: developed by author in Stella Architect

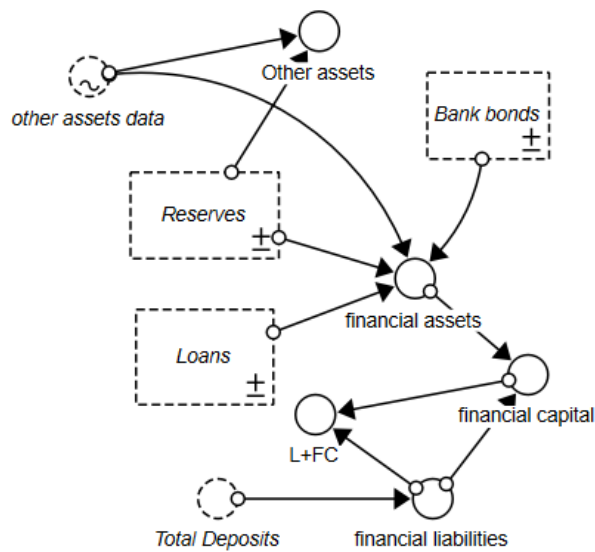


Figure C. 10. Balance Sheet module

Source: developed by author in Stella Architect

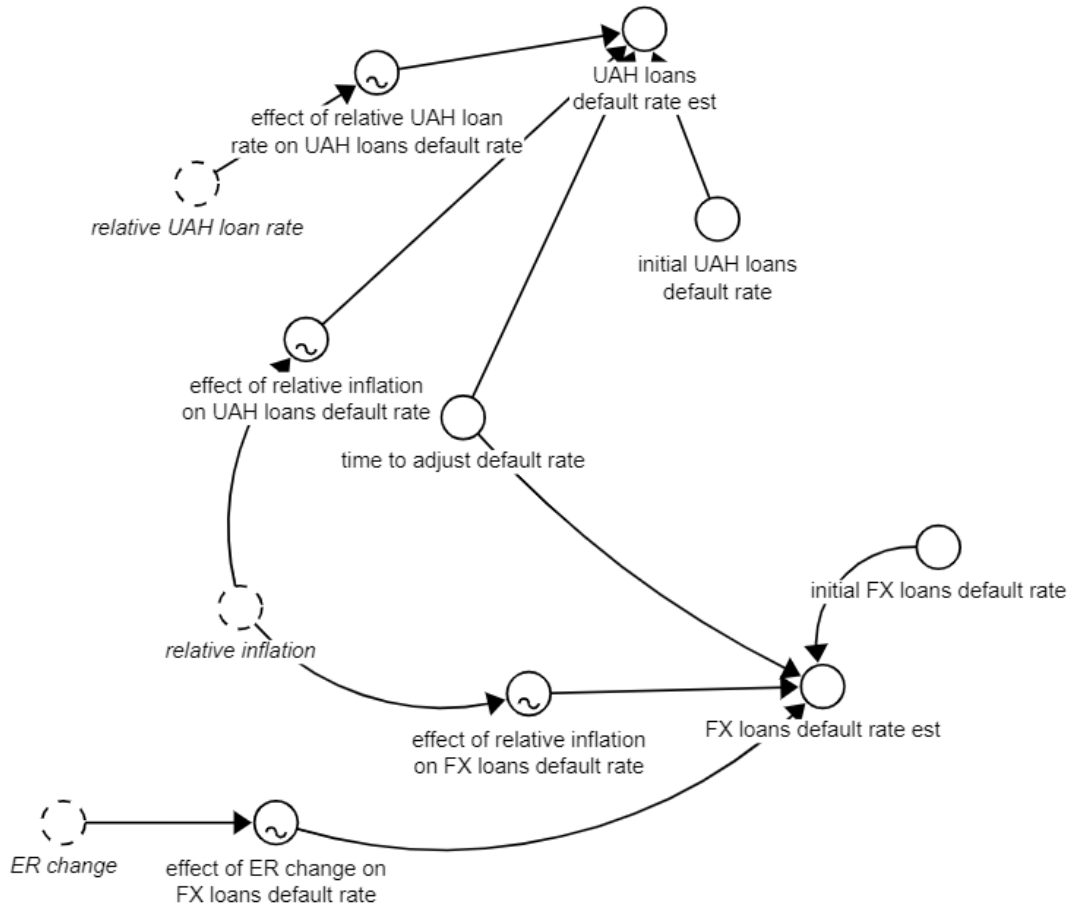


Figure C. 11. Non-performing loans module

Source: developed by author in Stella Architect

Appendix D

Consumer inflation panel regression testing results

Dependent Variable: C_PRICE_INDEX				
Method: Panel Least Squares				
Date: 04/09/23 Time: 15:59				
Sample (adjusted): 2017M01 2022M02				
Periods included: 62				
Cross-sections included: 12				
Total panel (balanced) observations: 744				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.562086	1.108221	-4.116585	0.0000
C_PRICE_INDEX(-1)	1.166141	0.035240	33.09112	0.0000
C_PRICE_INDEX(-2)	-0.248068	0.034088	-7.277369	0.0000
POLICY_RATE(-12)	-0.021890	0.012705	-1.723005	0.0853
LOG(NEER)	-5.103015	1.023520	-4.985751	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Root MSE	1.495952	R-squared	0.958334	
Mean dependent var	8.226478	Adjusted R-squared	0.957476	
S.D. dependent var	7.333638	S.E. of regression	1.512302	
Akaike info criterion	3.686414	Sum squared resid	1664.978	
Schwarz criterion	3.785597	Log likelihood	-1355.346	
Hannan-Quinn criter.	3.724646	F-statistic	1116.288	
Durbin-Watson stat	2.125004	Prob(F-statistic)	0.000000	

Figure D. 1. Consumer inflation panel estimation specification

Source: calculated by authors in Eviews 12

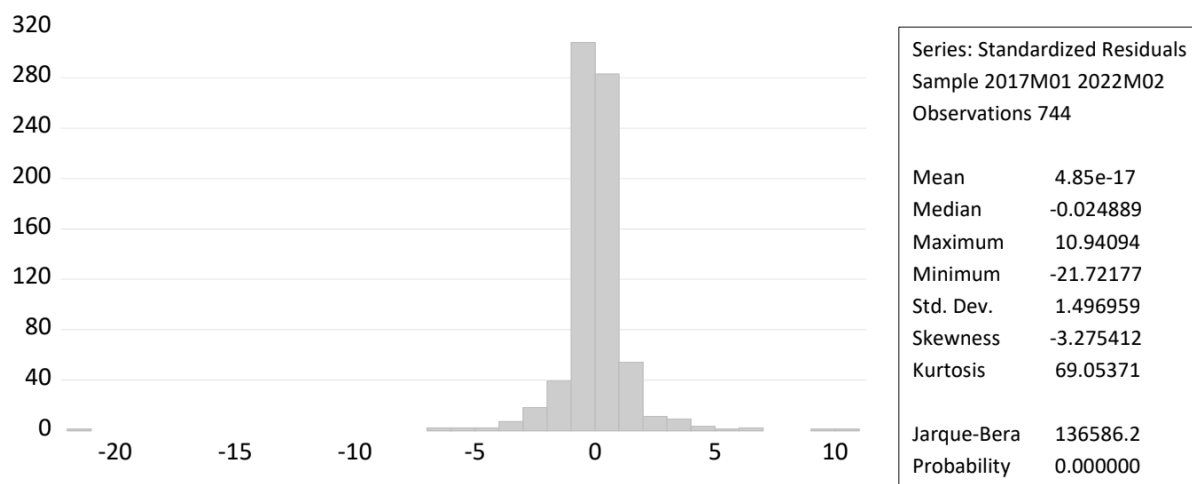


Figure D. 2. Residuals distribution (consumer inflation)

Source: calculated by authors in Eviews 12

Наукове видання

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The Collective Monograph
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The development of theoretical and methodological foundations in the field of state financial policy has been the subject of numerous works by both domestic and foreign scholars. Despite this, in contemporary conditions, the issues of state regulation require further resolution. The relevance of this research is strengthened by the complex socio-economic situation arising in Ukraine since the onset of a full-scale invasion, the growth of external and internal risks, social and financial instability, the increasing outflow of skilled labor, and the economic decline, significantly limiting the application of classic macroeconomic regulation tools.

The significance and complexity of these problems, both in theoretical and practical aspects, underline the importance and value of research in this direction, which should make a substantial scientific and practical contribution to enhancing the effectiveness of management decisions to ensure the macroeconomic stability of the state. Accordingly, the research aims to develop theoretical and methodological provision and contemporary economic-mathematical tools to form a financial policy strategy, which has the goal to ensure economic stability, to increase the competitiveness of the national economy, and restore economic growth in Ukraine.

For students of economic specialties, graduate students, teachers, civil servants, specialists and everyone who seeks to master the theoretical and practical aspects of building dynamic macroeconomic and simulation models for the formation of medium-term and long-term economic policy of the state, aimed at achieving macroeconomic stability even under unpredictable conditions of rapid development of external and internal crisis phenomena.

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