DOI: 10.55643/fcaptp.1.60.2025.4548

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Received: 28/08/2024
Accepted: 30/10/2024
Published: 28/02/2025

TRIGGER-VECTOR MODEL OF INDIVIDUAL INVESTORS' BEHAVIOUR IN THE DOMESTICI GOVERNMENT BORROWING MARKET

ABSTRACT

The increasing expenditures on defence, social protection, and economic recovery in Ukraine amidst a growing state budget deficit necessitate additional funding through the development of the domestic government borrowing market and the engagement of individual investors' funds. These investors can be both individuals, including labour migrants, and legal entities, particularly representatives of small and medium enterprises, both residents and non-residents. The article conducts impact modelling the impact of government bond issuance on the financial stability of the state, and methods to enhance the effectiveness of state financial policy in realizing the financial potential of individual investors.

An analysis of macroeconomic indicators reveals that the available funds held by individuals and legal entities are not fully utilized within the state's financial system, which hampers macroeconomic stability and, consequently, affects Ukraine's defence capabilities. The paper substantiates the appropriateness of individual investors allocating their funds to domestic government bonds, particularly military bonds. The research aims to develop a trigger-vector model of individual investor behaviour in the domestic government borrowing market and to justify its use for attracting additional funds to finance victory and post-war economic recovery in Ukraine.

This model is centred around an investment trigger that allows individual investors to make informed decisions based on an assessment of the advantages and risks associated with investing in military bonds. To evaluate the impact of quantitative and qualitative factors on investment decisions, particularly in military bonds, the trigger model is supplemented with a vector component.

The utilization of the trigger-vector model in practice can help in:

- Assessing the actual state of the domestic government borrowing market against predictions.
- Adjusting the strategy for the market's development.
- Evaluating changes in the behaviour of individual investors.
- Making necessary amendments to strategic and tactical objectives of state financial policy aimed at motivating individual investors to purchase domestic government bonds.

Keywords: state financial policy, domestic government borrowing market, military bonds, individual investors, trigger-vector model, investment trigger, macro-financial stability

JEL Classification: E22, E62, G19, H56, H63, H81

INTRODUCTION

Engaging individual investors in the domestic government borrowing market to address financial stability issues at the state level, especially during wartime and post-war economic recovery, has proven effective and efficient. The full-scale invasion of Ukraine by Russia has resulted in an increased budget deficit, rising national debt, higher military spending, forced migration of the population, and business closures. Given the daily

escalating costs of repairing critical infrastructure damage, Ukraine's defence budget expenditures have surged, necessitating new and diversified funding sources.

One such source is the engagement of individual investors in financial instruments in the domestic government borrowing market, primarily government bonds, particularly military bonds. These bonds were issued in Ukraine following the full-scale invasion and the declaration of martial law to attract private funds to support the economy and the country's defence capability during the wartime period.

The issuance of military bonds has a history that spans several centuries, with significant development in the early and mid-20th century, especially during the First and Second World Wars. The initial issuances of government bonds for war financing were undertaken by France in the late 17th century and by England in the early 18th century. The experience of France and England was later adopted by many countries that issued government bonds to finance military expenditures [4, 18, 19].

In the United States, the issuance of government bonds began in the early 19th century, but only members of the financial elite were able to purchase them. The general public was first given the opportunity to buy war bonds during the Civil War period of 1861–1865. Much of the dissemination of bonds among private individuals was facilitated by measures developed by the well-known American financier Jay Cooke, who proposed conducting mass advertising campaigns and permitting banks that bought government bonds to issue federal banknotes. The U.S. Treasury released loan certificates equivalent to bonds, purchased by private individuals, amounting to more than USD 27 million. Later, U.S. Treasury bonds, called "Liberty Bonds," were issued to finance the budget deficit following World War I. In 1917, the adoption of the First Liberty Loan Act allowed for the issuance of bonds amounting to USD 5 billion at 3.5 per cent interest [4, 18, 19].

From 1942 to 1945, war bonds were also issued in the Soviet Union. After World War II, bonds for the restoration of the economy were issued, which were mostly distributed forcibly among employees of enterprises, institutions, and organizations. In the early 1980s, bonds with a 20-year maturity were issued, but payments on them were not made due to the dissolution of the Union.

The post-war recovery experience of many countries worldwide, which at different times faced significant economic and infrastructure destruction, shows that accelerating the processes of economic reconstruction after the war is possible only with the implementation of prompt and effective economic, financial, social, and political reforms, the use of advanced technologies, and the mobilization of all available resources, including funds from individual investors.

The study of the experiences of other countries is relevant for Ukraine because, in conditions of a significant deficit of financial resources, personal finances are not fully integrated into the state's financial system as an investment resource. This necessitates the development of effective mechanisms by the state and the implementation of targeted policies aimed at cultivating conscious behaviour among individual investors. This behaviour should focus not only on earning income in the form of bond interest but, first and foremost, on fostering patriotism and the desire to contribute a modest amount towards victory and post-war reconstruction and development of the country. Considering the above, the chosen research topic, which focuses on building a trigger-vector model of individual investor behaviour in Ukraine's domestic government borrowing market based on the experiences of countries that have undergone war and post-war economic recovery, is both timely and highly relevant.

LITERATURE REVIEW

The development of the domestic government borrowing market, modelling the impact of government bond issuance on the financial condition of the state, and changes in public financial policy aimed at attracting individual investors have been subjects of research by many scholars.

Model of the Consequences of Economic Growth

Authors Z. Kalamov and K. Zimmermann [10] attempted to build a model for the consequences of government bond issuance on the economic growth of developing countries, with reference to the country's gross domestic product (GDP). Government-issued bonds, along with loans from international financial markets and tax revenue, improve the optimal ratio of domestic and external debt to GDP, and the ratio of public and private capital in percentages. They concluded that this also has a slightly negative effect on the average GDP growth rate and a positive effect on overall welfare. The interest premium on bonds depends on the perceived probability of default, resulting in an upward-sloping supply curve of funds. At a certain debt-to-GDP ratio, the issuance of GDP-linked bonds reduces the anticipated default risk, which depends on the uncertainty of future debt-to-GDP ratios.

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Demand Analysis of the Primary Government Bond Market in Germany

J. Shida, having analyzed the demand of the primary market for German government bonds, found that to capture different characteristics of empirical demand curves, he proposed introducing new auction demand indicators that reflect the expectations of participants during real-time government bond issuance. The main findings can be summarized as follows: demand is positively influenced by the secondary market yield of the corresponding security, issuer announcements of future issuances, the proposed auction volume, and the underpricing at previous auctions. Additionally, central bank purchases of bonds on the secondary market significantly positively impact demand, at least for short-term bonds. Market instability and the regulatory imposition of a leverage ratio for banks have a negative impact. The issuance of securities by non-governmental financial institutions does not significantly affect the demand for government bonds [20].

Analysis of the Impact of Preferential Regulatory Regime

K. Bonner [3] analyzed the impact of a preferential regulatory regime on banks' demand for government bonds. Using transaction-level data, the author demonstrated that a preferential regime in the area of micro-prudential liquidity and capital regulation significantly increases banks' demand for government bonds. The regulation of liquidity and capital also encourages banks to replace other bonds with government bonds, leading to a reduction in bank lending to the real economy.

This literature review highlights significant findings and varied methodologies employed by different scholars to understand the dynamics of the government bond market, demand influences, and regulatory impacts, thereby providing a comprehensive backdrop for further research in this field.

