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The inequality gap and the wartime shock: Income distribution in Ukraine

■ **Abstract.** Economic inequality has become a major global concern, and in Ukraine its assessment is complicated by methodological disagreements, post-Soviet institutional specificity, and the unprecedented distributional effects of the full-scale war that began in 2022. The study aimed to assess the dynamics of income inequality in Ukraine over 1990-2025 through systematic comparison of alternative data sources and international benchmarking against countries of similar institutional types. The methodological framework combined the analytical category of “inequality gap”, one-way analysis of variance (ANOVA) with Tukey HSD post-hoc tests, pooled OLS, Fixed Effects, and Random Effects panel specifications, and the Hausman test for model selection. The analysis revealed a statistically significant intergroup typology of countries by inequality gap ($F = 51.59$; $p < 0.001$), within which Ukraine (0.163) belonged to the post-Soviet group alongside Georgia (0.211) and Moldova (0.185). Testing of the Kuznets hypothesis showed that the cross-country inverted U-curve (pooled OLS, peak at $GDP \approx 10,452$ USD) did not hold when the panel structure was controlled for: the Random Effects specification, selected via the Hausman test, yielded a U-shaped (anti-Kuznets) relationship with a minimum at $GDP \approx 21,288$ USD. The Gini coefficient in Ukraine rose from 0.25 (2020) to 0.50 (2025), and the decomposition identified the asymmetric collapse of labour incomes in the bottom quintile alongside rising incomes of the top deciles as the key channel of this shock. The findings allowed positioning the Ukrainian situation not as a methodological anomaly but as a manifestation of institutional features of the post-Soviet space, requiring systemic reforms of economic de-shadowing and progressive asset taxation within the post-war recovery agenda

■ **Keywords:** income inequality; Gini coefficient; hidden inequality; DINA; Kuznets hypothesis; shadow economy; labour share

■ INTRODUCTION

Economic inequality has become one of the defining challenges of the contemporary global economy. Over the past decade, inequality research has evolved from a relatively narrow academic field into a central issue of economic policy and international development debates. This transformation has been driven not only by rising distributive disparities but also by methodological advances in their measurement. The development of Distributional National Accounts (DINA), combining household surveys, tax statistics, and national accounts, substantially changed the understanding of global

income concentration. According to recent international estimates, the top 10% of the world population receive approximately 52% of total global income, whereas the bottom 50% account for only 8.5%, indicating a historically high degree of concentration (Chancel *et al.*, 2022).

At the same time, empirical studies increasingly demonstrate that traditional survey-based methodologies systematically underestimate inequality, particularly in countries characterised by large shadow sectors, concentrated capital ownership, and weak institutional transparency. These methodological distortions are especially

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relevant for post-socialist and transition economies. Within this context, Ukraine represents a particularly important and methodologically challenging case. Official survey-based statistics have long recorded one of the lowest Gini coefficients in Europe – approximately 0.24–0.26 – formally placing Ukraine among the continent's most equal economies (World Bank, 2024). However, alternative DINA-based estimates produce substantially higher levels of inequality because they partially capture hidden capital concentration and shadow incomes. Considering that the shadow economy in Ukraine has been estimated at roughly 30–45% of GDP, the discrepancy between official and alternative measurements acquires structural significance rather than representing a purely technical statistical issue (Ministry of Economy, Environment and Agriculture of Ukraine, 2021).

Recent empirical literature increasingly interprets inequality as a phenomenon shaped by institutional quality, labour-market structures, and macroeconomic policy. S. Aleksić & R. Jovović (2025), examining Southeast European transition countries, identified institutional instability and uneven modernisation as key drivers of persistent inequality. Similar conclusions were reached by F. Martín-Mayoral & M. Plúa (2026), who demonstrated that governance quality and institutional capacity significantly influence inequality dynamics, while the classical Kuznets assumption of automatic inequality decline remains empirically unstable.

