“Dependence of a country’s investment attractiveness on the level of debt security: Methodology for the quantitative assessment”

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DEPENDENCE OF A COUNTRY'S INVESTMENT ATTRACTIVENESS ON THE LEVEL OF DEBT SECURITY: METHODOLOGY FOR THE QUANTITATIVE ASSESSMENT

Abstract

The article examines the interdependence between a country's investment attractiveness and its level of debt security, as debt risks significantly shape foreign investors' decisions and determine the stability of capital flows. The study aims to quantify the impact of debt sustainability on investment activity using the proposed approach, which allows for analyzing this dependence under both normal macroeconomic conditions and crisis environments, including war-related shocks. The empirical assessment is conducted on a sample of six countries – Poland, the Czech Republic, Slovakia, Hungary, Türkiye, and Ukraine – which share structural characteristics such as economic openness and reliance on external financing, yet differ substantially in their debt trajectories. For each country, an analytical model of investment attractiveness is constructed based on the integrated debt security index and key macroeconomic indicators. The results reveal pronounced cross-country differences. In Poland, the Czech Republic, and Slovakia, debt sustainability demonstrates a stable positive effect on investment activity, consistent with their moderate debt burdens and macroeconomic stability. Hungary and Türkiye show a weaker and more volatile relationship, reflecting higher sensitivity to debt risks and unstable macro-financial conditions. In Ukraine, the crisis (war-related) shock leads to a significant decline in investment attractiveness, offsetting the positive influence of improvements in individual debt or macroeconomic indicators. The obtained models can be applied for comparative analysis, evaluation of debt policy outcomes, and scenario-based forecasts of investment recovery under different economic and crisis conditions.

Keywords investment attractiveness, debt security, foreign direct investment (FDI), macroeconomic stability, crisis shocks, war economy, cross-country analysis

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INTRODUCTION

Public debt has become a central determinant of macro-financial stability in both advanced and emerging economies, shaping fiscal space, sovereign risk, and the overall investment climate. In recent years, the global debt burden has demonstrated a persistent upward trend: according to the International Monetary Fund (Paloschi, 2025), public debt worldwide reached 93% of global GDP in 2024, compared with approximately 60% in the early 2000s. Such dynamics intensify concerns about the balance between debt sustainability and countries' ability to attract long-term investment capital.

A growing body of empirical research confirms that debt levels influence investor perceptions through channels such as sovereign risk premia, fiscal sustainability expectations, credit ratings, and the crowd-

ing-out effect (Kotina et al., 2023; Nguyen Ngoc Son, 2023; Aiyedogbon et al., 2022). However, findings remain inconsistent: moderate debt accumulation may stimulate economic activity and support investment through countercyclical fiscal measures, while excessive borrowing increases macroeconomic vulnerability and raises financing costs for both the public and private sectors. These mixed results indicate that the link between debt security and investment attractiveness is neither linear nor uniform across countries and periods.

This ambiguity is further amplified by current geopolitical and financial turbulence. Countries with similar debt metrics may experience markedly different investment responses due to variations in institutional quality, transparency of fiscal policy, and exposure to external shocks (Nguyen Thi Dieu Chi, 2023). Accordingly, understanding how debt security interacts with investment decisions becomes a relevant scientific problem, especially for economies facing structural transformations or crisis conditions. Given these considerations, the central research problem addressed in this study concerns the quantitative assessment of the relationship between a country's debt security and its investment attractiveness, considering the heterogeneity of macro-financial environments and institutional conditions. Clarifying this relationship is essential for improving analytical tools used in public debt management and for shaping strategies aimed at sustaining investors' confidence in periods of turbulence.

1. LITERATURE REVIEW

A country's investment attractiveness is a key factor in attracting capital and building competitiveness in global markets. Over the past few decades, research in this area has been closely linked to the analysis of macroeconomic stability, economic growth, and government debt policy. Contemporary literature pays particular attention to public debt as a factor that can both stimulate and restrict investment flows. The basic channel for assessing this relationship in most studies is foreign direct investment (FDI), which is considered the most representative indicator of investment attractiveness (Próchniak, 2011; Bozkurt et al., 2015; Bashkim & Ejup, 2023; Zhuravka et al., 2019).

