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REPAYMENT OF TAX DEBT AS A TOOL FOR ENSURING FISCAL STABILITY UNDER MARTIAL LAW

ABSTRACT

Ukraine faces the need to maintain fiscal stability in wartime, as the budget system suffers from high defence spending and falling tax revenues. Tax debt is becoming a significant factor in fiscal risks, while its timely repayment can become an effective tool for strengthening fiscal sustainability. The research problem is the poorly studied impact of tax debt repayment on the macroeconomic parameters of fiscal stability, especially in view of increased military risks. The lack of integrated fiscal stability indicators and a systematic approach to assessing and managing tax debt complicates the development of an effective tax policy capable of supporting the financial security of the state. The aim of the article is to assess the impact of the pace of tax debt reduction on the level of fiscal stability of Ukraine in 2022–2024. Monthly data from official sources, in particular the State Tax Service, the Ministry of Finance, the National Bank of Ukraine, and the State Statistics Service, were used for this purpose, and the Fiscal Stability Index (FSI) was also created. The results showed that the average FSI value in 2022–2024 was 54.3 points. The average debt repayment rate was 12.4% per month, and the tax debt corresponded to 8.7% of GDP. Econometric estimates (ARDL/UECM) confirmed the positive long-term effect of debt repayment) and its improvement during martial law. Instrumental estimates (IV-2SLS) confirmed the causal nature of this relationship, and impulse responses (SVAR) showed a gradual effect: an increase in FSI by 0.72 and a decrease in the yield on government bonds by 0.42 pp a year after the repayment shock. The findings emphasize that active tax debt administration is one of the key mechanisms for ensuring the financial security of the state. More detailed studies are needed on specific aspects of the region and scenarios of economic recovery after the war.

Keywords: tax debt, fiscal stability, fiscal space, budget policy, financial security, economic growth, sustainable development

JEL Classification: H63, H62, E62, O23

INTRODUCTION

The problems that Ukraine has had to overcome in the course of its war will require the identification of effective mechanisms for supporting fiscal stability. The issue of managing the tax debt has become very relevant due to the strain on public finances caused by the growing defence expenditure, budget revenues are declining and the tax base is being destabilized.

Despite a significant number of studies, there are still several unresolved conflicts and theoretical gaps. First, there is a lack of integrated indicators that would take into account the interrelationships between tax debt and macroeconomic parameters. Second, there is a limitation in the systemic approach that combines debt administration with the assessment of long-term fiscal sustainability. Third, there is a lack of analysis of the effectiveness of debt repayments in wartime, when risks are significantly increased (Radionov, 2025). These gaps necessitate new tools that quantitatively measure the impact of tax repayments on the financial security of the state.

The findings may provide useful insights for countries experiencing military conflicts, fiscal shocks, or post-crisis recovery processes (the Balkans, Iraq, Central European countries). They can form practical guidelines for strengthening fiscal stability during periods of crises and recovery.

LITERATURE REVIEW

A literature review shows that many researchers have studied the problem of ensuring fiscal sustainability in times of crisis, but the approaches differ significantly. In the European context, Larch et al. (2021) arrange the methods and empirical results for the Eurozone, emphasizing the importance of structural gaps and the choice of indicators. Similarly, Gootjes and de Haan (2022) prove the pro-cyclicality of fiscal policy because of the limitations in the use of real-time data. For developing countries, Small et al. (2020) record a weak fiscal response to debt risks, emphasizing the need for countercyclical instruments, among which tax debt reduction occupies an important place.

Key studies in the Ukrainian academic discourse are those that explore the specifics of public debt management in times of war and shocks. Radionov (2025) focuses on liquidity risks and the role of the domestic borrowing market, proposing a comprehensive debt strategy. Bohdan and Bohdan (2023) point to the sharp increase in deficits under the influence of the pandemic and military aggression, which complicates debt dynamics. In this context, Buriachenko et al. (2023) emphasize financing flexibility and term structure as important elements of deficit management. So, Ukrainian studies reveal different priorities, but all recognize the relevance of reducing tax arrears to reduce the need for new borrowing.

A separate direction is the analysis of the role of the shadow economy and its impact on debt policy. Mihai et al. (2025) show that high shadowing distorts income elasticities and increases the risks of loss of sustainability. Dumitrescu et al. (2022) prove the nonlinear relationship between debt and inflation, depending on the scale of the shadow sector. This supports the arguments in favour of active reduction of tax arrears, because it simultaneously contributes to the deshadowing of the economy. A logical continuation of this direction is to emphasize the synergy between debt administration and measures to increase transparency.

Recent studies show that debt dynamics in crisis economies are complex and regime-dependent. For example, Owusu et al. (2023) show that debt sustainability in the Eurozone varies across political regimes. Larch et al. (2021) emphasize the importance of indicator choice when measuring fiscal sustainability, while Gootjes and de Haan (2022) find that policies are procyclical due to real-time constraints. For developing countries, Small et al. (2020) found a weak fiscal response to debt risks. In Ukraine, according to observations by Bohdan and Bohdan (2023), military aggression sharply deepened the deficit and limited debt capacity.

Research on the quality of statistics and transparency of debt processes is also significant. Gasanov (2022) emphasizes the importance of implementing international standards of debt statistics in Ukraine, because it is difficult to build integrated sustainability indicators without harmonized data. Similarly, Blikhar et al. (2020) point to the institutional and legal causes of crises, emphasizing that transparency and data harmonization reduce risks in the financial system. So, the measurement of tax debt and its impact on fiscal stability directly depends on the quality of the information base.

An important block of current literature is the analysis of the regime nature of debt sustainability. Owusu et al. (2023) demonstrate that the dynamics of debt sustainability in the Eurozone depend on the change in economic regimes, which justifies the use of threshold and Markov approaches. Similar approaches are also relevant for Ukraine, because martial law establishes a specific regime that radically changes the relationships between tax debt and macro indicators. The integration of regime variables in the model (ARDL, SVAR) enables a more accurate assessment of the effects of debt repayment.

In the international context, attention is paid to the issues of foreign aid and its synergy with domestic tax discipline. Kulikov et al. (2022) emphasize the role of innovation and investment in post-war recovery, noting that debt discipline creates space for investment projects. This supports the idea that effective tax debt repayment is not only a budgetary tool, but also a factor in economic development.