Another important direction of contemporary research concerns labour-market transformations and macroeconomic policy. E. Šoltés *et al.* (2023), using panel data for EU countries, identified an inverse relationship between the labour income share and inequality, concluding that declining labour income shares intensify income concentration in the upper deciles. P. Kerimov & Y. Shapoval (2024), focusing on Ukraine, demonstrated that social transfers only partially mitigate poverty risks under conditions of labour-market instability and wartime pressure. Y. Shapoval *et al.* (2024) further showed that rigid monetary policy regimes during crises may amplify distributive asymmetries by producing unequal effects on inflation exposure and employment. Similarly, A. Rabhi & B. Parsons (2025) found that inflationary shocks disproportionately affect lower-income groups in developing economies.

Despite the rapid expansion of contemporary inequality research, several important gaps remain unresolved. Existing studies rarely compare alternative estimates of inequality derived from official survey statistics and DINA-type methodologies. The post-Soviet region also remains insufficiently typologised according to the scale of hidden inequality associated with shadow economies and concentrated capital ownership. Finally, the distributive consequences of the full-scale war in Ukraine remain insufficiently quantified despite the unprecedented scale of the shock. According to international estimates, Ukraine's GDP declined by 29.1% in 2022 following the beginning of the full-scale invasion (World Bank, 2025). The economic collapse was accompanied by large-scale labour-market disruption, forced migration, destruction of productive assets, and asymmetric changes in household incomes. Existing studies, however, remain largely based on official household survey data and may therefore underestimate the actual scale of wartime inequality transformations.

The purpose of this article was to assess the dynamics of income inequality in Ukraine over the period 1990–2025 through a systematic comparison of alternative data sources and benchmarking against countries of similar institutional types. To achieve this aim, the article addresses the following tasks: to systematically compare alternative estimates of the Gini coefficient for Ukraine and to compute the inequality gap for a panel of 10 institutionally diverse countries, testing the statistical significance of intergroup differences and assess within-group heterogeneity in hidden inequality; to empirically test the Kuznets hypothesis on panel data using real GDP per capita, with formal selection between Pooled OLS, Fixed Effects, and Random Effects specifications; to assess the magnitude and structural drivers of the wartime inequality shock in Ukraine over 2022–2025.

■ MATERIALS AND METHODS

The empirical basis of the study comprises four independent data sources covering the period 1980–2025 for Ukraine and 1990–2024 for the nine comparator countries. The World Inequality Database (WID.world, n.d.) provides estimates of the Pre-tax National Income Gini coefficient and income shares (Top 10%, Middle 40%, Bottom 50%) under the DINA methodology. This database uses a combined approach: survey data as the base, with subsequent corrections based on national accounts (for sum totals) and tax statistics (for refining top-decile distributions). It should be noted that for Ukraine, WID data are genuinely updated only through 2019, while values for 2020–2024 are extrapolated (frozen series, Gini = 0.4292). It imposes an evident limitation: a full DINA analysis for the wartime period is impossible until new national accounts and tax data become available. The World Bank Poverty and Inequality Platform (PIP) provides a survey-based Gini index computed from official household surveys. For Ukraine, this series covers 24 observations over 1992–2020 with partial gaps in 1994, 1997–1998, and 2000–2001. The coefficient values range from 24.0% (2014) to 39.2% (1995). The latest update for Ukraine is 2020 (25.6%); the subsequent wartime period is not covered due to survey curtailment.

The third source is data from the State Statistics Service of Ukraine, drawn from the annual tables “Differentiation of the Living Standards of the Population” based on the Household Living Conditions Survey. The available observation points are the Gini coefficients for total income in 2019 (0.249), 2020 (0.247), and 2021 (0.244). These data effectively duplicate the World Bank PIP estimates, which is logical, since both sources are based on the same Household Living Conditions Survey with some methodological variations (cash income vs total income, different deflators, etc.). The fourth source – the World Bank's Listening to Ukraine (L2UKR) – is a series of wartime telephone surveys providing Gini estimates for 2023 (0.41) and 2025 (0.50). Separately, for testing the S. Kuznets (1955) hypothesis, the GDP per capita PPP (constant 2021 international \$) indicator from World Development Indicators (WDI), series NY.GDP.PCAP.PP.KD is used. This indicator is available for all 10 countries in the sample over the full period 1990–2024, ensuring a balanced panel. The country sample for comparative analysis includes 10 states grouped into four institutional clusters: CEE/EU (Poland, Czech Republic,

Croatia, Romania), post-Soviet (Ukraine, Georgia, Moldova), Latin America (Brazil, Colombia), and post-conflict (Iraq). This selection allows positioning Ukraine in the context of both its immediate institutional analogs and countries with radically different distributional regimes. The total sample for panel model construction ranges from 218 to 246 observations, depending on the model specification.