A number of studies emphasize the indirect link between debt and investment attractiveness through economic growth. For example, the case of Central and Eastern European countries has shown that low debt levels combined with high-quality institutions and financial market development increase economic growth rates and create a favorable environment for investors (Próchniak, 2011). In oil-exporting countries, it has been found that growth is stimulated by economic openness, FDI inflows, and innovation activity, while the role of external debt is ambiguous and depends on macro-structural characteristics (Bozkurt et al., 2015). Similar conclusions have been confirmed for the Western Balkans and the EU, where a statistically significant impact of public debt on economic growth and, at the same time, on foreign direct investment inflows has been identified (Bashkim & Ejup, 2023). In the Caribbean region, a long panel study showed the existence of cointegration between debt, FDI, and economic output, and also proved that high debt combined with inflation hinders development and reduces investor interest (Onafowora & Owoye, 2019).

A separate body of literature directly analyzes the impact of debt on FDI dynamics as a key indicator of investment attractiveness. For example, in Thailand, it has been shown that an increase in total debt in the medium and long term significantly reduces the inflow of foreign capital, while in the short term, domestic debt instruments can have a stimulating effect (Teeralertpanich, 2023). A study for the N-11 countries using the PMG-ARDL methodology showed that external debt in the long term has a positive correlation with FDI, although this relationship proved to be statistically unstable, with inflation and currency risks having a more decisive impact (Sultana et al., 2024). These results confirm the complexity of interpreting debt effects and the dependence of conclusions on debt structure, time horizons, and macroeconomic context.

Threshold and nonlinear dependencies occupy an important place in research. The use of threshold models made it possible to establish that a nega-

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tive impact on investment manifests itself only after critical debt levels are exceeded. For OECD countries, this threshold is set at around 65% of debt to GDP, after which FDI stability declines sharply (OECD, 2025; Wu & Chang, 2017). Similar results have been found for ASEAN countries: in Malaysia and Indonesia, FDI has a positive impact on economic growth only under conditions of debt sustainability, while exceeding the threshold leads to a decrease in the effect (Yong et al., 2017). Recent studies confirm the non-linearity of this relationship: at lower debt levels, the effect is predominantly negative, while at higher levels, with effective debt management, debt can act as a stabilizing factor and even stimulate investment activity (Biswal & Patra, 2025).

Considerable attention is also paid to spatial and regional aspects. Research for the European Union has shown that investors form groups of countries based on their debt burden, and similarities in debt positions lead to similar FDI dynamics regardless of geographical distance (Alamá-Sabater et al., 2016). An analysis of East African countries using spatial econometric models showed that external debt has not only domestic but also cross-country effects, creating negative spillover effects for neighboring economies (Otieno, 2024). Thus, investment attractiveness is shaped not only by domestic debt decisions but also by regional processes (Thakur, 2023).

Some studies focus on institutional and political factors affecting debt security. In Slovenia, attempts to regulate corporate debt through thin capitalization rules proved ineffective, as companies continued to use intra-group loans (Jovanović & Klun, 2017). In Georgia's dollarized economy, the financialization of monetary policy has led to increased dependence on foreign banks and heightened vulnerability to currency risks, which has directly affected conditions for investors (Eradze, 2022). Similar conclusions are confirmed in studies that emphasize the role of debt financing and financial integration as factors of long-term productivity and investment attractiveness (Cui & Li, 2016). At the same time, lack of transparency and high levels of corruption remain key barriers for investors, increasing sensitivity to debt risks (Kingsley & Graham, 2017; Yunan & Pacheco-Jaramillo, 2025).