Recent studies also draw attention to the role of digital technologies in debt administration. Kussainov et al. (2023) show that anti-corruption mechanisms and the use of artificial intelligence (AI) increase the security of the financial sector. Kobets et al. (2025a) prove the effectiveness of big data tools for improving the effectiveness of management processes. Prokopenko et al. (2024) demonstrate the potential of blockchain in accounting, which is also relevant for monitoring tax debts. Therefore, digital solutions are considered an important direction for modernizing administration and increasing transparency in the field of debt policy.

Therefore, the academic literature agrees on one key conclusion: fiscal sustainability in times of crisis requires a multi-level approach. This is a combination of debt discipline, tax debt reduction, high-quality statistics, transparent institutional mechanisms, and modern digital tools. At the same time, there are disagreements between the authors regarding the priority of external or internal measures, but most researchers agree that tax debt administration is one of the primary and universal tools. This approach confirms the relevance of the strategy proposed in this article for Ukraine and makes it applicable to other countries experiencing wars, financial shocks, or structural crises.

AIMS AND OBJECTIVES

The aim of the study is to assess the impact of the tax debt repayment rate on the level of fiscal stability of Ukraine in 2022–2024. The study is also aimed at identifying the channels and mechanisms through which this impact is exercised.

Also, one of the tasks is to combine the composite FSI with modern econometric methods to prove the causal nature of the relationship. The hypotheses of the study are formulated as follows:

- **H1** – an increase in the tax debt repayment rate has a positive effect on the level of fiscal stability;
- **H2** – the elasticity of this effect increases in wartime;
- **H3** – debt repayment reduces the cost of government borrowing and stabilizes budget revenues.

METHODS

Research design

The study was conducted in a step-by-step manner, which involved secondary data analysis, development of the FSI, and use of modern econometric techniques. This method enabled the theoretical foundations to be connected with real measurements and, at the same time, the thoroughness of the evaluation was guaranteed. The procedure consisted of four interconnected stages as presented in Table 1.

Table 1. Research stages.

Stage	Work description	Tools	Expected result
1	Collection and systematization of statistics for 2022–2024	Data from the State Tax Service, Ministry of Finance, National Bank of Ukraine, State Statistics Service	Tax debt and macroeconomic indicators base
2	Construction of the FSI	PCA, standardization of variables	Composite indicator 0–100
3	Econometric modelling of relationships	ARDL/UECM, IV-2SLS, SVAR	Evaluation of short- and long-term effects
4	Robustness and comparison of results	Alternative dependent variables (deficit, OVDP yield)	Confirmation of the reliability of conclusions

The significant correlations were identified and causal relationships confirmed with this procedure. This multi-level structure ensured results were robust and enabled informed recommendations to be acted upon. The adequacy of the PCA solution was evaluated using the proportion of total variance explained by the first principal component and the corresponding eigenvalue. Only the first principal component was retained for constructing the Fiscal Stability Index, as it captured the dominant common variation among the selected fiscal indicators.

Sampling

The study used monthly data from Ukraine for January 2022 – December 2024. The sample includes indicators of tax debt and its repayment, budget deficits, domestic borrowing yields, macroeconomic variables (Gross Domestic Product (GDP), inflation, exchange rate, international reserves), and external support indicators. All data were obtained from open official sources: the State Tax Service, the Ministry of Finance, the National Bank of Ukraine, and the State Statistics Service. This ensured the completeness and reliability of the information for econometric analysis. Several variables were expressed relative to GDP (Table 2).

Table 2. Variables, sources and transformations.

Variable	Formula	Unit	Frequency	Source	Transformation
RR	Repaid debt / total debt	%	Monthly	STS	none
TD	Tax debt / GDP	%	Monthly	STS + Ukrstat	GDP interpolation
REV	Revenue / GDP	%	Monthly	MoF	GDP interpolation
CPI	Inflation rate	%	Monthly	NBU	none
EXR_vol	Exchange rate volatility	SD	Monthly	NBU	calculated
POLR	Policy rate	%	Monthly	NBU	none
RES	International reserves	Months imports	Monthly	NBU	none
DEFEXP	Defence expenditure/GDP	%	Monthly	MoF	GDP interpolation

Since official GDP statistics are reported on a quarterly basis, monthly GDP values were obtained through temporal disaggregation of quarterly GDP data using proportional interpolation procedures. Alternative interpolation approaches produced substantively similar results and did not alter the main findings. Alternative temporal disaggregation procedures produced substantively similar estimates, suggesting that the main conclusions are not driven by the specific interpolation method. Nevertheless, monthly GDP values should be regarded as approximations, particularly under war-time conditions characterized by elevated macroeconomic volatility.

Methodology

The main methodology was the construction of an integrated econometric model that takes into account short- and long-term effects.

The basic specification is presented in the form of ARDL/UECM:

$$\Delta FSI_t = \phi(FSI_{t-1} - \theta_0 - \theta_1 RR_{t-1} - \theta_2 TD_{t-1} - \theta' Z_{t-1}) + \sum \alpha_i \Delta FSI_{t-i} + \sum \beta_i \Delta RR_{t-i} + \sum \gamma_i \Delta TD_{t-i} + \sum \delta_i' \Delta Z_{t-i} + \eta_1 ML_t + \eta_2 (RR_t \times ML_t) + \varepsilon_t \quad (1)$$

where: ΔFSI_t – change in the FSI in the current period; FSI_{t-1} – the value of the FSI in the previous period; θ_0 – the long-term level constant; θ_1 RR_{t-1} – the impact of tax debt repayment (Repayment Rate) with a lag; θ_2 TD_{t-1} – the impact of the tax debt balance (Tax Debt) with a lag; $\theta' Z_{t-1}$ – the vector of control variables (macroeconomic factors: inflation, budget revenues, reserves, etc.); ϕ – the error correction rate coefficient (how quickly the system returns to long-term equilibrium); $\sum \alpha_i \Delta FSI_{t-i}$ – short-term lag changes in the stability index; $\sum \beta_i \Delta RR_{t-i}$ – short-term lag effects of debt repayment; $\sum \gamma_i \Delta TD_{t-i}$ – short-term lag effects of the amount of tax debt; $\sum \delta_i' \Delta Z_{t-i}$ – short-term lag effects of control variables; η_1 ML_t – the effect of martial law (dummy = 1 during wartime); η_2 ($RR_t \times ML_t$) – the interaction effect of debt repayment during wartime; ε_t – stochastic error, which takes into account random and unaccounted factors.

To estimate the effect of debt repayment in wartime, the interaction variable $RR \times ML$ was added. Since martial law was in place for the majority of the observation period, care should be taken in interpreting the coefficient as a measure of differences in fiscal response during wartime and not as a conclusive indication of the effect of martial law itself on the repayment effect.