Yield of Government Bonds on European Markets

M. Nguyen [17] investigated the yields of government bonds in European markets. The author demonstrated that private investors demand higher yields for government bonds compared to discounted other investments. Although Eurozone government bonds are denominated in a single currency and are subject to the same jurisdiction of the European Central Bank, they significantly differ in terms of issuers, maturities, coupon rates, and yields. The study asserts that bond yields can also be influenced by funding constraints.

Modelling Volatility on European Bond Markets

X. Zhang and A. Dufour [25] attempted to model the volatility of European bond markets using a multiplicative-component GARCH model. This model considers the impact of previous changes in indicators and past variance estimates, referred to as "old news." The authors proposed a flexible and efficient procedure for joint filtering of mean prices and estimation of volatility models, showing that intraday data contain relevant information for daily volatility forecasts. The research is based on the assumption that changes in yields are an important factor in explaining the term structure of interest rates.

Momentum Theory in Government Bond Markets

A. Zaremba applied the momentum theory to the study of government bond markets, suggesting that securities with good (bad) past performances tend to continue in that direction in the future. The author provides two explanations for this effect: behavioural and risk-based. The behavioural explanation posits that investors allocate funds based on the relative historical performance of investment styles, and this performance chase leads to cash flows that impact prices and cause autocorrelation effects. The risk-based explanation suggests that the attractiveness of bonds should be partially explained by risk determinants that result in variations in bond yields. These explanations are used to account for the yield of bond portfolios [24].

Impact of Risk on Private Investors' Decisions

D. Georgoutsos and P. Migiakis investigated the impact of risk on private investors' decisions regarding the purchase of government bonds. Analyzing data on the sale of government bonds for 30 countries from 2001 to 2019, the authors found that government debt spreads are influenced by heterogeneous factors related to their credit ratings. Spreads on low-risk sovereign bonds increase with higher growth rates and inflation, while spreads on high-risk bonds decrease with higher growth rates and are more sensitive to global volatility. The findings support the effectiveness of counter-cyclical fiscal policies, indicating that bond spreads can be expected to decrease if the economy is growing and market volatility is low [8].

When considering the issues of private investors making investments, it is essential to take into account the external environment and conditions in which the issuing state of the bonds operates. In relation to the current situation in Ukraine, Luty I. and N. Medvedkova, justifying the priorities of the state's financial policy, point out that the main goal should be

to ensure full funding for the Armed Forces of Ukraine (AFU) and the country's security and defence sector, particularly through the development of the domestic government borrowing market. In the future, among the instruments of this market, the authors highlight the need to use "recovery bonds," which could be issued not only by the state but also by individual territorial communities, with both individuals and legal entities as investors in the post-war recovery of Ukraine [13].

In this context, Oleksandr Amosha and Olena Amosha propose the creation of European-style industrial and residential infrastructure as a strategic direction for post-war economic recovery in Ukraine. They argue that infrastructure development should be one of the main components of the strategy formula for further revitalization of the national economy and its social sphere [1]. A similar view is expressed by A. Danilenko and G. Yershova, who note that post-war economic recovery and ensuring further economic development require, first and foremost, intensive industrial development, and that the reconstruction must be aimed not at restoring the former economy, but at reforming it according to international standards and aspiring for future EU membership. Therefore, the authors consider determining economic development priorities to be crucial for our country. The foundation for this is the development of the processing industry and education [5].

The impact of the Russian-Ukrainian war on the hierarchical structure of domestic government bond markets was studied by Turkish researchers I. Yagli and B. Deviren. The authors examined the network structure of bond markets using daily yield data on government bonds over 10 years for 25 economies of developed and developing countries, including European countries and those with the largest bond markets such as the USA, China, and Japan, from early January 2015 to the end of August 2022, specifically highlighting the period of the Russian-Ukrainian war.

The results of the conducted studies indicate that there are close interrelations between the government bond markets of EU countries that use the euro as their official currency, aligned with their economic ties. The coronavirus pandemic had a significant impact on domestic government bond markets during the pre-war period, and after February 2022, the aggression by Russia pushed prices up. During the pre-war period, central banks of most countries deemed inflation as being caused by supply issues triggered by the pandemic, considering it temporary. Governments preferred not to intervene in interest rates, but the rising inflation compelled central banks to adopt tight monetary policies, aggressively raising policy rates. For instance, the Federal Reserve of the United States did not change the federal funds rate throughout 2021, but in 2022 it intervened seven times in the interest rates to curb inflation. The increase in interest rates encouraged both institutional and individual investors to invest in government bonds since they offer better protection against inflation. The authors of the study also emphasize that although the war is between two countries, the entire global economy feels the effects, as both Russia and Ukraine are producers of key commodities. Thus, studying how the war has affected domestic government bond markets may be significant for both investors and policymakers [23].

American economist B. Eichengreen considers it appropriate to use certain principles of the Marshall Plan for the post-war recovery of Ukraine, akin to the post-World War II economic recovery of affected countries. Specifically, he suggests that it is unnecessary to wait for the complete cessation of hostilities to provide aid, which should be given as soon as possible, but selectively, avoiding expenditures on assets that could be destroyed during fighting (e.g., rebuilding bridges). Particularly interesting is the author's suggestion of Western nations offering guarantees for new Ukrainian government bonds. Such guarantees for Ukraine's domestic government bonds would be just one way for Western governments to reduce the cost of aid for the post-war economic recovery of Ukraine. Citing the Marshall Plan's approach of providing advanced American technologies to affected countries, Eichengreen proposes the same for Ukraine. He sees value not only in rebuilding the destroyed energy infrastructure but also in making the energy system "greener," modernizing transportation, and updating urban planning [7].

Considering the main theoretical and practical points raised in the scientific works reviewed, it should be noted that insufficient attention has been given specifically to the questions of modelling the behaviour of individual investors in the domestic government borrowing market and the motives behind their selection of particular financial instruments.

AIMS AND OBJECTIVES

The aim of this article is to develop a trigger-vector model of the behaviour of individual investors in the market for domestic government borrowings and to justify directions for its use to attract additional funds for financing victory and post-war reconstruction of Ukraine's economy. To achieve this goal, the following tasks have been addressed:

- investigated possible investment options for individual investors, identifying their advantages and disadvantages;

DOI: 10.55643/fcaptp.1.60.2025.4548

- conducted an analysis of macroeconomic indicators, justifying the feasibility of investing in domestic government bonds, particularly military bonds;
- developed a trigger-vector model that allows for the evaluation of changes in the behaviour of individual investors in the domestic government borrowing market and for adjustments to be made to forecasts of future collaboration and investor motivation.

METHODS

In the course of the research, general scientific and special methods were utilized, specifically:

- Historical method to identify the evolution of the issuance of government domestic bonds, particularly military bonds in global and domestic practices.
- Dialectical method to substantiate the prospects for attracting individual investors to operations in the domestic government borrowing market.
- Induction and deduction methods to identify quantitative and qualitative factors influencing the investment decisions of individual investors.
- Economic-statistical, analytical, and graphic-analytical methods for the analysis of macroeconomic indicators.
- Survey and expert assessment methods, scientific abstraction in constructing the trigger-vector model of individual investors' behaviour in the domestic government borrowing market.

RESULTS

The financial policy of the state during wartime should implement measures to transform existing financial relations in the context of creating incentives for attracting private investment. The state and individual investors must productively interact with each other to achieve common results based on the formation of a system of relationships involving the use of organizational, legal, and economic mechanisms, and technologies that ensure comprehensive financing of the state's security and defence sector and macro-financial stability, which is a prerequisite for fulfilling the constitutional functions of the state during wartime.