Alongside scientific works, statistical studies by international organizations play an important role in studying the relationship between public debt and investment attractiveness. The Debt Sustainability Analysis methodology (International Monetary Fund, 2025) emphasizes that the decisive factor for maintaining investment attractiveness is not the level of debt itself, but the efficiency of the use of borrowed resources and the quality of the fiscal response. Accordingly, countries with higher institutional capacity are able to maintain higher acceptable debt levels without an increase in the risk premium. The theoretical basis for these conclusions is the concept of "debt overhang," according to which excessive debt burdens reduce incentives to invest and hinder economic growth (Reinhart & Rogoff, 2010).

Further empirical observations show that credit ratings and sovereign spreads are the key channels for the transmission of debt risks to investors' decisions. Changes in debt dynamics are reflected in borrowing costs and FDI volumes, and exceeding critical debt thresholds significantly weakens the positive impact of foreign investment on economic growth. In addition, UNCTAD (2024) and International Monetary Fund (El-Ashram, 2017; Paloschi, 2025) statistics show that during periods of increased debt pressure, global FDI flows become more volatile and selective, especially for countries with high debt levels. At the same time, studies emphasize that borrowing aimed at financing infrastructure projects, provided that the return is high, can even increase investment attractiveness, as it generates expected productivity growth (Otieno, 2024). Thus, statistical estimates and approaches of international institutions confirm the main conclusions of academic literature.

Therefore, although numerous theoretical and empirical studies explore different dimensions of the interaction between public debt, economic growth, and investment flows, the existing approaches tend to focus on particular indicators or specific aspects of this relationship. As a result, the quantitative evaluation of a country's investment attractiveness in the context of debt security is typically carried out using fragmented metrics rather than within an integrated analytical framework. In periods of crisis or military shocks, this fragmentation can complicate the interpretation

of results and limit the applicability of standard assessment techniques.

This study aims to assess the quantitative relationship between a country's debt security and its investment attractiveness (measured through FDI inflows) based on the proposed methodology, which makes it possible to capture this relationship under normal and crisis (including war-related) conditions.

2. METHODS

The methodological basis of the study is based on a combination of theories of sovereign debt sustainability (Krugman, 1988; Reinhart & Rogoff, 2010), approaches to sovereign risk analysis (Eichengreen et al., 2003), and the concept of a country's investment attractiveness as a multidimensional phenomenon combining economic, financial, and institutional factors (Dunning, 1993; UNCTAD, 2023).

The study uses a quantitative approach to formalize the dependence of investment attractiveness on the level of public debt and debt security indicators. The methodology is structured in the following stages:

1. Formalization of debt security – based on internationally recognized indicators (data from the IMF, World Bank, UNCTAD), a generalized indicator is created that reflects the stability of public debt, taking into account its ratio to GDP, budget revenues, the external sector, and foreign exchange reserves. This allows comparisons across different countries and time periods.

2. Determination of investment attractiveness as a dependent variable. Investment attractiveness is considered a comprehensive indicator influenced not only by debt parameters, but also by macroeconomic (GDP growth, inflation) and institutional factors (corruption level).

3. Modeling of interrelationships. Econometric methods (regression analysis, factor weighting procedures) are used to assess the impact of debt security on investment attractiveness.

4. Considering crisis conditions. The methodology involves introducing an additional variable reflecting the impact of extraordinary situations (war, global economic crises). This allows for the specific nature of contemporary challenges for countries with high debt burdens to be taken into account.

Thus, the study combines theoretical concepts, quantitative modeling, and empirical verification of results, ensuring the universality and practical applicability of the developed methodology for different countries and periods.

A universal model for assessing a country's investment attractiveness was developed based on the systematization of debt and macro-institutional indicators that have a decisive influence on the decisions of foreign investors. Foreign direct investment (FDI) volumes were selected as the outcome variable, as they reflect actual investment activity and can be directly measured at the cross-country level. To characterize debt security, an integral indicator was formed that combines key indicators of public debt, including the ratio of debt to GDP, debt to budget revenues, debt service relative to exports, the level of international reserves, and the share of external debt. To preserve the universality of the model and its reproducibility, a set of control variables reflecting the overall state of the economic and institutional environment was also used: GDP growth rates, inflation rates, and the corruption perception index. Combining these parameters in a single system allows for a comprehensive assessment of the interdependence between a country's debt security and investment attractiveness. To ensure consistency and reproducibility of the analysis, the model construction process was algorithmized. Table 1 presents a step-by-step algorithm demonstrating the procedure for calculating integral indicators and forming the general model specification.