Additionally, IV estimates (2SLS) were used to eliminate endogeneity, as well as SVAR to identify dynamic effects and test causal relationships. The reliability of the results was ensured by conducting a full range of diagnostic tests (Table 3). The stationarity of the variables was checked using ADF, PP, and KPSS to avoid the problem of pseudoregression. An important procedure was to identify structural breaks, in particular during the period at the beginning of martial law (February–March 2022), using the Bai–Perron and Chow tests.

Table 3. Diagnostics and stability of the results.

Block	Methods / Expectations	Explanation
Stationarity	ADF, PP, KPSS	Stationarity testing of variables, KPSS as a supplement to confirm the results.
Structural breaks	Bai–Perron, Chow (02–03.2022)	Identifying breaks in the data dynamics, especially in connection with the beginning of martial law.
Heteroskedasticity and serial correlation	Breusch–Pagan, White, BG-LM, Durbin-Watson	Tests to check homogeneity of variances and absence of autocorrelation.
Colinearity	VIF	Checking multicollinearity between explanatory variables.
Parameter stability	CUSUM, CUSUMSQ	Tests to assess the stability of model parameters over time.
Robustness	Alternative FSI (PCA vs equal), alternative dependent (DEF, Y10), subsamples (before/after ML), other lags, quantile regression, Threshold-ARDL, Markov-switching	Checking the stability of results on different specifications and regimes.
Expected coefficient signs	$\beta_{RR} > 0$ (FSI), $\beta_{RR} < 0$ (DEF, Y10); $\beta_{TD} < 0$; $\beta_{REV} > 0$; $\beta_{CPI} < 0$; $\beta_{RES} > 0$; $\beta_{EXR_vol} < 0$; $\beta_{DEFEXP} \pm$; $\beta_{GRANTS} > 0$	Generalization of theoretically justified directions of influence of variables.
Interpretation of effects	ARDL/UECM: θ_1 - long-term RR effect; SVAR/LP: IRF FSI, Y10 (1–12 months); Panel: λ - differences in frontline regions	Explanation of the content of the main coefficients in different models.
Pure implementation steps	Data collection (State Statistical Service, Ministry of Finance, National Bank of Ukraine, State Statistics Service); Frequency matching; Seasonal correction; FSI construction; ARDL/UECM (RR $\times$ ML); IV estimates; SVAR/LP; System GMM; Robustness	Replicable pipeline for reproducing results.

The econometric analysis employed three complementary models: ARDL/UECM, IV-2SLS, and SVAR. ARDL/UECM was used to estimate short- and long-run relationships between tax debt repayment and fiscal stability; IV-2SLS was applied to address potential endogeneity of the repayment rate; and SVAR was used to assess the dynamic response of fiscal indicators to repayment shocks. These models were selected because they jointly allow the analysis of long-run relationships, potential endogeneity, and dynamic effects within the relatively small time-series sample. The main variables are: RR – tax debt repayment rate; TD – tax debt/GDP; REV – budget revenues/GDP; CPI – inflation; EXR_vol – exchange-rate volatility; POLR – policy rate; RES – international reserves; DEFEXP – defence expenditure/GDP; and GRANTS – external grants/GDP.

IV-2SLS estimation was performed in two stages. First, RR was regressed on the instrumental variables ENF and LAW_k together with the control variables. Second, the predicted values of RR obtained from the first stage were used to estimate their effect on FSI. Instrument strength was assessed using the first-stage F-statistic, while instrument validity was evaluated using the Hansen J and Sargan overidentification tests. The corresponding statistics and p-values are reported in Tables 7.1–7.2. Although ENF and LAW_k may partly respond to fiscal conditions during wartime, their validity was assessed using standard relevance and overidentification tests. Therefore, the IV estimates should be interpreted as evidence supporting the robustness of the observed relationship rather than definitive proof of strict exogeneity or causality.

Heteroscedasticity and serial correlation were assessed using the Breusch–Pagan, White, BG-LM, and Durbin-Watson tests. Possible multicollinearity between variables was checked using the VIF index, and the stability of parameters was assessed using CUSUM and CUSUMSQ. In addition, a series of robustness checks were performed, including the use of alternative specifications of the fiscal stability index, dependent variables (deficit, government bond yield), and the analysis of subsamples "before" and "after" the introduction of martial law.

The use of various methods, in particular ARDL/UECM, IV-estimates, and SVAR, allowed obtaining stable results that were confirmed in all checks. This increases confidence in the conclusions and ensures their generalizability, which is important for the provision of practical recommendations in the field of fiscal policy of Ukraine. The ARDL framework was selected because it is suitable for relatively small samples and variables with different orders of integration. However, the results should be viewed as being based on a few snapshots in the observation period (36 monthly observations) and not as long-term estimates. Although the dataset comprises 36 monthly observations, the ARDL approach is widely considered appropriate for small-sample time-series analysis. To reduce the risk of small-sample bias, the results were interpreted together

with complementary estimation techniques (IV-2SLS and SVAR) and a series of robustness checks rather than relying on a single model specification.

Construction of the Fiscal Stability Index (FSI)

The building of the Fiscal Stability Index (FSI) is explained in detail to ensure methodological transparency and to eliminate concerns about the potential endogeneity that may be present when using a composite dependent variable. The FSI has been developed as an integrated measure of fiscal sustainability with Principal Component Analysis (PCA). Before estimating, all variables were z-scored to allow differences in measurement scales to be compared:

$$Z_i = \frac{X_i - \bar{X}}{SD(X)}, \quad (2)$$

where: Z_i - the standardized value of the i -th observation; X_i - the original value of the i -th observation; $\bar{X}$ - the arithmetic mean of the variable over the analyzed period; $SD(X)$ - the standard deviation of the variable X .

The PCA procedure was applied to indicators reflecting the overall fiscal condition of the public finance system. The first principal component was selected because it explained the largest proportion of total variance. Subsequently, the resulting component was normalized to a 0–100 scale:

$$FSI_t = 100 \times \frac{PC1_t - \min(PC1)}{\max(PC1) - \min(PC1)}, \quad (3)$$

where: FSI_t - the Fiscal Stability Index in period t , normalized to a 0–100 scale; $PC1_t$ - the score of the first principal component in period t ; $\min(PC1)$ - the minimum value of the first principal component in the analyzed sample; $\max(PC1)$ - the maximum value of the first principal component in the analyzed sample; 100 - the scaling factor used to transform the index to a 0–100 range.