In any society, there is a certain stratification of social layers of the population. Typically, people with above-average income have achieved it through professional skills, abilities, and specific knowledge. They are fully aware that over time, money depreciates, which necessitates taking measures to prevent this. A significant influence on individuals' desire to invest money comes from inflation, as rising inflation creates a need to preserve one's assets from depreciation. This was particularly noticeable after the full-scale invasion in 2022 when inflation reached 26% (Figure 1).

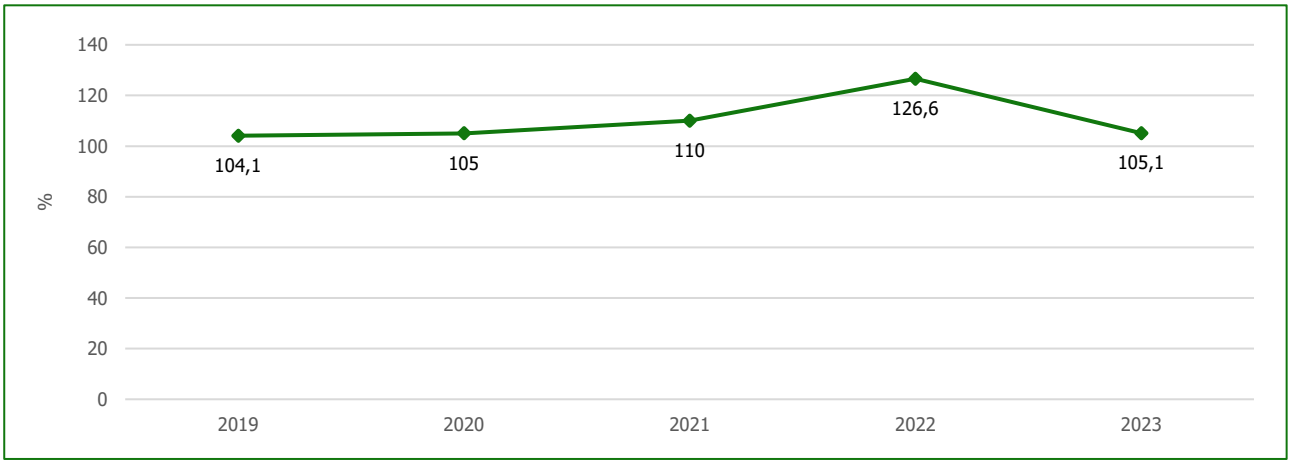

Figure 1. Inflation Index in Ukraine. *(Source: Compiled by the authors based on [16])*

In developing a behavioural model for individual investors in the domestic government borrowing market, it is necessary to consider the level of interaction between personal finances and behavioural finance. The authors of the work [11] note that behavioural finance "takes into account the probability of irrational behaviour by investors when making financial decisions".

Nobel Laureate Herbert Simon introduced the concept of "bounded rationality" into scientific discourse, positing that decision-makers do not aim to maximize profit but rather choose the first satisfactory option according to their subjective assessment of the situation influenced by their level of financial literacy and the available information [22].

Complementing Simon's theory is the concept of "herd behaviour", which demonstrates the existence of irrational financial decisions based on the actions of the decision-makers environment. These decisions can have both positive and negative outcomes. The "herd effect" is especially prevalent during crises [21].

Work [9] provides a critique of the expected utility theory, which the authors describe as a "descriptive model for decision-making under risk". The authors propose and justify an alternative model known as prospect theory. This theory describes individual behaviour under uncertainty, emphasizing subjectivity and asserting that choices between alternatives are made based on potential gains and losses. Essentially, it is a descriptive theory that allows for modelling real-life decision-making scenarios.

According to the investment risk theory, among two assets with the same profitability, investors will always choose the one with lower risk. Thus, there is a directly proportional relationship between expected return and expected risk, which also needs to be considered when modelling the behaviour of individual investors in the domestic government borrowing market [15].

The study of individual behaviour models, which directly affect decision-making regarding investment efficiency in the financial market, is the focus of this work [14]. According to the authors, "modern views on the bounded rationality of financial market participants require more active research into their behaviour models".

Given the above, legal and natural persons, as individual investors with available funds, face the question of making corresponding investment decisions. Possible directions for these decisions are shown in Figure 2.

Let's consider each option illustrated in Figure 2. Undoubtedly, such decisions need to be made based on the current situation, leveraging available financial knowledge, and, in the context of the digitization of the financial sector and the economy as a whole, also possessing the necessary digital skills and competencies. Quite often, legal and natural persons invest funds in bank deposits, hoping to earn income. The advantages of this method of saving funds are that one can choose virtually any bank and corresponding offer, with there being a wide variety in the banking services market. Moreover, the process of opening a deposit account can be completed online.

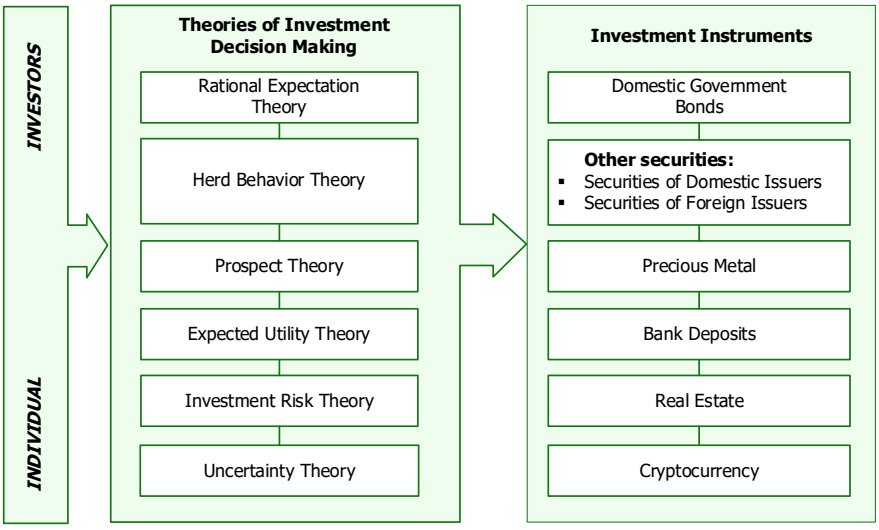

Figure 2. Possible Investment Options for Individual Investors. *(Source: Compiled by the authors based on [9, 11, 14, 15, 21, 22])*

The disadvantages include, firstly, the lengthy procedure and limitations on the return of funds in the event of a bank's bankruptcy through the Deposit Guarantee Fund (limitations are lifted during martial law and for three consecutive months), and taxation of interest earned on deposits.

Deposits can also be considered not very profitable because, in many cases, deposits in the local currency (hryvnia) only slightly offset the inflation index. In 2022, inflation was more than twice the interest rate offered by deposits (see Figure 3).