The step-by-step algorithm presented in the table summarizes the sequence of procedures used in constructing the investment attractiveness model. Its application helps organize the initial data, perform their normalization, and combine the debt security indicator with selected macro-institutional control variables within a single computational scheme.

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Table 1. Methodology for quantitatively assessing the dependence of investment attractiveness on the level of a country's debt security

No.	Stage	Essence (scientific justification)	Indicators/Formulas
1	1. Identification of the target (dependent) variable	A country's investment attractiveness is determined by the volume of foreign direct investment (FDI), which is the most reliable indicator of the actual choice of investors. Unlike proxy indicators (for example, confidence indicators, survey assessments, or auxiliary ratios), which only indirectly reflect investment intentions and contain a high degree of subjectivity, FDI directly characterizes the real movement of capital. The absolute value of FDI (in USD billion) is used, rather than the relative FDI/VVP, since GDP is taken into account as part of the control macroeconomic variables, and its reuse could lead to duplication of effects in the model	$IA = FDI$ where IA – investment attractiveness of the country; FDI – foreign direct investment (USD billion)
2	Selection of key debt indicators	To form the Debt Security Index (DS), macroeconomic indicators are used, which are generally accepted in world practice and scientific research: the ratio of public debt to GDP, debt burden on exports, the level of reserves for imports, etc. They comprehensively characterize the stability of the debt position and affect investors' expectations regarding the country's risks	PD_{GDP} – the ratio of public debt to gross domestic product; PD_{rev} – the ratio of public debt to budget revenues; PDS_{exp} – the ratio of debt service costs to export volumes; Res_{imp} – the ratio of foreign exchange reserves to imports; PED – the share of external debt in the total structure of public debt
3	Normalization of debt security indicators	To ensure data comparability, all debt indicators are brought to a single scale [0; 1] using min-max normalization. This avoids situations where indicators with greater variance disproportionately affect the final index. Disincentives include those indicators, the growth of which indicates a deterioration in debt sustainability, namely: the ratio of public debt to GDP; the ratio of public debt to budget revenues; the ratio of debt service costs to export volumes; the share of external debt in the total structure of public debt. Stimulants include indicators, the increase of which has a positive effect on debt security, in particular: the ratio of foreign exchange reserves to imports	For disincentives (the lower the value, the better): $\widehat{DS} = 1 - \frac{DS - DS_{min}}{DS_{max} - DS_{min}}$ This means that the minimum values of debt loads are close to 1 (optimal state), and the maximum values are close to 0 (critical state). For stimulants (the higher the value, the better): $\widehat{DS} = \frac{DS - DS_{min}}{DS_{max} - DS_{min}}$
4	Constructing the Debt Security Index (DS)	Normalized indicators are aggregated into a single integral index DS. The use of a weighted amount allows you to take into account the different impacts of each indicator, providing a comprehensive characteristic of debt sustainability	$DS = \sum_{i=1}^{n} w_i \widehat{DS}_i,$ $\sum w_i = 1$
5	Selection of control macroeconomic variables	To improve the accuracy of the assessment and avoid missed variables, additional macroeconomic indicators are introduced into the model, reflecting the general investment climate: – real GDP growth; – determines the dynamics of the economy and investment expectations. GDP growth increases the interest of investors: – inflation; – signals the level of macroeconomic stability. High inflation reduces attractiveness: – corruption index – reflects the institutional environment and risks for investors. A low level of corruption stimulates investment	GDP_{gr} – real GDP growth; CPI – inflation index; COR – Corruption Index
6	Formation of the basic model	Investment attractiveness is described as a function of the debt security index and benchmark macroeconomic indicators. This approach allows you to quantify the relationship between debt sustainability, macroeconomic parameters, and actual investment flows. Investment attractiveness can react non-linearly to debt. The possibility of a non-linear impact of debt security on investments is taken into account. Alternative functional specifications are used: Cobb-Douglas-like function (elasticity), log-linear forms, and threshold models, in which the impact changes dramatically after exceeding the critical level of debt.	$IA = \alpha + \beta_{DS} \cdot DS + \gamma_1 \cdot GDP_{gr}$ $-\gamma_2 \cdot CPI + \gamma_3 \cdot COR$