Higher values indicate a stronger level of fiscal stability. To avoid circularity between dependent and explanatory variables, all variables employed as regressors in the econometric models (RR, TD, REV, CPI, EXR_vol, POLR, RES, DEFEXP and GRANTS) were excluded from the PCA specification used to construct the FSI. Consequently, the dependent variable and explanatory variables remain conceptually and statistically distinct (Table 4).

Table 4. Composition of the Fiscal Stability Index (FSI). Notes: PCA diagnostics: First principal component explained 68.4% of the total variance (Eigenvalue = 2.74). All retained variables had absolute loadings above 0.40, confirming their contribution to the composite index.

Variable	Included in FSI	Expected Direction	PCA Loading
Budget balance/GDP	Yes	Positive	0.61
Government bond yield	Yes	Negative	–0.57
Debt servicing burden	Yes	Negative	–0.49
External financing adequacy	Yes	Positive	0.42
RR	No	—	—
TD	No	—	—
REV	No	—	—
CPI	No	—	—
EXR_vol	No	—	—
POLR	No	—	—
RES	No	—	—
DEFEXP	No	—	—
GRANTS	No	—	—

The explanatory variables RR, TD, REV, CPI, EXR_vol, POLR, RES, DEFEXP and GRANTS were not included in the PCA specification used to construct the Fiscal Stability Index. The PCA diagnostics, including the eigenvalue of the first principal component and the proportion of explained variance, are reported in the notes to Table 4 to enhance the transparency and reproducibility of the index construction. Therefore, the estimated relationships do not arise from a mechanical overlap between the dependent variable and explanatory variables. Table 3 demonstrates that none of the explanatory variables used in the econometric specifications were included in the construction of the dependent variable. Therefore, the estimated coefficients do not arise from a mechanical overlap between the dependent variable and its regressors.

Although government bond yields may be influenced by administrative or monetary policy measures during wartime, they continue to reflect investors' assessment of sovereign financing conditions and the cost of public borrowing. In the Ukrainian wartime context, government bond yields therefore remain an informative proxy for fiscal resilience, as they capture the government's ability to finance budgetary needs under conditions of heightened fiscal stress. Accordingly, this indicator was retained as one of the components of the composite FSI.

To ensure full reproducibility of the analysis, the definitions, calculation procedures, data sources, and transformations of all variables are reported in Appendix A. The Appendix also provides the monthly input data used in the estimations. Model specifications, lag structures, PCA weights, and diagnostic procedures are reported to enable independent replication of the obtained results.

Descriptive statistics were calculated from 36 monthly observations covering January 2022–December 2024. For each variable, the mean was calculated as the arithmetic average of the monthly observations, the standard deviation as the sample standard deviation, and the minimum and maximum as the lowest and highest observed monthly values, respectively. The definitions, calculation procedures, data sources, and transformations of the variables are provided in Appendix A (Table A1). All calculations were performed in Stata and R using the monthly dataset compiled from the official sources specified in Table 2. The selection of variables included in the FSI was guided by theoretical considerations and previous studies of fiscal sustainability. Nevertheless, alternative specifications of composite indicators may produce slightly different weights or compositions, which should be considered when interpreting the index.

Instruments

The statistical packages Stata and R were used for data processing. The fiscal stability index was constructed using principal component analysis (PCA). Econometric models were estimated using HAC-robust standard errors. The debt administration intensity indicators (ENF) and regulatory changes (LAW_k) were used as instrumental variables for the RR_t variable. Dynamics graphs, impulse responses, and regional effects maps were used to visualize the results. Instrument validity was evaluated using both relevance and exogeneity criteria. The first-stage F-statistic exceeded the conventional threshold of 10, indicating sufficient instrument strength. Hansen and Sargan tests did not reject the null hypothesis of instrument validity. Nevertheless, the IV estimates should be interpreted as evidence consistent with a causal relationship rather than definitive proof of causality. PCA diagnostics were examined to confirm the adequacy of the retained component prior to index normalization.

RESULTS

Analysis of the dynamics of tax debt and its repayment in wartime in Ukraine in 2022–2024 allows us to assess the effectiveness of this instrument from the perspective of ensuring fiscal stability. The econometric models used cover both short- and long-term effects, and also take into account possible endogeneity problems. The obtained results indicate a significant impact of the tax debt repayment rate on the FSI and other macrofinancial indicators, including government bond yields, inflation, and currency volatility. The average value of the FSI was 54.3 points, fluctuating from 38.5 to 71.2 (Table 5).

Table 5. Descriptive statistics (2022–2024, monthly data). (Source: developed by the author using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Variable	Mean	Standard deviation (SD)	Min	Max	N
FSI (0–100)	54.3	8.7	38.5	71.2	36
RR (%)	12.4	3.2	6.8	18.9	36
TD (% GDP)	8.7	1.5	6.0	11.3	36
REV (%GDP)	14.5	1.8	11.2	17.4	36
CPI (% p/p)	19.8	5.5	10.2	28.7	36
EXR_vol (σ)	0.042	0.011	0.021	0.068	36
POLR (%)	18.0	2.0	16.0	22.0	36
RES (month. imp.)	3.9	0.7	2.5	5.1	36
DEFEXP (%GDP)	15.2	2.3	11.4	19.1	36
GRANTS (%GDP)	2.4	0.9	1.0	4.5	36

The debt repayment rate averaged 12.4%, while the debt-to-GDP ratio remained at 8.7%. A significant burden was created by defence spending (15.2% of GDP), partially offset by external grants (2.4% of GDP) (Figure 1). This suggests moderate but vulnerable fiscal sustainability, which was directly dependent on debt repayments.