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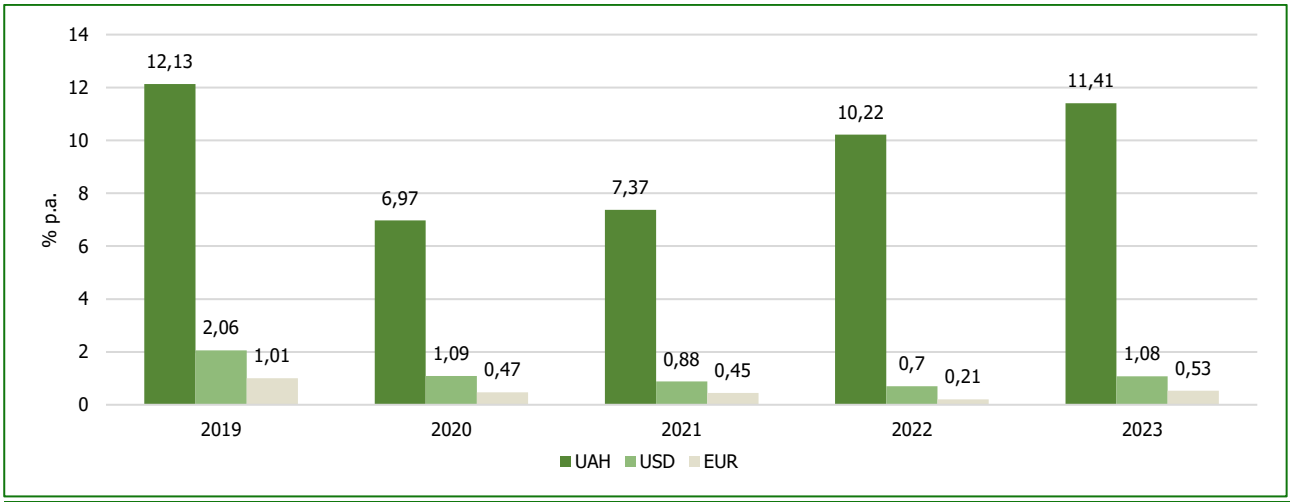
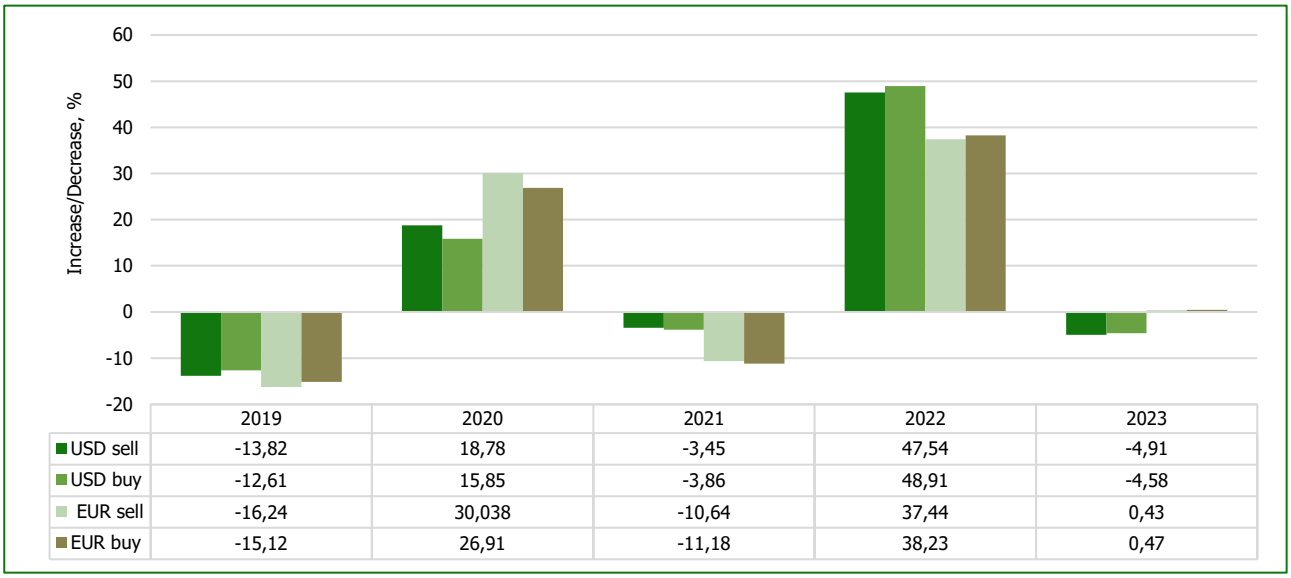


Figure 3. Ukrainian Deposit Rate Index for Individuals after Taxation. *(Source: Compiled by the authors based on [16])*

Deposits in USD and EUR are sensible from the perspective of currency preservation in a banking institution, especially when there are prerequisites for the appreciation of these currencies against the hryvnia. A significant risk lies in the potential errors made when attempting to predict currency fluctuations. For instance, after the increase in the USD exchange rate amid the military actions in 2022, 2023 saw a strengthening of the hryvnia against the USD, which did not occur concerning the EUR, possibly due to the increased demand for the currency from forced migrants from Ukraine to EU countries. Additionally, some banks might make repayments of foreign currency deposits in hryvnia according to the NBU exchange rate or delay these repayments (Figure 4).



	2019	2020	2021	2022	2023
USD sell	-13,82	18,78	-3,45	47,54	-4,91
USD buy	-12,61	15,85	-3,86	48,91	-4,58
EUR sell	-16,24	30,038	-10,64	37,44	0,43
EUR buy	-15,12	26,91	-11,18	38,23	0,47

Figure 4. Dynamics of Currency Exchange Rate Fluctuations Compared to the Previous Year. *(Source: Compiled by the authors based on [16])*

Public distrust of banking institutions leads to significant sums of cash being kept at home, which has negative consequences for the state's financial system and carries additional risks of loss for the owners during wartime and amid rising fraudulent activities.

Another option to protect one's funds from depreciation is the purchase of banking metals. Gold is typically the most popular asset in the precious metals market. Internationally, gold is used in various transactions - it can be part of a savings account, a means of payment in real estate purchases, and most often an investment tool. Following gold, silver holds the second position. However, investments in silver have lost some relevance recently, as global silver deposits are quite abundant, and platinum and palladium are becoming more popular as alternatives. Prices for banking metals have been gradually rising in recent years, attracting investor attention (see Figure 5).

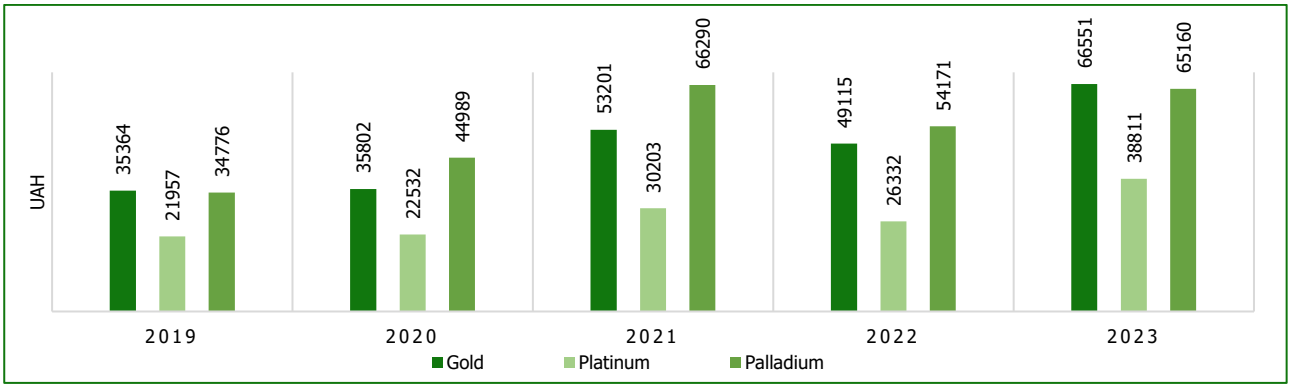


Figure 5. Price Dynamics for Banking Metals: Gold, Platinum, and Palladium per Troy Ounce. *(Source: Compiled by the authors based on [2, 16])*

A positive aspect of investing in banking metals is their protection against rapid depreciation, especially during crises. However, there are several disadvantages to investing in banking metals. Firstly, the buying and selling prices of banking metals can significantly differ. For instance, one of the leaders in Ukraine's banking sector, PJSC "PrivatBank," sells gold bars at prices ranging from 3410 to 4160 UAH/gram, depending on their size, while buying the same bars at 3000 UAH/gram. Silver bars are sold at prices ranging from 48 to 90.9 UAH/gram, but are bought at 32 UAH/gram (data as of June 23, 2024) [2]. Thus, the markup on silver, especially for the smallest bars, can approach 300%. Secondly, storing significant amounts of banking metals at home can be risky, and storing them in bank safety deposit boxes incurs additional costs. Moreover, funds invested in banking metals do not substantially contribute to the recovery and development of the economy.