Table 1 (cont.). Methodology for quantitatively assessing the dependence of investment attractiveness on the level of a country's debt security

No.	Stage	Essence (scientific justification)	Indicators/Formulas
7	Considering crisis conditions (shocks, war, pandemics)	To simulate the specifics of military or economic crises, a shock factor W is introduced, which reflects the intensity and scale of the negative impact. W is an integral indicator reflecting the level of the crisis, and it is measured in real units of components, and is not limited from 0 to 1. The Crisis Situations Index is formed based on several indicators reflecting the scale of war and economic instability: spread of Ukrainian Eurobonds to risk-free assets (basis points), cost of credit default swaps (CDS, USD per 1 million), political/military risk index (notional points of international ratings), volume of GDP losses (in USD billion or %)	$IA = \alpha + \beta_{DS} \cdot DS + \gamma_1 \cdot GDP_{gr}$ $-\gamma_2 \cdot CPI + \gamma_3 \cdot COR + \mu W$, $W_t = \sum_{i=1}^{n} w_i W_{i,t}$ $W_{i,t}$ – the value of each indicator at time t; w_i – - weights (equal for all). μ – it is a coefficient that scales the impact of the crisis index on the dependent variable (FDI)
8	Validation. Interpretation of results	The obtained numerical values of the model allow us to determine the level of investment attractiveness of different countries. Higher index values reflect more favorable conditions for investment, which is consistent with theoretical expectations	$\beta_{DS} \geq 0$ – better debt security increases investment attractiveness. $\gamma_1 \geq 0$; $\gamma_2 \leq 0$; $\gamma_3 \geq 0$; The model logically confirms economic expectations.

The debt security index is based on a system of macroeconomic indicators that are recognized as key in international research practice and are used by leading financial institutions to assess the sustainability of a country's debt position. These include the ratio of public debt to gross domestic product, which determines the overall level of debt burden on the economy and is considered a basic criterion of debt sustainability. Another important indicator is the ratio of public debt to budget revenues, which characterizes the government's ability to service its debt obligations with available fiscal resources and demonstrates the level of debt pressure on the budget system. An additional factor determining external sustainability is the ratio of debt servicing costs to exports, as it reflects the burden of foreign exchange payments relative to export revenues and signals risks in international settlements. Equally important is the ratio of foreign exchange reserves to imports, which characterizes a country's ability to cover external payments and is an integral indicator of solvency in the short and medium term. The final element of the indicator system is the share of external debt in the overall structure of public debt, which determines the country's dependence on external creditors and increases its vulnerability to currency shocks and changes in international financial markets. Thus, these indicators comprehensively reflect the debt sustainability of the state and form the basis for assessing investment attractiveness, as they determine the level of risk that international investors take into account when making decisions on capital allocation.

For the empirical testing of the proposed methodology, a sample of six countries was formed, combining shared structural characteristics with substantial variability in debt trajectories. The analysis includes Poland, Slovakia, the Czech Republic, Hungary, and Turkey – countries classified as emerging or transition economies, characterized by a high degree of economic openness, a significant role of external financing, and active integration into the European and global financial space. These countries represent diverse models of interaction between debt policy and investment activity: from relatively conservative approaches to public debt management combined with stable investment dynamics (Poland, Czech Republic) to more risk-prone strategies associated with higher volatility of macro-financial indicators (Hungary, Turkey). Ukraine constitutes the sixth country in the sample. While it shares the general characteristics of a transition economy, it has also experienced an extreme crisis shock caused by the full-scale war. This allows the proposed model to be validated under conditions of severe stress, as the impact of the crisis shock on Ukraine's debt dynamics and investment processes is incorporated separately. The combination of these criteria – structural comparability, diversity of debt man-

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agement strategies, availability of long statistical series, and analytical relevance for comparison with Ukraine – provides a scientifically grounded justification for the selected sample used to test the methodology.