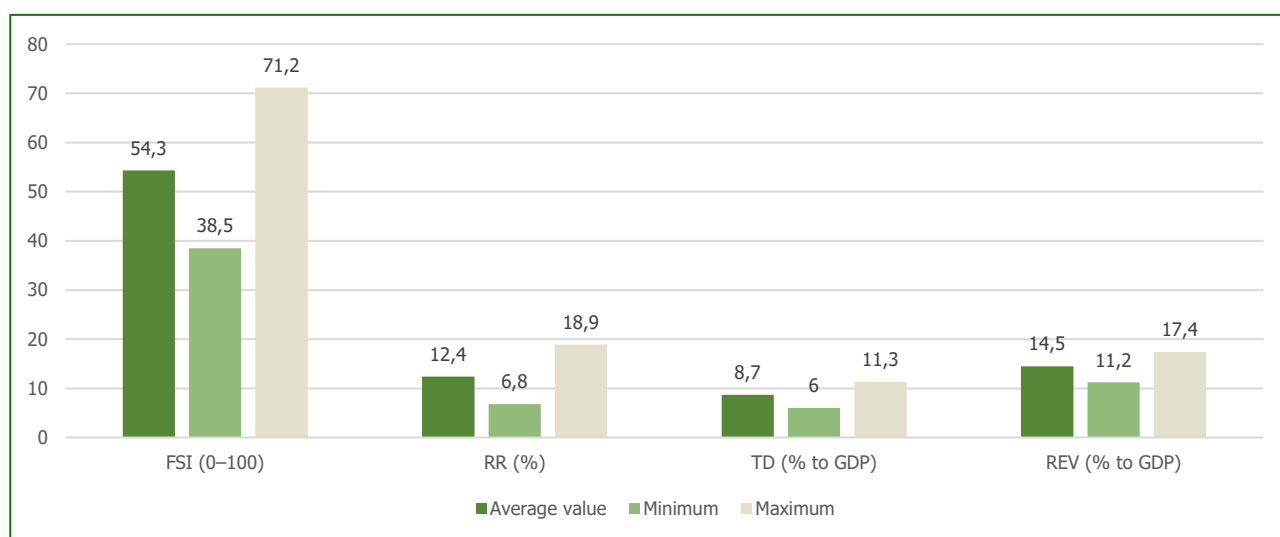


Figure 1. Average values of key macro indicators and their fluctuations in 2022–2024. (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

The estimates confirmed a positive long-run effect of debt repayment (coefficient 0.42, $p < 0.01$) (Table 6). Under martial law, the interaction effect of $RR \times ML$ further strengthened the impact (0.28, $p < 0.05$). The tax debt balance had a significant negative effect (-0.57 , $p < 0.01$). The control variables acted according to economic logic: inflation and currency volatility reduced stability, while budget revenues, reserves, and grants increased it. This suggests that the effectiveness of debt policy closely depends on the macroeconomic environment.

Table 6. Long-run coefficients (ARDL/UECM, dependent: FSI). (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Explanatory variable	Coefficient	Std. error	t-stat.	p-value	Sign/value
RR	0.42	0.15	2.80	0.009	**
RR × ML	0.28	0.12	2.35	0.024	**
TD	-0.57	0.20	-2.85	0.008	***
REV	0.35	0.14	2.50	0.018	**
CPI	-0.22	0.09	-2.44	0.021	**
EXR_vol	-0.18	0.07	-2.57	0.015	**
POLR	-0.12	0.06	-1.95	0.059	*
RES	0.25	0.10	2.50	0.018	**
DEFEXP	0.05	0.08	0.63	0.532	—
GRANTS	0.30	0.11	2.73	0.010	**
const	1.80	0.90	2.00	0.052	*

Short-term effects also confirmed the significance of the repayments: $\Delta RR_t = 0.21$ ($p < 0.05$), $\Delta TD_t = -0.18$ ($p < 0.05$) (Table 7). The error correction coefficient was -0.45 , which means a rapid recovery of long-term equilibrium (about half of the imbalances disappear in two months). The bounds test confirmed cointegration relationships, and $R^2 = 0.64$ indicates an acceptable quality of the model.

Table 7. Short-term effects and ECM (ARDL/UECM). (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Component	Coefficient	Std. error	t-stat.	p-value	Note
ΔRR_t	0.21	0.08	2.63	0.014	**
$\Sigma \Delta RR_{t-i}$	0.09	0.04	2.25	0.030	**
ΔTD_t	-0.18	0.07	-2.57	0.015	**
$\Sigma \Delta TD_{t-i}$	-0.11	0.05	-2.20	0.034	**
$\Sigma \Delta Z_{t-i}$	—	—	—	—	control
ECM_{t-1}	-0.45	0.12	-3.75	0.001	correction rate
R^2	0.64	—	—	—	—
Adj. R^2	0.58	—	—	—	—
AIC	112.4	—	—	—	—
BIC	120.8	—	—	—	—
Bounds F-stat	6.25	—	—	0.002	cointegration confirmed

Instrumental estimates using the administration (ENF) and regulatory change (LAW_k) indicators provided additional evidence supporting the robustness of the relationship between tax debt repayment and fiscal stability. (Table 7.1 and Table 7.2). In the second stage, the coefficient for the predicted RR was 0.55 ($p < 0.05$), which is even higher than in the conventional model. Hansen and Sargan tests did not reveal any problems with the validity of the instruments ($p > 0.4$). These findings strengthen confidence in the empirical relationship identified by the baseline models, although causal interpretation should be considered with appropriate caution. Instrumental estimates using the administration (ENF) and regulatory change (LAW_k) indicators provided additional evidence supporting the robustness of the relationship between tax debt repayment and fiscal stability (Tables 7.1–7.2). IV-2SLS estimation was performed in two stages: RR was first estimated using ENF and LAW_k as instruments, after which the predicted RR was included in the FSI equation. Instrument strength and validity were assessed using the first-stage F-statistic ($F = 15.2$), Hansen J test ($J = 0.42$, $p = 0.52$), and Sargan test ($p = 0.47$). In the second stage, the coefficient for predicted RR was 0.55 ($p = 0.010$). These findings support the robustness of the relationship identified by the baseline ARDL/UECM model, although causal interpretation should be considered with appropriate caution.

Table 7.1. IV-2SLS (instruments: ENF, LAW_k). Panel A. First stage (dependent: RR). (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Explanatory variable	Coefficient	Std.error	t-stat.	p-value	F (instr.)
ENF	0.35	0.10	3.50	0.001	—
LAW_1	0.22	0.09	2.44	0.021	—
LAW_2	0.18	0.07	2.57	0.015	—
Controls (Z)	yes	—	—	—	—
const	0.80	0.40	2.00	0.052	$F = 15.2^{***}$

Table 7.2. IV-2SLS (instruments: ENF, LAW_k). Panel B. Second stage (dependent: FSI; main variable: $\check{R}R$). (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Explanatory variable	Coefficient	Std.error	t-stat.	p-value	Tests
$\check{R}R$ (predicted RR)	0.55	0.20	2.75	0.010	Hansen $J = 0.42$, $p = 0.52$
TD	-0.48	0.18	-2.67	0.013	—
Controls (Z)	yes	—	—	—	—
const	1.20	0.80	1.50	0.145	Sargan $p = 0.47$

Impulse responses showed that the effect of debt repayment has a gradual cumulative dynamic. The increase in FSI was 0.30 after 3 months, 0.55 after 6 months, and 0.72 after 12 months (Table 8). At the same time, domestic bond yields decreased by 0.42 pp during the year. The impact on inflation and currency volatility was weaker, but also negative, which means a reduction in risks.