Investing in real estate and cryptocurrency is quite risky for preserving funds. Real estate investments are subject to the volatility of the real estate market, especially during crises and military actions. Buying cryptocurrency is characterized by risk and unpredictability, particularly for novices who lack sufficient experience, knowledge, and skills to handle these virtual assets. To trade cryptocurrency, one must first choose an exchange. The most well-known exchanges are Binance, Huobi, KuCoin, and others. Each exchange charges a commission for services: 0.5–1% for depositing funds, 0.06–0.1% for each transaction, and 2–4% for withdrawing funds.

Investing in foreign securities requires first having a bank account outside Ukraine and using the SWIFT system to transfer funds to an overseas account. Additionally, one must confirm the source of the funds and then conduct buy-sell operations for securities through a licensed broker. The commission is about 1% of the transaction amount and 1-5% for withdrawing funds to a bank account. Additionally, income earned abroad is subject to taxes: 18% individual income tax and a 1.5% military levy. If the investor receives dividends, they only pay 10.5%. If taxes were withheld at the income source, they could be deducted from the amount due in Ukraine.

The conducted analysis of various financial instrument investment options allows us to conclude that investments in government bonds remain among the most attractive today in terms of preserving and growing funds. In the context of Russia's full-scale war against Ukraine, these bonds play a significant role in financially supporting the state's military needs and addressing several economic and social problems. The dynamics of interest rates on domestic bonds with maturities of 1 and 3 years are shown in Figure 6.

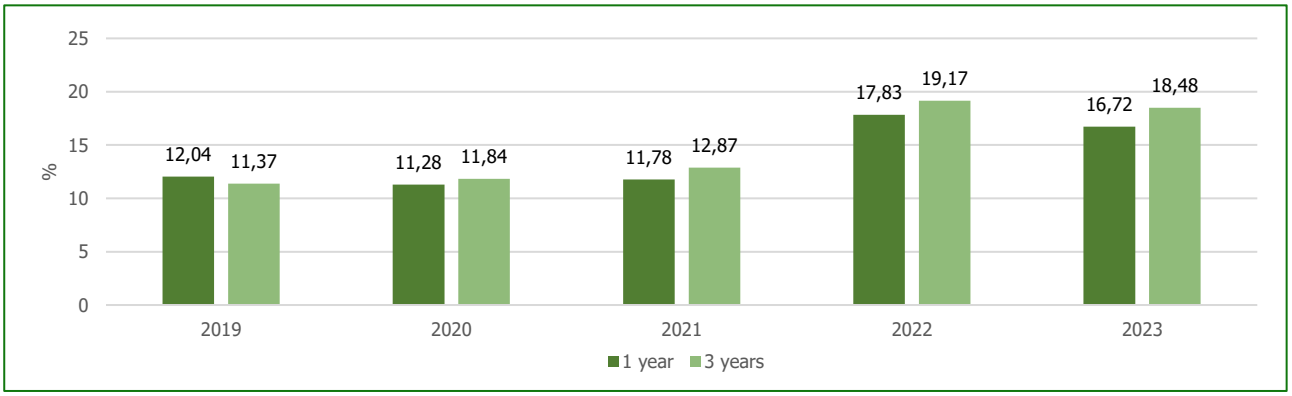


Figure 6. Average Yield of domestic government bonds (%). *(Source: Compiled by the authors based on [16])*

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Investing in government bonds also has its advantages and disadvantages, which should be considered when making informed investment decisions. The undeniable benefits of investing in government bonds include:

- *Stability and Security:* government bonds are considered one of the safest investment instruments since the risk of government default is typically low.
- *Stable Income:* Interest payments on government bonds are usually stable and predictable, making them attractive to investors.
- *Liquidity:* government bonds are generally liquid, meaning they can be sold at any time on the bond market.
- Portfolio Diversification: Investing in government bonds can help distribute risks in an investment portfolio, especially if the portfolio includes high-risk assets.

The primary disadvantages or risks associated with investing in domestic government bonds are:

- *Interest Rate Levels*: Changes in the National Bank of Ukraine (NBU) discount rate can affect the income from government bonds, i.e. when the discount rate decreases, the interest rate on the bonds also decreases.
- *Inflation Risk:* Rising inflation diminishes the real yield on government bonds.
- *Default Risk:* Although government bonds are considered highly reliable and liquid, there is always a risk that the government may fail to meet its debt obligations.
- *Market Risk:* Market price changes of government bonds, influenced by various factors such as military actions, financial crises, and the overall economic situation, also pose a risk.

The process of attracting funds from individual investors for purchasing government bonds, particularly military bonds, should be transparent and open. As noted by the authors of the work [12], the implementation of transparent and open budgeting in the defence and security sector will promote the development of relationships between political institutions and civil society. This transparency allows individual investors to receive timely information about the level of military expenditures and the extent of the state's military needs, enabling them to make informed decisions regarding investments in military bonds.

According to the NBU, as of January 1, 2024, the population holds UAH 764.4 billion in cash [16]. In the context of a state budget deficit, the Government of Ukraine, together with regulators of the domestic government borrowing market, should pay significant attention to developing tactical and strategic directions of financial policy. This policy should aim to attract funds from individual investors to achieve victory in the war and for the post-war economic recovery.

Individual investors in the government bonds market can include both natural persons such as labour migrants, and legal entities, particularly representatives of small and medium-sized enterprises (SMEs) in the private sector.

The volume and channels of funds transferred by Ukrainian citizens from abroad are shown in Figure 7.