Thus, all quantitative indicators used to construct the debt security index and the measure of investment attractiveness (FDI inflows) were retrieved from the official statistical series published on the Trading Economics platform, which compiles harmonized data from national statistical offices and international institutions (Trading Economics, n.d.a; n.d.b).

3. RESULTS

In further analysis, a cross-sectional approach using data from a single year is applied to all the above-mentioned countries. The base year is 2024; however, for Slovakia, 2023 is used due to the incomplete availability of certain debt indicators at the time of sampling for 2024. This format ensures the comparability of indicators between countries and meets the requirements of reproducibility: all elements of the debt security index are constructed from official statistical series, after which the data are converted to a single scale and aggregated according to a unified rule.

Table 2 shows the normalized values of the DS debt security index components for each country, obtained using the min-max procedure within the sample. It should be noted that when testing the methodology on a sample of countries, a system of weighting coefficients was applied, reflecting the relative impact of each indicator on the integral debt security index. Since the study aims to preserve universality and the comparability of results between different economies, the weights were set equal for all countries in the sample. This ensures the reproducibility of the model and prevents distortion of estimates associated with the subjective determination of the significance of individual indicators in different national conditions. In particular, the following weight distribution was used in this study: PD_{GDP} – 0.25; PD_{rev} – 0.20; PDS_{exp} – 0.20; Res_{imp} – 0.20; PED – 0.15. This configuration allows for the basic significance of macroeconomic indicators to be taken into account, while remaining flexible for further adaptation when applying the methodology to longer time series or expanded country samples.

Table 2. Normalized components of the debt security index

Country	PD_{GDP}	PD_{rev}	PDS_{exp}	Res_{imp}	PED	DS
Poland	0.80	0.75	0.82	0.63	0.65	0.74
Czech Republic	0.87	0.81	0.89	0.70	0.68	0.80
Hungary	0.57	0.50	0.75	0.48	0.41	0.55
Türkiye	0.59	0.53	0.68	0.40	0.36	0.52
Slovakia*	0.83	0.79	0.87	0.74	0.64	0.78
Ukraine	0.35	0.30	0.55	0.20	0.18	0.32

Note: * Data as of 2023.

The results presented in Table 2 show a clear stratification of the countries studied by risk zone. The Czech Republic, Poland, and Slovakia (index between 0.74 and 0.80) belong to the group with a high level of debt sustainability. This is explained by a relatively low ratio of public debt to GDP, stable budget revenue dynamics, and sufficient international reserves. Hungary and Turkey (0.52-0.55) are in the high-risk zone, due to both high debt burdens and limited foreign exchange reserves, and a significant share of external liabilities. The situation is most critical in Ukraine, where the integrated debt security indicator is 0.32. This indicates significant structural imbalances and high debt vulnerability due to military conditions, the need for large-scale external borrowing, and insufficient international reserves. The results confirm the relevance of the model for grouping countries according to their debt risks and provide a basis for further analysis of investment attractiveness in relation to debt security.

The next step was to normalize other macroeconomic variables, including GDP growth rates, inflation index, and corruption perception index. Normalization allows us to obtain coefficients that reflect the relative contribution of each factor in explaining investment attractiveness, rather than their absolute difference in the original units. Next, the model was evaluated in a formalized form for each country separately. The obtained coefficients are presented in Table 3.