To systematise the analysis, the 10 countries under study were divided into four institutional groups based on three interrelated criteria: historical trajectory of economic development; level of integration into the global economy and institutional architecture; type of macroeconomic environment (peacetime vs conflict). The CEE/EU group (Poland, the Czech Republic, Croatia, and Romania) comprises Central and Eastern European countries that underwent transformation in the 1990s and have since integrated into the European Union. Common features of the group include EU membership (institutional harmonisation with the *acquis communautaire*), well-developed social protection institutions, and moderate levels of shadow economy (10-20% of GDP) (Schneider *et al.*, 2010). Croatia is included in the group as it joined the EU in 2013 and adopted the corresponding institutional standards. The post-Soviet group (Ukraine, Georgia, Moldova) comprises former USSR countries that did not integrate into the EU and retained key institutional features inherited from the transition period: substantial shadow economies (30-45% of GDP), capital concentration among oligarchic groups, and limited effectiveness of formal rule-of-law institutions. All three countries are associated EU members through Association Agreements, but have no prospects of full membership in the short term (as of 2022 for Ukraine). Membership in this group is determined by institutional history (the transition from a planned economy without subsequent EU integration), not by empirically measured inequality gaps, which may vary considerably across these countries. The Latin American group (Brazil, Colombia) represents a region with traditionally high-income inequality ($Gini > 0.5$) and a structurally different type of economic development, based on commodity exports and substantial informal employment. The inclusion of this group allows Ukraine to be positioned in a broader global context and to test whether high hidden inequality is unique to post-Soviet economies.

The post-conflict group is represented by a single country – Iraq. Two considerations justify including only one country in this group. First, for most post-conflict countries (Syria, Afghanistan, Libya), WID or World Bank PIP data are unavailable or fragmentary. Second, Iraq demonstrates a unique combination of long-term armed conflict with a functioning state statistics system, making it the only reasonably reliable analogue for parts of Ukraine's wartime indicators. Given the small sample size ($n = 3$), the results for this group are interpreted with caution. Theoretical justification. The concept of the inequality gap (IG) as a measure of hidden inequality draws on the methodological literature on inequality measurement, notably the works of A.B. Atkinson (2015), T. Piketty *et al.* (2018), and F. Alvaredo *et al.* (2017). According to this literature, survey-based methodologies systematically understate the incomes of top deciles due to three structural limitations: low response rates of the wealthiest households in sample surveys; under-reporting of capital and

entrepreneurial incomes; the fundamental impossibility of capturing incomes that flow through shadow and offshore structures. The DINA methodology compensates for these limitations by integrating survey data with tax statistics and national accounts, providing a more complete picture of income distribution. Consequently, a systematic positive difference between the DINA-Gini and survey-Gini can be interpreted as a measure of that portion of inequality which actually exists in the economy but is not captured by survey instruments. Operational definition. The inequality gap (IG) is computed as the arithmetic difference between the WID estimate and the World Bank PIP estimate of the Gini coefficient for a given year and country:

$$G_{\{i,t\}} = G_{\{i,t\}}^{\{WID\}} - G_{\{i,t\}}^{\{WB\}}, \quad (1)$$

where $G_{\{i,t\}}^{\{WB\}}$ – the Gini coefficient for country i in year t according to WID.world (DINA), and $G_{\{i,t\}}^{\{WID\}}$ – the same coefficient according to World Bank PIP (survey-based). This measure is interpreted as an indicator of “hidden inequality” not captured by traditional household surveys. Large IG values are associated with three interrelated mechanisms. First, in economies with a substantial shadow economy, a meaningful share of household and entrepreneurial incomes is not reported in surveys, which depresses the survey-based Gini relative to the actual distribution. Second, the top deciles tend to be systematically under-represented in survey samples – both through lower response rates and under-reporting of capital income – further compressing the upper tail of the survey distribution. Third, a substantial share of wealth in countries with concentrated ownership is held in the form of assets (real estate, corporate equity, offshore structures) that are poorly captured by income surveys but are reconciled through national accounts within the DINA framework, producing a higher Gini in the DINA-based estimate.