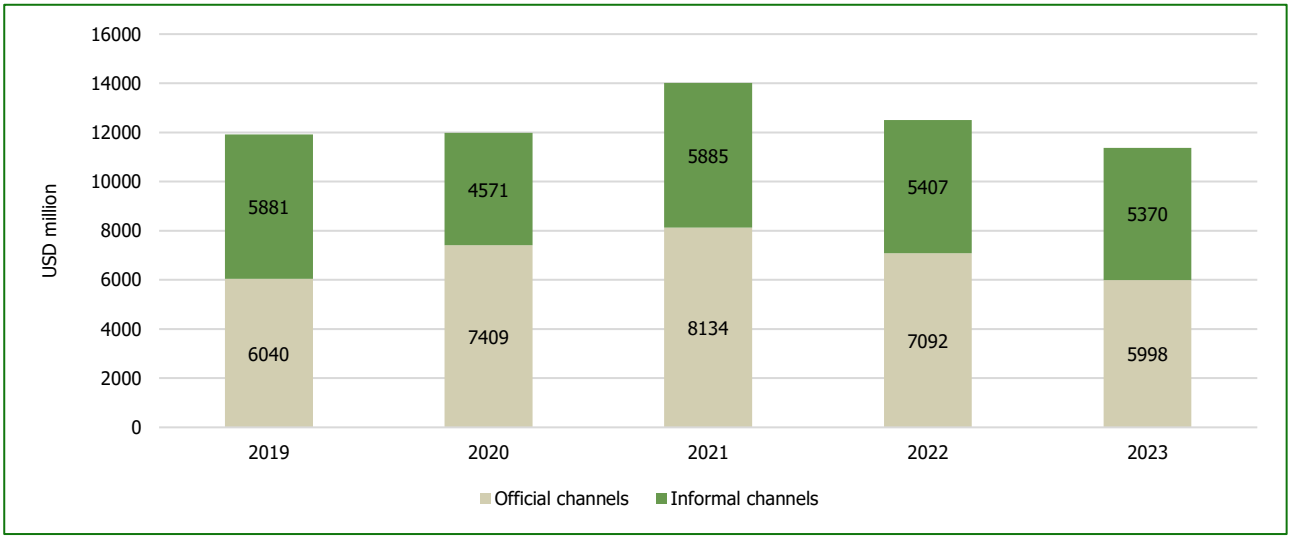

Figure 7. Volumes of Private Money Transfers to Ukraine, USD million. *(Source: Compiled by the authors based on [16])*

The development of the state's economy is impossible without the growth of small and medium-sized businesses and attracting their representatives to invest in government bonds. The state should particularly focus on assessing the financial

potential of sole proprietors (FOP) and implementing measures aimed at involving them in investment processes in the government bonds market.

An analysis of the number of sole proprietors and their income sizes for the period 2019-2023 is shown in Figure 8.

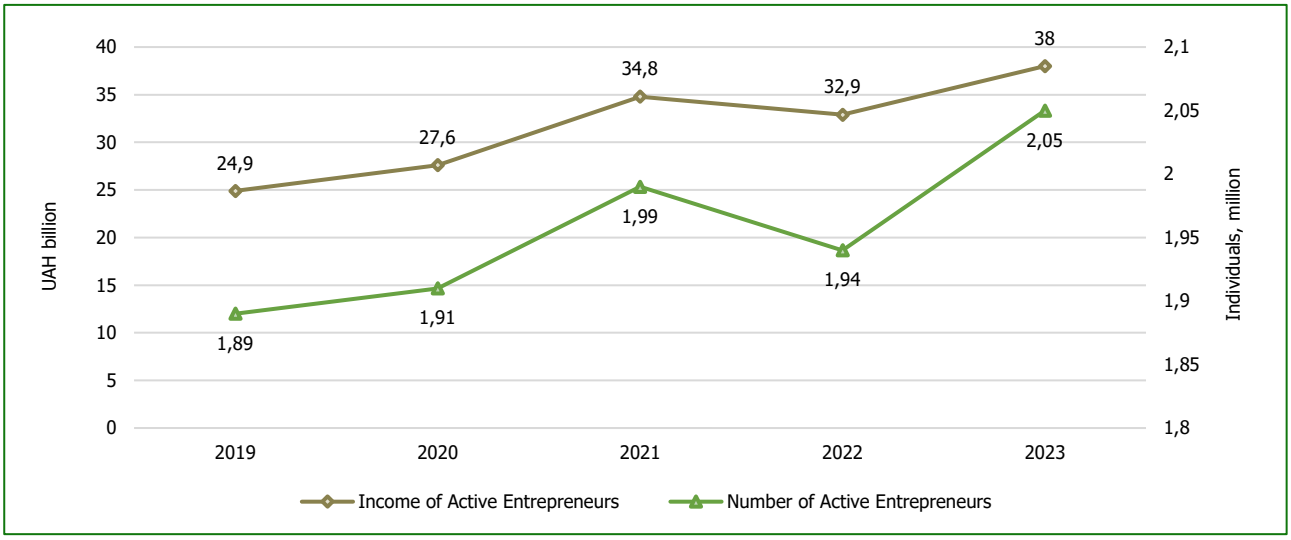

Figure 8. Number of Sole Proprietors and Their Incomes. *(Source: Compiled by the authors based on [6])*

Thus, the free funds available to both legal and natural persons are, firstly, not fully utilized to stabilize the situation in the country, which negatively affects the economy and the nation's defence capability, and secondly, these funds are devalued from the perspective of personal finances, failing to generate passive income and being exposed to loss risks under uncertain conditions. To change the situation, it is necessary to manage the investment process in government bonds from the standpoint of personal finances, modelling the behaviour of individual investors in the domestic government borrowing market. This will help make optimal management decisions and adjust the development strategy of the government bonds market. While developing a trigger-vector model of individual investor behaviour in the domestic government borrowing market, the following issues should be considered:

- the absence of complete information about the financial potential and long-term possibilities for investing personal finances in purchasing government bonds;
- increasing the number of parameters in the model makes it overly cumbersome;
- much of the information affecting the model's accuracy does not consider the specific conditions under which an individual investor makes decisions;
- the presence of stochastic changes in the functioning and development of the domestic government borrowing market and its components reduces the model's forecast accuracy.

The model of individual investor behaviour on the domestic government borrowing market encompasses the periods of issuance, sale, and redemption of government bonds. Building the trigger-vector model will allow us to determine the correspondence of the actual state of the market to the forecast. It should be noted that, over time, due to market uncertainty, the forecast accuracy decreases, which may necessitate adjusting planned measures. The model's error is proportional to the time variable.

In building the model, we will consider that the process of implementing government bonds has specific characteristics, which involve the following assumptions. Firstly, there exists a certain number of potential investors whose income level exceeds their consumption level and who understand that holding free funds in current bank accounts amidst rising inflation will not generate the desired income.

Secondly, individual investors aim to at least minimize their losses and at most increase their funds, and this goal can only be achieved through investment.

Thirdly, individual investors should act rationally and choose an investment option that ensures the maximum growth of their funds with minimal risk.

DOI: 10.55643/fcaptp.1.60.2025.4548

Considering the above, the state, as the issuer of government bonds, needs to implement appropriate marketing measures, actively promote policies to enhance financial and digital literacy among the population and private entrepreneurs, and intensify patriotic education initiatives. The latter is essential for fostering conscious behaviour among individual investors. They need to understand that investing in government bonds is not solely about receiving guaranteed income but also about ensuring personal financial security in a free country. A conscious individual investor realizes that investing in their country's economy will contribute to victory over the enemy, help restore destroyed property, and support people who have been injured or lost their property. Without the contribution of individual investors towards future victory, achieving this goal will be quite challenging.

As a result, it is proposed to build a trigger-vector model to assess the possibility of an investor making a positive decision. Making a decision to invest in government bonds requires a certain trigger—a switch that "turns" an investor's decision from negative to positive under the influence of certain factors. To evaluate the potential benefits and losses of such an investment, it is proposed to use an investment trigger, graphically represented in Figure 9.