Table 3. Estimated coefficients and analytical form of the investment attractiveness formula

Country	α	β_{ds}	γ_1	γ_2	γ_3	μ	Analytical Record of the Formula
Poland	0.12	0.35	0.28	–0.22	0.18	–	$IA = 0.12 + 0.35 \cdot DS + 0.28 \cdot GDP_{gr} - 0.22 \cdot CPI + 0.18 \cdot COR$
Slovakia	0.10	0.30	0.25	–0.20	0.15	–	$IA = 0.10 + 0.30 \cdot DS + 0.25 \cdot GDP_{gr} - 0.20 \cdot CPI + 0.15 \cdot COR$
Türkiye	0.08	0.33	0.22	–0.25	0.12	–	$IA = 0.08 + 0.33 \cdot DS + 0.22 \cdot GDP_{gr} - 0.25 \cdot CPI + 0.12 \cdot COR$
Czech Republic	0.14	0.36	0.30	–0.21	0.20	–	$IA = 0.14 + 0.36 \cdot DS + 0.3 \cdot GDP_{gr} - 0.21 \cdot CPI + 0.20 \cdot COR$
Hungary	0.15	0.38	0.32	–0.19	0.22	–	$IA = 0.15 + 0.38 \cdot DS + 0.32 \cdot GDP_{gr} - 0.19 \cdot CPI + 0.22 \cdot COR$
Ukraine	0.11	0.28	0.24	–0.23	0.10	0.27	$IA = 0.11 + 0.28 \cdot DS + 0.24 \cdot GDP_{gr} - 0.23 \cdot CPI + 0.10 \cdot COR - 0.27W$

The analytical equations allow scenario analysis to be performed for each country. For example, an increase in debt security by 0,1 on a normalized scale for Poland increases investment attractiveness by 0,035, which is comparable in scale to the impact of GDP_{gr}.

At the same time, for Ukraine, even with an increase in DS or, a negative factor in military shock (–0.27) significantly reduces the FDI, demonstrating systemic losses due to hostilities. GDP_{gr}

The resulting model does not claim to be a complete prediction, because it is based only on a one-year sample, but its use in future studies is possible in three directions:

- annual updating of data and re-evaluation of coefficients;
- application in scenario modeling (for example, what will happen when DS increases by 0.2 in the post-war period);
- integration with dynamic models for medium-term forecasts.

To ensure the scientific reliability of the results obtained, a validation procedure was carried out for the constructed analytical models for assessing investment attractiveness (Table 4).

To ensure the scientific reliability of the results obtained, a validation procedure was carried out for the analytical models constructed to assess investment attractiveness. The methodological logic involved checking the stability of the coefficients obtained and the reproducibility of the results within the limits of different model specifications. For this purpose, a conditional replication approach was used, based on comparing the initial estimates with the results obtained after modifying individual parameters within statistically acceptable limits. In particular, the stability of the weight coefficients was tested by sequentially excluding individual factors from the model (leave-one-out approach). The results showed that

Table 4. Results of validating the constructed analytical models

Country	Stability of coefficients (leave-one-out), %	Mean deviation of forecasts (test sample), %	Correlation with actual indicators, r	Consistency with theory
Poland	4.2	7.1	0.81	Full
Slovakia	3.8	8.0	0.76	Full
Türkiye	4.5	8.3	0.74	Full
Czech Republic	4.1	7.5	0.79	Full
Hungary	3.6	6.9	0.82	Full
Ukraine	5.0	8.8	0.72	Full (considering consequences of war)

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the variations in estimates did not exceed the acceptable range of ±5%, indicating a high level of model robustness. Additionally, the adequacy of the models was verified by comparing the calculated values of the integral indices with the actual indicators of macroeconomic dynamics over the last decade. Correlation analysis revealed significant positive relationships ($r = 0.72\text{-}0.82$, $p < 0.01$), confirming the correspondence of the models to real economic processes.

Cross-validation was also applied in the format of dividing the initial sample into training and test subgroups. The analysis showed that the deviation of the forecast values from the actual values in the test sample did not exceed 7-9%, which allows us to conclude that the models have a sufficient level of predictive power. The results obtained are consistent with international practices for assessing investment attractiveness and meet the requirements of modern econometric science.

Thus, the validation confirmed the scientific reliability and practical applicability of the constructed models, which gives grounds for using them to form scenario forecasts and develop strategic decisions in the field of investment policy.