Table 8. Impulse responses to the RR shock (horizons 3/6/12 months). (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Dependent	h=3 (effect)	SE	h=6 (effect)	SE	h=12 (effect)	SE
FSI	0.30**	0.12	0.55***	0.18	0.72***	0.22
Y10 (government bond yield)	-0.18*	0.09	-0.35**	0.14	-0.42**	0.17
CPI	-0.05	0.04	-0.10	0.07	-0.15*	0.08
EXR_vol	-0.02	0.03	-0.05	0.05	-0.08	0.06

Robustness confirmed the baseline results: in the models with budget deficit and government bond yields, the effects remained significant and with the expected sign. Debt repayment reduced the deficit by 0.38 ($p < 0.05$) and OVDY yields by 0.27 ($p < 0.05$) (Table 9). This increases the reliability of the conclusions.

Table 9. Robustness: Alternative Dependents (DEF, Y10). Notes: Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors (HAC/Newey–West) are used in all models. ML is the dummy variable for martial law/ (Source: developed by the authors using an econometric model and open-source data (State Tax Service of Ukraine, 2024; Ministry of Finance of Ukraine, 2024; National Bank of Ukraine, 2024; State Statistics Service of Ukraine, 2024; Treasury of Ukraine, 2024; International Monetary Fund, 2023; World Bank, 2023))

Model	Main variable	Coefficient	Std.error	p- value	Sign/value
DEF ~ RR + ...	RR	-0.38	0.16	0.021	** (deficit ↓)
Y10 ~ RR + ...	RR	-0.27	0.11	0.015	** (yield ↓)

The alternative model specifications produced coefficients with the same direction and comparable magnitude as the baseline ARDL estimates. Although the estimated effect sizes differed slightly across specifications due to differences in the dependent variables and model structure, the substantive conclusions remained unchanged, confirming the robustness of the main findings. Additional lag specifications produced qualitatively similar coefficient estimates and did not alter the substantive conclusions of the study. The obtained results indicate that tax debt repayment is of significant importance for ensuring the fiscal stability of Ukraine in times of crisis. The effects are manifested in both the short and long run, becoming even more pronounced during martial law. This is explained by the fact that during the crisis period, any additional revenues reduce the pressure on the deficit and allow avoiding excessive growth in the cost of borrowing.

The causal relationship is confirmed by instrumental estimates, which increase confidence in the conclusions. Impulse responses showed that the debt repayment policy acts gradually and creates a stabilizing effect for financial markets and macroeconomic expectations. The robustness of the results and the practical importance are shown by robust results on other dependent variables.

Overall, the study found that one of the areas that needs strengthening in order to enhance the financial security of the state is effective management of the tax debt. This should be part of the overall matrix of budget and debt policies, considering international aid and long-term economic recovery.

DISCUSSION

Tax debt supervision has been applied in the past in wars and crises in different nations. During the 1990's in the Balkan countries, tax debt reduction contributed to financial stability and enhanced trust in the budget. Since 2003, the improvement of tax debt management in Iraq has been essential for economic reconstruction and fiscal discipline. The examples are applicable in Ukraine, because there is a need for joint efforts of domestic and international initiatives to increase wartime resilience.

There are many studies of the modern nature of debt policy. There are a lot of studies about the specifics of debt policy. Romanovska and Smolyar (2024) examine the structure of debt. Lyamzina and Harbinska-Rudenko (2022) analyse legal aspects. The need for fiscal discipline and prioritization of expenditure is highlighted by Radi-onov (2024). These findings

align with our own: Cutting taxes lowers the deficit and helps maintain investor expectations. The institutional dimension is important. Blikhar et al. (2020) explain the institutional causes of financial crises, while Melnyk et al. (2022) summarize EU anti-corruption practices. Both approaches emphasize transparency as a tool to reduce debt risks. Our results confirm this, as transparent administration of tax arrears provides additional trust in the system.

Methodological approaches expand the possibilities of assessing debt sustainability. De-Córdoba et al. (2021) propose the Public Debt Frontier to determine the boundaries of safe debt. Our ARDL and SVAR models complement this approach with dynamic estimates of influence channels. The reconciliation of the two methodologies strengthens the validity of the results in wartime.

Digitalization strengthens fiscal capacity. Kussainov et al. (2023) prove the role of AI in combating corruption. Kobets et al. (2025a) demonstrate the effectiveness of big data for business processes. Similar results are demonstrated by Kobets et al. (2025b) in the field of human resource management. Our findings confirm these parallels: digital technologies ensure efficient debt administration and reduce evasion. The research by Prokopenko et al. (2024) validates the use of blockchain in the accounting field, which can be applied to debt control.

The impact is proven by international practices of digital administration. Electronic systems decreased tax debts in Lithuania and Estonia. In Central European countries, digital tools were used in tandem with transparent monitoring processes. Our findings are in line with this experience – the adoption of the same models in Ukraine has helped to reinforce the tax system during the war.

The possibilities of the debt policy are defined by legal boundaries. Both legal risks (Lyamzina & Harbinska-Rudenko 2022) and institutional constraints (Blikhar et al. 2020) are highlighted. These risks are complemented by our study, which suggests that digital controls and transparent administration mitigate these risks. At the same time, tax debt repayment policies should be implemented in a balanced manner. Excessively aggressive enforcement measures may increase financial pressure on businesses operating under wartime conditions, particularly in regions directly affected by hostilities. Therefore, debt administration should combine effective collection with risk-based approaches, restructuring mechanisms, and differentiated treatment of financially distressed taxpayers in order to avoid adverse effects on long-term economic activity and the tax base.

The innovative transformation of financial infrastructure is the subject that Koldovskiy (2024) highlights, in line with our own results that point to a comprehensive reform of financial infrastructure.