Theoretically expected IG levels. Based on the literature, one can outline the expected IG ranges for different economic types. For developed countries with low shadow economies (10-15% of GDP), the expected IG is 0.10-0.15. For countries with moderate shadow economies (15-25%), it is 0.15-0.20. For countries with substantial shadow sectors and concentrated oligarchic ownership (25%+), the expected IG exceeds 0.20. These theoretical expectations are used in the results section as a benchmark for interpreting the empirically observed typology. Distinguishing from statistical artifacts. The interpretation of IG as an indicator of hidden inequality assumes that the methodological difference between WID and World Bank PIP is structural, rather than random or driven by technical factors. To validate this assumption, three potential sources of ‘spurious’ discrepancies must be considered.

First, differences in the underlying indicators. WID uses the concept of pre-tax national income, while the World Bank PIP uses disposable income from surveys. It creates a systematic upward bias in the WID Gini, independent of the shadow economy. However, this bias is relatively stable over time (approximately 0.05-0.08), whereas the IG for post-Soviet countries exceeds 0.15. Therefore, part of the difference is explained by the underlying indicator methodology, but not all of it. Second, different equivalence scales and units of analysis. WID aggregates income per adult,

whereas the World Bank PIP often uses per capita or household-level measures. It creates a relatively small difference (0.01–0.03) that is constant over time. Third, potential sampling biases in the survey data. If World Bank PIP surveys in Ukraine have systematically lower response rates among wealthy households, part of the IG may be explained by this rather than by actual shadow income concentration.

Given these caveats, IG should be interpreted as an upper bound estimate of hidden inequality – not all of the observed difference necessarily reflects the shadow economy. Still, systematically high IG values (above 0.15) over extended periods are difficult to explain solely by statistical artefacts. It is precisely the comparison of IG across countries with different institutional environments that allows distinguishing the “structural” component of IG (related to the shadow economy and capital concentration) from the “methodological” component (related to differences in measurement). Analysis of variance for the country typology. To test the statistical significance of intergroup differences in the inequality gap, one-way analysis of variance (ANOVA) is applied. The dependent variable is IG; the independent variable is the categorical country group (CEE/EU, Post-Soviet, Latin America, Conflict). Ukraine is treated as a member of the Post-Soviet group in line with the institutional classification criteria. The null hypothesis is that the mean IG values are equal across groups. For pairwise comparisons, the Tukey HSD post hoc test is used to control the family-wise error rate. Testing the Kuznets hypothesis. The Kuznets hypothesis is tested via the classical quadratic specification:

$$C_{\{i,t\}}^{\{WB\}} = \beta^0 + \beta^1 \cdot \ln(GDP_{\{i,t\}}) + \beta^2 \cdot \ln(GDP_{\{i,t\}})^2 + \varepsilon_{\{i,t\}}, \quad (2)$$

where $C_{\{i,t\}}^{\{WB\}}$ – the survey-based Gini for country i in year t ; $GDP_{\{i,t\}}$ – GDP per capita (PPP, constant 2021 international \$). An inverted U-curve (confirming the Kuznets hypothesis) obtains when; In the case of opposite signs ($\beta_1 < 0 \wedge \beta_2 > 0$), the specification describes a U-shaped (anti-Kuznets) relationship $GDP_{\{i,t\}}^{\beta_1} > 0 \wedge \beta^2 < GDP^* = \exp(-\beta_1/(2\beta_2))$. All computations are performed in R 4.3.3 using the packages tidyverse, plm, lmtest, strucchange, ineq, and corplot. Graphical visualisation is implemented with ggplot2 and ggrepel. Data were preprocessed and combined into a single master dataset containing 451 observations from 10 countries over the period 1980–2025, covering 15 key indicators of inequality and macroeconomic context. Computation of the turning point. The extremum of the quadratic

function (maximum for an inverted U or minimum for a U-shape) is found by analytical first-order differentiation:

$$\frac{\partial G}{\partial \ln(GDP)} = \beta^1 + 2 \cdot \beta^2 \cdot \ln(GDP) = 0, \quad (3)$$

from which the optimal value of $\ln(GDP)$ is:

$$\ln(GDP^*) = -\frac{\beta^1}{(2 \cdot \beta^2)}, \quad (4)$$

and the turning point in GDP per capita units is:

$$GDP^* = \exp\left(-\frac{\beta^1}{(2 \cdot \beta^2)}\right). \quad (5)$$

Limitations of turning point interpretation. The computed turning point is valid only if both coefficients β_1 and β_2 are statistically significant; the computed GDP^* value falls within the observed GDP range in the sample (in-sample); the specification matches the nature of the relationship (quadratic function adequately describes the data). Choice of panel model specification. The Kuznets model is estimated using three methods to ensure complete analysis: pooled OLS (which reveals the overall cross-country pattern without controlling for unobserved time-invariant country characteristics), Fixed Effects (which controls for unobserved time-invariant country characteristics through within-country estimation), and Random Effects (which assumes that individual effects are uncorrelated with regressors). For the formal choice between Fixed Effects and Random Effects, the Hausman test is applied. The null hypothesis of the test is that the difference between the FE and RE estimates is not systematic (i.e., the RE specification is valid). If the χ^2 statistic does not reject H_0 ($p > 0.05$), Random Effects is the preferred choice due to estimator efficiency. If H_0 is rejected, preference is given to Fixed Effects as a consistent specification in the presence of correlation between individual effects and regressors. Pooled OLS is not validated by the Hausman test and was used exclusively as a reference model for revealing the compositional effect of the sample.

■ RESULTS AND DISCUSSION

The first stage of the analysis consists of comparing four independent estimates of the Gini coefficient for Ukraine, presented in Figure 1. The most important empirical finding at this stage is a systematic and statistically stable discrepancy between methodologies that is not reducible to random sampling variation.

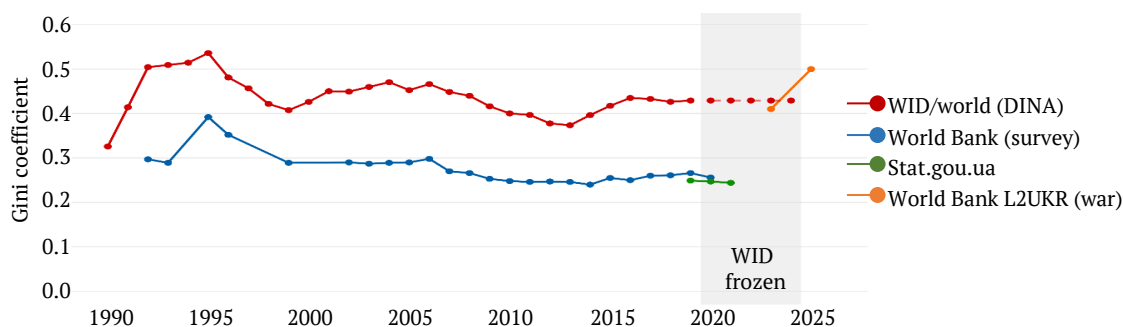


Figure 1. Dynamics of the Gini coefficient in Ukraine: alternative estimates (1990–2025)

Source: prepared by the author

The mean Gini coefficient estimated by WID.world is 0.437 ($n=35$), within the range 0.375–0.536, indicating that Ukraine has moderately high inequality by international DINA standards. At the same time, survey-based estimates by the World Bank yield a mean of 0.277 ($n=24$) within the range 0.240–0.392, corresponding to the level of low-inequality EU countries. State Statistics Service data for 2019–2021 (mean 0.247) fall within the same range, which is logical, since both survey-based sources are grounded in the same Household Living Conditions Survey. The divergence between approaches is not an artefact of specific years or sampling features. It has a fundamentally methodological nature and reflects a fundamental difference in the definition of “income”: DINA includes all components of national income, including undistributed corporate profits, which are disproportionately concentrated in the top decile, whereas survey-based methodologies are restricted to the incomes households report in questionnaires. In countries with a developed shadow economy and concentrated capital, this difference assumes a structural character.