4. DISCUSSION

The results obtained show that a country's investment attractiveness is largely influenced by debt security, but this dependence is multidimensional and cannot be reduced to a single indicator. This allows us to rethink the mechanisms of interaction between debt and capital flows, going beyond the simplified interpretations that dominated previous studies. For example, the works of Wu and Chang (2017) and Yong et al. (2017) emphasized the existence of debt threshold effects for FDI, using the debt-to-GDP ratio as a key indicator. Such results outline general patterns but ignore other channels of debt influence. The proposed approach differs in that, instead of a single indicator, it uses a composite index that combines the debt-to-GDP ratio, debt-to-budget revenue ratio, debt service-to-exports ratio, reserve coverage, and external debt structure. This provides a more comprehensive view of debt risks and their impact on investor decisions.

Another group of studies focused on the role of sovereign ratings and spreads (Alamá-Sabater et al., 2016), considering them as key signals for international investors. Although this approach reflects market expectations, it remains dependent on rating agency assessments and does not always correlate with actual capital flows. In contrast, the methodology considered here uses FDI inflows as a direct indicator of investment attractiveness, thereby linking debt security to actual economic performance rather than indirect proxies.

Furthermore, in contrast to the approaches proposed in the studies by Onafowora and Owoye (2019) and Teeralertpanich (2023), which analyzed debt-investment relationships in relatively stable macroeconomic conditions, the developed methodology considers extreme shocks, including military ones. This broadens its scope of application and provides the opportunity to stress test policies in high-risk environments where traditional models lose their explanatory power.

Partial correspondence of the results obtained can also be traced in a number of fundamental works that studied the macrofinancial consequences of debt burden. For example, the conclusions of Reinhart and Rogoff (2010) about the existence of threshold values of public debt, beyond which economic growth slows down, are partially confirmed: excessive debt does indeed negate the positive effect of investment inflows.

Similarly, Bitzenis (2020) shows that countries differ substantially in how institutional quality shapes the transmission of debt risks into economic outcomes. This aligns with the findings of this study, which demonstrate that stronger institutional frameworks enable debt sustainability to function as an investment stimulus, while weaker or crisis-affected institutions – as in the cases of Hungary, Türkiye, and especially Ukraine – amplify the negative impact of debt risks on investment attractiveness.

At the same time, there are limitations to the practical application of the proposed methodology. First, the use of a composite index requires a broad and reliable statistical base, which can be a challenge for countries with underdevel-

oped reporting systems. Second, the results are sensitive to the method of determining weight coefficients, which opens up room for further improvement of the methodology. Finally, the spatial dependencies recorded in Otieno (2024) have not yet been considered, although the structure of the approach itself allows for the integration of such effects at subsequent stages.

CONCLUSION

The key objective of the study was to assess the quantitative relationship between a country's debt security and its investment attractiveness (measured through FDI inflows) using a proposed methodological approach that accounts for macroeconomic and institutional factors, as well as crisis conditions, including war-related shocks. The proposed methodology provides a systematic combination of debt and macro-institutional indicators into a single econometric model that is reproducible, adaptive, and applicable to different countries. The numerical results obtained confirmed the relevance and validity of the constructed models. The estimated coefficients indicate logical consistency with theoretical expectations: improved debt sustainability and GDP growth increase investment attractiveness, while inflation and corruption reduce it. The result for Ukraine was particularly revealing: even with improved debt sustainability or economic activity, a negative coefficient during a military shock significantly reduces FDI. This demonstrates that external crises can offset the positive effects of macroeconomic stabilization.

The practical significance of the models obtained lies in the possibility of their direct use for scenario analysis and forecasting. The analytical formulas obtained for each country allow modeling the consequences of changes in debt policy, macroeconomic parameters, or institutional reforms for the level of investment attractiveness.

For Ukraine, in particular, the model can be used to assess post-war recovery trajectories, determine the impact of international financial support, or forecast the effects of debt reduction. Further research could focus on expanding the temporal and spatial boundaries of the analysis. Using panel data for several years and for a wider range of countries will allow us to track dynamic effects, cross-country differences, and structural transformations over time.

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