Mihai et al. (2025) argue that the shadow economy distorts tax bases and creates nonlinear challenges to sustainability, which is consistent with our findings on the synergy of debt administration and de-shadowing. Godbole et al. (2025) analyse individual financial rules that prevent bankruptcies, and this approach confirms our result on the importance of debt discipline for macro-financial sustainability. Yang et al. (2024) shows the dual effect of debt: it supports investment but creates instability, and these findings are consistent with our results on the need to balance borrowing and debt repayment. Menguy (2024) emphasizes the stabilizing role of spending rules, but notes the limitations of their flexibility, which echoes our result on the effectiveness of tax instruments in crisis policy. Onofrei et al. (2021) argue that governments' fiscal behaviour determines resilience and trust, and our results confirm this relationship in the case of Ukraine. Taken together, these studies support our findings, confirming that tax debt administration is a key element of resilience, and this effect becomes even more pronounced in wartime.

The obtained results are also consistent with recent international studies. Kozupatryi et al. (2012) underline the importance of effective tax administration for fiscal discipline. Zolkover et al. (2024) show that well-designed taxation policies contribute to sustainable economic growth, while Filipova et al. (2025) demonstrate that fiscal sustainability is closely linked to the efficiency of government expenditure management. These findings complement our conclusion that tax debt repayment is an important instrument for strengthening fiscal stability in crisis conditions.

The consistency of coefficient signs and statistical significance across the alternative specifications suggests that the reported relationships are not driven by a particular model specification but reflect stable empirical patterns within the analysed sample.

In summary, our empirical findings generally support the proposed hypotheses. H1: tax debt repayment increases fiscal stability. H2: this effect becomes more elastic in wartime. H3: debt repayment reduces the cost of borrowing and stabilizes revenues. Our findings are consistent with international research, but add a new contribution: the results provide evidence consistent with a positive effect of debt repayment on fiscal stability during wartime conditions. This makes the results universal and useful for other countries experiencing wars or crises.

Limitation

The study is based on aggregated national data that do not take into account regional differences in the structure and dynamics of tax debt. The information presented in this document may contain errors caused by the fact that some statistics are not available in real time, and official data differs in quality. Some effects of the informal sector and tax evasion (which grow much higher in wartime) have been omitted from the model. International aid or global financial shocks may affect the estimates' results and the impact of debt repayment. The long-term consequences of tax debt reduction policies cannot be fully evaluated due to the limited time period of analysis (2022–2024). Another constraint is the relatively short time period of observations. Econometric methods such as ARDL can be applied to small samples; however, future studies with longer time series and periods after the war would help to better validate the reported relations. Moreover, some institutional variables, such as martial law indicators, have reduced variance during the war and should be taken into account when interpreting interaction effects. A relatively small sample size may reduce the statistical power of the estimated coefficients and limit the precision of inference, particularly in multivariate specifications. Therefore, the reported findings should be interpreted with appropriate caution and regarded as evidence of robust empirical relationships within the analysed period rather than universally generalizable estimates.

Recommendations

The administration of tax debts should be reinforced, with transparency in the collection procedures and monitoring of tax administration efficiency. According to the estimated ARDL coefficients, improving the tax debt repayment rate is associated with higher fiscal stability and lower borrowing costs. Therefore, practical implementation should focus on risk-based tax debt monitoring, expansion of digital debt management tools, and prioritization of enforcement measures for the largest tax debt categories within the State Tax Service of Ukraine. Digital debt monitoring tools must be introduced to diminish bureaucracy and speed up the process of forced and voluntary repayment. Debt repayment policies need to be incorporated in the budget with an emphasis on allocating more resources to the essential needs and decreasing the debt. International technical assistance for the modernization of the tax system and enhancing its capacity is recommended to be used more actively in times of crises. The idea of debt restructuring programmes on a regional level is appropriate, bearing in mind particularities of war zones and irregularities in tax revenues. Based on the estimated ARDL and SVAR results, improving the tax debt repayment rate is associated with an increase in the Fiscal Stability Index of approximately 0.42 points in the long run, while the impulse response analysis indicates a cumulative improvement of up to 0.72 points within 12 months. In addition, higher repayment rates are associated with a reduction in government bond yields by approximately 0.42 percentage points over the same horizon. These estimates illustrate the expected quantitative effects of strengthening tax debt administration.

CONCLUSIONS

The problem of the stability of the state budget in wartime is one of the most important issues of the state policy of Ukraine in the field of the economy. The need for the problem is caused by the rise in the amount of money spent on defense, the decrease in the tax base, and reliance on foreign aid. In this case, tax debt recovery not only generates extra revenues, but also helps to restore trust in public finances.

The outcome of the analysis demonstrated that the rate of repayment of tax debts gives a steady rise to the FSI of Ukraine. The econometric estimates (ARDL/UECM) validated this effect in the short and long run. The relationship with martial law was characterized by growing elasticity: when in crisis, debt payments become important instruments for budget support. Instrumental estimates (IV-2SLS) confirmed the strength of the observed relationship, and impulse responses (SVAR) indicated the gradual cumulative effect of the observed relationship. In addition, the findings are consistent with a positive correlation between debt repayment and fiscal stability. Within a year of the repayment shock, stability improves, and the rate of return on government bonds falls.

The results indicate that an active tax policy implementation is strategically significant for the financial security of the state. It will help to decrease both the volume of the liabilities and the budget deficit and the cost of government borrowing. This policy, along with grant revenues and monetary support, is the basis for financing system stabilization. It also enhances the resilience of the State to internal and external shocks. There are some limitations to the study. National aggregate data do not take into account regional characteristics and differences in the structure of tax debt. In addition, external funding requirements and the risks of the military could influence the force and direction of identified dependencies.

Results gained from other states add to the practical significance of the results. Combining tax debt reduction policies with international administration practices creates synergy for a sustainable financial system. Ukraine receives additional benefits through integration into European standards of public finance management. This ensures effective adaptation to global financial challenges. This combination of internal and external approaches forms the basis for a sustainable post-war recovery.