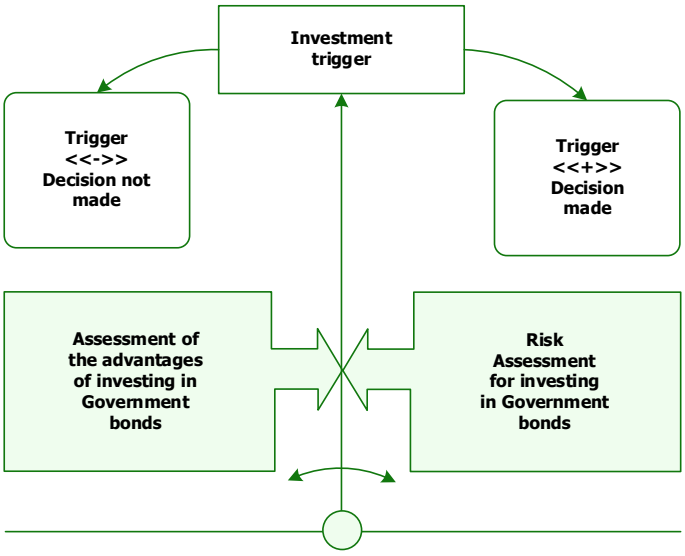

Figure 9. Evaluation of the Advantages and Risks of Investing in Military Government Bonds.

The following procedure is proposed for constructing an investment trigger:

1. Determine the set of investment advantages in military bonds, denoted as P (profit), where P = {P1, P2, P3, …, Pk}.
2. Assign a weight coefficient KPi to each advantage, ensuring that the sum of the weight coefficients equals 1: ∑ KPi = 1.
3. Evaluate each advantage of Pi using an expert method on a 9-point scale.
4. On the ordinate axis, plot the sum of the point evaluations of the investment advantages in military bonds considering the corresponding weight coefficients: ∑KPi * Pi.
5. Similarly, determine the set of risks R (risks) when investing in domestic government bonds, where R = {R1, R2, R3, …, Rm}.
6. Assign a weight coefficient KRi to each type of risk, ensuring that the sum of the weight coefficients equals 1: ∑ KRi = 1.
7. Evaluate each risk Ri using an expert method on a 9-point scale.
8. On the abscissa axis, plot the sum of the point evaluations of the risks of investing in government bonds considering the corresponding weight coefficients: ∑ KRi * Ri.
9. Compare the set of advantages with the set of risks.
10. Determine the trigger activation.

The decision to invest in government bonds is made based on the trigger activation according to the advantages. If losses outweigh the advantages, then investing under these conditions is impractical. If the advantages exceed the losses, the trigger is activated, leading to a positive investment decision.

The rationale for using the term "trigger" in this model is that when the values of the sets of advantages and risks are equal, potential losses equal advantages. However, in practice, this scenario is unlikely as the decision must either be made or not.

Factors influencing the investment decisions of individual investors can be conditionally divided into two groups: quantitative and qualitative. Quantitative factors drive investment through a range of benefits that investors can receive and quantify. These factors include interest rates, income levels, the volume of bond issuance, the maturity periods of the bonds, and others. Qualitative factors can be measured using a point-scoring method. They include the investor's internal state when making investment decisions. For our country, patriotism should be paramount in making investment decisions. The second most important factor is financial literacy, as a significant portion of the population with low financial literacy not only does not know about the benefits of investing in domestic government bonds but also does not understand where and under what conditions they can purchase them.

To evaluate the impact of factors that motivate individual investors to decide on investing in domestic government bonds, especially military bonds, it is proposed to complement the trigger model with a vector component. A two-dimensional vector model has been constructed to assess the influence of quantitative and qualitative factors on individual investors' investment decisions. This model uses survey methods and expert evaluations for its construction (Figure 10).

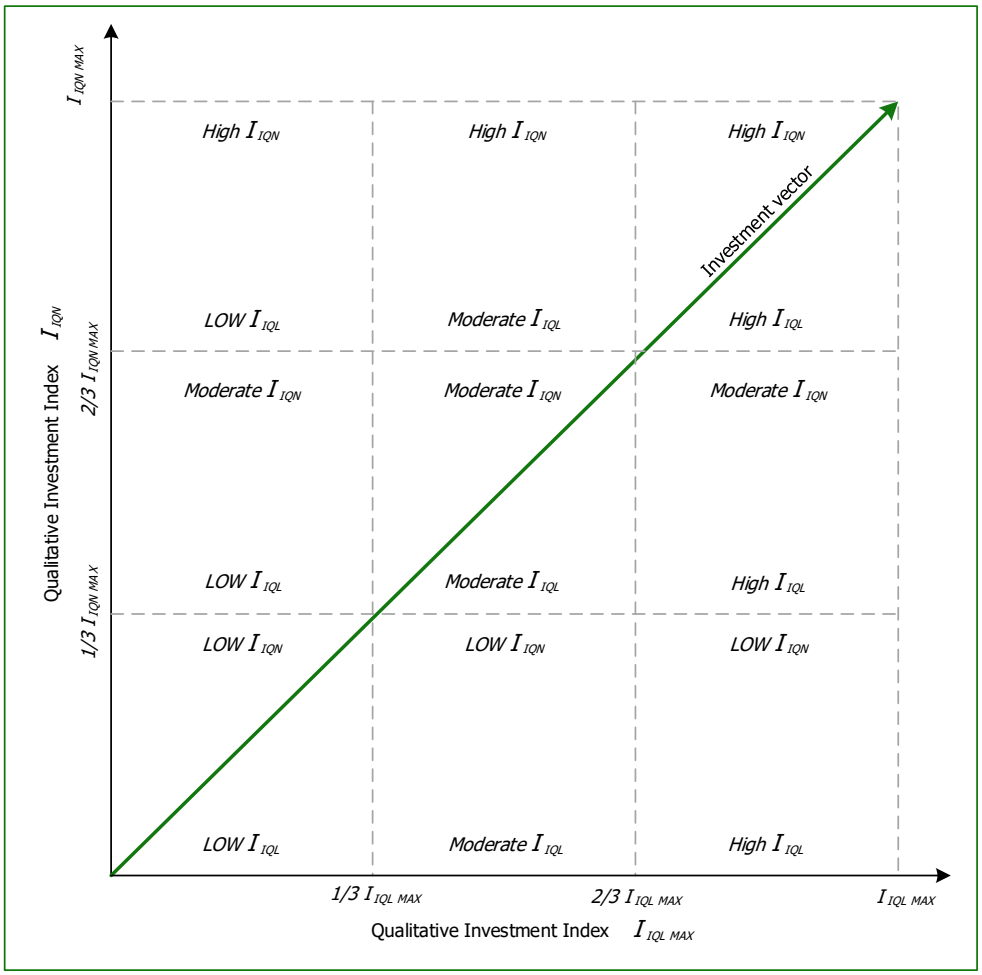

Figure 10. Two-Dimensional Vector Model for Evaluating the Impact of Factors on Investment Decisions.

For overall quantitative evaluation of the impact of factors on investment decisions, it is proposed to use the integral index I_{IF}, which is calculated using the following formula:

DOI: 10.55643/fcaptp.1.60.2025.4548

$$I_{\text{IF}} = p_{I_{IQN}}^{weight} \cdot I_{\text{IQN}} + p_{I_{IQL}}^{weight} \cdot I_{IQL} \quad (1)$$

where $p_{I_{IQN}}^{weight}$, $p_{I_{IQL}}^{weight}$ - are the weight indices respectively; I_{IQN} , I_{IQL} - are the values of the influence indices of qualitative and quantitative factors on investment decision-making respectively.

These weight indices are established by expert methods such that their total equals 1. The influence indices of qualitative and quantitative factors are determined through survey-based sampling of potential investors using questionnaires. The values of each index should range from 0 to 1. Thus, at the lowest level, $I_{IF} = 0$, and at the highest level, $I_{IF} = 1$. However, the quantitative assessment of this index does not provide a complete picture of the impact of factors on investment decisions but rather serves as a generalized assessment indicator. To obtain more comprehensive information, it is recommended to use the aforementioned two-dimensional model.

This model involves nine sectors for evaluating the integral index. The algorithm for determining the latter using the two-dimensional model is as follows:

1. Determine the relative importance of each index through expert assessment and questionnaires, which will limit the maximum score. The sum of the relative importance must equal 1.
2. Based on surveys and questionnaires, evaluate the value of the respective index within a range from 0 to the corresponding maximum score.
3. Assess the quantitative and qualitative factors for each index (low, moderate, or high) based on the following criterion: if the obtained value of a certain index is less than a third of the maximum score, then the level will be considered low; if it is between one-third and two-thirds, it is considered moderate; if it is more than two-thirds, it is considered high.
4. Plot the respective index values in the two-dimensional space and identify the sector of the model that characterizes the state of the influence factors on individual investors' decisions to purchase.
5. Draw appropriate conclusions considering the sector of the model in which the integral index IIF is positioned.

DISCUSSION

Research on the scientific perspectives of both foreign and domestic scholars regarding the prospects of developing the market for domestic government borrowing, as well as on the modelling of the impact of government bond issuance on the financial state of the country [1, 3-5, 7, 8, 11-14, 18, 19], has shown a significant focus on issues such as economic recovery, the issuance of new types of financial instruments, and the application of certain principles from the Marshall Plan for post-war economic recovery in Ukraine. However, in our opinion, insufficient attention has been paid to developing state-level measures for attracting private funds from individual investors for the purchase of government bonds. The capitalization of individual investors' savings in domestic government bonds, particularly military bonds and "recovery bonds," requires harmonizing the interests of both the state and investors, as well as creating state-level conditions to motivate the latter to support the stability of the country's financial system.

Given the realities of war and the associated economic, political, financial, social, and environmental risks, it is crucial for the state, as the government bonds issuer, to study the behaviour of individual investors in the domestic government borrowing market. Existing theories describing investor behaviour in financial markets [9, 11, 14, 15, 21, 22] do not account for the unique features of the domestic government borrowing market in a country at war, which requires substantial financial resources to cover the government debt deficit and for economic recovery. Based on these realities, the authors developed a trigger-vector model for the behaviour of individual investors in the domestic government borrowing market. This model enables the determination of the alignment between the actual and forecasted states of this market, allows adjustments to its developmental trends under the influence of various factors, assesses changes occurring in individual investor behaviour, and based on this, makes adjustments to the tactical goals of state financial policies to motivate individual investors to invest in the purchase of government bonds. This approach aims to achieve a consensus between public and private interests.

CONCLUSIONS

In circumstances of economic, political, financial, and social instability caused by the war, the state must seek additional sources of funding for both the defence budget and the overall economy. Domestic government borrowings are a priority source of financing the military, covering the state budget deficit, ensuring post-war economic recovery, and maintaining macro-financial stability. In Ukraine, the potential of personal finance is practically untapped by engaging individual investors in operations on the domestic government bond market.

In this regard, this article analyzes the advantages and disadvantages of possible investment options for individual investors. Based on the analysis of macro-indicators, the investment attractiveness of the domestic government bond market is demonstrated. Given the turbulence and uncertainty of government policies regarding personal finances, the developed trigger-vector model allows for assessing changes in the behaviour of individual investors in the domestic government bond market. This enables making adjustments to forecasts for future cooperation and investor motivation.

In the context of building a democratic society and forming a digital economy, mandatory buying or selling of government bonds by the state is unacceptable. Therefore, when developing measures to stimulate individual investors in the domestic government bond market, it is necessary to consider their investment capabilities and increase their interest in investing specifically in government bonds.

In order to achieve this, special attention should be paid at the state level aiming at:

- increasing individual investors' financial and digital literacy;
- enhancing the role of intermediary institutions;
- ensuring transparency of operations;
- and implementing patriotic education measures.

These efforts should help shape conscious investor behaviour and an understanding of the need to invest in financing victory and the post-war economic recovery of the state.

ADDITIONAL INFORMATION

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Conceptualization: Igor Lyutiy, Andriy Zhukov
Data curation: Andriy Zhukov
Formal Analysis: Andriy Zhukov
Methodology: Andriy Zhukov
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Supervision: Igor Lyutiy
Validation: Andriy Zhukov
Investigation: Andriy Zhukov
Visualization: Andriy Zhukov
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FUNDING

The Authors received no funding for this research.

CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

DOI: 10.55643/fcaptp.1.60.2025.4548

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ТРИГЕРНО-ВЕКТОРНА МОДЕЛЬ ПОВЕДІНКИ ІНДИВІДУАЛЬНИХ ІНВЕСТОРІВ НА РИНКУ ВНУТРІШНІХ ДЕРЖАВНИХ ЗАПОЗИЧЕНЬ

Зростання видатків на оборону, соціальний захист населення, відновлення економіки України в умовах зростання дефіциту державного бюджету потребує додаткового фінансування через розвиток ринку внутрішніх державних

запозичень і залучення коштів індивідуальних інвесторів. Останніми можуть виступати як фізичні особи, зокрема трудові мігранти, так і юридичні особи, особливо представники малого й середнього бізнесу, як резиденти, так і нерезиденти. У статті проведено моделювання впливу випуску облігацій державної позики на фінансову стабільність держави, напрями підвищення ефективності державної фінансової політики в контексті реалізації фінансового потенціалу індивідуальних інвесторів. Аналіз макропоказників дав змогу зробити висновок про те, що вільні кошти, які є у юридичних і фізичних осіб, не в повній мірі використовуються у фінансовій системі держави, що не дозволяє забезпечити макроекономічну стабільність, а відповідно впливає на обороноздатність України. Обґрунтовано доцільність вкладання власних коштів індивідуальними інвесторами саме в ОВДП, зокрема військові облігації. Визначено мету дослідження, яка полягає в розробці тригерно-векторної моделі поведінки індивідуальних інвесторів на ринку державних внутрішніх запозичень і обґрунтуванні напрямів її використання для залучення додаткових коштів на фінансування перемоги та повоєнного відновлення економіки України. В основі зазначеної моделі виокремлюється інвестиційний тригер, який дозволяє індивідуальним інвесторам прийняти обґрунтоване рішення на основі оцінки переваг і ризиків інвестування у військові ОВДП. Для оцінки впливу кількісних і якісних чинників, на прийняття рішень щодо інвестування в ОВДП, особливо військові облігації, тригерна модель доповнена векторною складовою.

Практичне використання тригерно-векторної моделі дасть змогу визначати відповідність фактичного стану ринку внутрішніх державних запозичень прогнозному, коригувати стратегію його розвитку, оцінювати зміни в поведінці індивідуальних інвесторів і вносити корективи в стратегічні й тактичні цілі державної фінансової політики з метою мотивації індивідуальних інвесторів до вкладання коштів у купівлю ОВДП.

Ключові слова: Ключові слова: фінансова політика держави, ринок внутрішніх державних запозичень, військові облігації, індивідуальні інвестори, тригерно-векторна модель, інвестиційний тригер, макрофінансова стабільність.

JEL Класифікація: E22, E62, G19, H56, H63, H81

DOI: 10.55643/fcaptp.1.60.2025.4548