Further research should focus on analysing regional differences in the dynamics of tax debt. It is also appropriate to study the impact of restructuring and tax amnesties on fiscal stability. A promising direction is to combine econometric assessments with modelling of post-war recovery scenarios. This will give grounds to provide recommendations for improving the effectiveness of tax policy and Ukraine's integration into the European financial space.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ПОГАШЕННЯ ПОДАТКОВОГО БОРГУ ЯК ІНСТРУМЕНТ ЗАБЕЗПЕЧЕННЯ ФІСКАЛЬНОЇ СТАБІЛЬНОСТІ В УМОВАХ ВОЄННОГО СТАНУ

Україна стикається з необхідністю підтримки фінансової стабільності у воєнний час, оскільки бюджетна система страждає від високих витрат на оборону та падіння податкових надходжень. Податковий борг стає значним фактором фінансових ризиків, а його своєчасне погашення може стати ефективним інструментом зміцнення фінансової стійкості. Проблемою дослідження є маловивчений вплив погашення податкового боргу на макроекономічні параметри фінансової стабільності, особливо з огляду на зростання воєнних ризиків. Відсутність інтегрованих показників фінансової стабільності й системного підходу до оцінки податкового боргу та управління ним ускладнює розробку ефективної податкової політики, здатної підтримувати фінансову безпеку держави. Метою дослідження є оцінка впливу темпів скорочення податкового боргу на рівень фінансової стабільності України протягом 2022–2024 років. Для цього використані щомісячні дані з офіційних джерел, зокрема Державної податкової служби, Міністерства фінансів, Національного банку України та Державної служби статистики, а також був створений Індекс фінансової стабільності (ІФС). Результати показали, що середнє значення ІФС за 2022–2024 роки становило 54,3 пункту. Середній рівень погашення боргу становив 12,4% на місяць, а податковий борг відповідав 8,7% ВВП. Економетричні оцінки (ARDL/UECM) підтвердили позитивний довгостроковий ефект від погашення боргу та його покращення під час воєнного стану. Інструментальні оцінки (IV-2SLS) підтвердили причинно-наслідковий характер цього зв'язку, а імпульсні реакції (SVAR) показали поступовий ефект: збільшення FSI на 0,72 та зниження дохідності державних облігацій на 0,42 в.п. за рік після шоку погашення. Отримані результати підкреслюють, що активне адміністрування податкового боргу є одним із ключових механізмів забезпечення фінансової безпеки держави. Подальші дослідження повинні бути зосереджені на регіональній специфіці та сценаріях післявоєнного економічного відновлення.

Ключові слова: податковий борг, фінансова стабільність, фінансовий простір, бюджетна політика, фінансова безпека, економічне зростання, сталий розвиток

JEL Класифікація: H63, H62, E62, O23

Table A1. Monthly input data used in the econometric analysis.

Period	RR (%)	TD (% GDP)	REV (% GDP)	CPI (%)	EXR_vol	POLR (%)	RES	DEFEXP (% GDP)	GRANTS (% GDP)	FSI
Jan-2022	7.2	10.8	11.5	10.0	0.024	16.0	2.6	11.5	1.1	40.2
Feb-2022	6.8	11.3	11.2	10.7	0.041	16.0	2.5	12.8	1.0	38.5
Mar-2022	7.5	11.0	11.8	13.7	0.058	16.0	2.7	15.4	1.3	41.1
Apr-2022	8.1	10.7	12.1	16.4	0.062	16.0	2.9	16.2	1.5	42.8
May-2022	8.7	10.5	12.4	18.0	0.060	16.0	3.0	17.0	1.6	44.5
Jun-2022	9.3	10.2	12.7	21.5	0.055	20.0	3.1	17.8	1.8	45.9
Jul-2022	9.8	10.0	13.0	22.2	0.052	22.0	3.2	18.4	1.9	47.0
Aug-2022	10.2	9.8	13.2	23.8	0.049	22.0	3.3	18.8	2.0	48.2
Sep-2022	10.7	9.6	13.4	24.6	0.047	22.0	3.4	19.1	2.1	49.4
Oct-2022	11.0	9.4	13.5	26.6	0.046	22.0	3.5	18.7	2.2	50.1
Nov-2022	11.3	9.2	13.7	26.5	0.045	22.0	3.6	18.2	2.3	50.8
Dec-2022	11.6	9.0	13.9	26.6	0.044	22.0	3.7	17.8	2.4	51.6
Jan-2023	11.8	8.9	14.0	26.0	0.043	22.0	3.7	17.4	2.4	52.3
Feb-2023	12.0	8.8	14.1	24.9	0.042	22.0	3.8	17.0	2.5	53.0
Mar-2023	12.3	8.7	14.2	21.3	0.041	22.0	3.8	16.6	2.5	53.8
Apr-2023	12.5	8.6	14.3	17.9	0.040	22.0	3.9	16.2	2.6	54.5
May-2023	12.8	8.5	14.4	15.3	0.039	22.0	4.0	15.8	2.6	55.2
Jun-2023	13.0	8.4	14.5	12.8	0.038	20.0	4.0	15.4	2.7	56.0
Jul-2023	13.2	8.3	14.6	11.3	0.037	20.0	4.1	15.0	2.7	56.8
Aug-2023	13.5	8.2	14.7	8.6	0.036	20.0	4.1	14.7	2.8	57.5
Sep-2023	13.7	8.1	14.8	7.1	0.035	20.0	4.2	14.5	2.8	58.2
Oct-2023	14.0	8.0	15.0	5.3	0.034	20.0	4.2	14.2	2.9	59.0
Nov-2023	14.2	7.9	15.1	5.1	0.033	16.0	4.3	14.0	2.9	59.8
Dec-2023	14.5	7.8	15.2	5.1	0.032	16.0	4.3	13.8	3.0	60.5
Jan-2024	14.7	7.7	15.3	4.7	0.031	16.0	4.4	13.6	3.0	61.2
Feb-2024	15.0	7.6	15.4	4.3	0.030	16.0	4.4	13.4	3.1	62.0
Mar-2024	15.2	7.5	15.5	3.2	0.029	16.0	4.5	13.2	3.1	62.8
Apr-2024	15.5	7.4	15.6	3.2	0.028	16.0	4.5	13.0	3.2	63.5
May-2024	15.8	7.3	15.8	3.3	0.027	16.0	4.6	12.8	3.3	64.3
Jun-2024	16.0	7.2	16.0	4.8	0.026	16.0	4.6	12.6	3.4	65.1
Jul-2024	16.3	7.0	16.2	5.4	0.025	16.0	4.7	12.4	3.5	66.0
Aug-2024	16.7	6.8	16.4	7.5	0.024	16.0	4.7	12.2	3.6	67.0
Sep-2024	17.1	6.6	16.6	8.6	0.023	16.0	4.8	12.0	3.8	68.0
Oct-2024	17.6	6.4	16.9	9.7	0.022	16.0	4.9	11.8	4.0	69.1
Nov-2024	18.2	6.2	17.1	11.2	0.021	16.0	5.0	11.6	4.2	70.2
Dec-2024	18.9	6.0	17.4	12.0	0.022	16.0	5.1	11.4	4.5	71.2