The wartime L2UKR data points (2023: 0.41; 2025: 0.50) deserve particular attention. They lie between WID estimates for the pre-war period and survey estimates, interpreted as the transformation of previously “hidden” inequality into “visible” inequality through two mechanisms. First, the collapse of specific economic sectors (notably those linked to frontline areas and destroyed infrastructure) reduced the incomes of lower deciles to such an extent that this became visible even in surveys. Second, budgetary payments to military personnel redistributed incomes in a way that is more readily captured in surveys, since these payments are formal and accounted through the banking system. The identified methodological discrepancies naturally raise the question: Is the Ukrainian gap between alternative Gini estimates a unique case, or does it reflect a broader pattern? Answering this requires cross-country comparison. Computation of the inequality gap for all 10 countries in the sample over 1990–2024 yielded 246 observations of paired estimates (Gini_WID – Gini_WB). Results are presented in Table 1.

Table 1. Country ranking by inequality gap and ANOVA results (1990–2024)

Rank	Country	Group	N	Mean	Median	SD	Min	Max
1	Iraq	Conflict	3	0.380	0.358	0.071	0.323	0.459
2	Georgia	Post-Soviet	29	0.211	0.202	0.024	0.179	0.258
3	Moldova	Post-Soviet	27	0.185	0.187	0.043	0.080	0.237
4	Romania	CEE/EU	30	0.184	0.182	0.027	0.128	0.243
5	Colombia	Latin America	27	0.177	0.175	0.020	0.140	0.230
6	Ukraine	Post-Soviet	24	0.163	0.163	0.024	0.119	0.220
7	Croatia	CEE/EU	21	0.159	0.152	0.018	0.134	0.200
8	Poland	CEE/EU	30	0.139	0.141	0.039	0.069	0.201
9	Brazil	Latin America	31	0.138	0.141	0.033	0.087	0.215
10	Czech Rep.	CEE/EU	24	0.125	0.126	0.011	0.103	0.146
Group averages:								
	Conflict		3	0.380				
	Post-Soviet (incl. Ukraine)		80	0.186				
	Latin America		58	0.158				
	CEE/EU		105	0.141				

Note: Inequality gap = Gini_WID – Gini_WB. Data are sorted by mean gap value in descending order. Ukraine is shown in bold. ANOVA revealed a statistically significant difference between groups: $F(3, 242) = 51.59$; $p < 0.001$

Source: calculated by the author using based on World Bank (2024), WID.world (n.d.)

The Tukey HSD post-hoc test confirms the significance of pairwise differences between Conflict-CEE/EU, Post-Soviet-CEE/EU, Conflict-Latin America, Conflict-Post-Soviet, Post-Soviet-Latin America (all $p < 0.001$), except the comparison Latin America-CEE/EU ($p = 0.940$). The empirical ranking of countries by mean inequality gap reveals a more nuanced picture than a strict institutional ordering would suggest. While the four groups are statistically distinguishable in their means (see ANOVA results below), there is substantial within-group heterogeneity and partial overlap between groups. Iraq leads by a significant margin (0.380), reflecting the post-conflict context. Within the post-Soviet group, Georgia (0.211) and Moldova (0.185) show high IG values consistent with strong shadow-economy and oligarchic-concentration features. Ukraine (0.163), however, occupies an intermediate position: it is the lowest within its institutional group and is comparable to Romania (0.184, CEE/EU) and Colombia (0.177, Latin America). Croatia (0.159), Poland (0.139), Brazil (0.138), and the Czech

Republic (0.125) close the ranking. This empirical heterogeneity within groups – and overlap between groups – is itself an important finding: it demonstrates that institutional inheritance shapes the average level of hidden inequality but does not deterministically predict the individual country position.

As reported in Table 1, the four institutional groups differ significantly in their mean IG values. The Tukey HSD post hoc test revealed significant pairwise differences in most comparisons. The largest gap is recorded between the Conflict and CEE/EU groups (0.227 points). The “Post-Soviet vs CEE/EU” gap is 0.035 points and also statistically significant ($p < 0.001$), documenting the structural persistence of the institutional divide between these two groups 30 years after the start of transition. An interesting incidental result is the absence of a significant difference between “Latin America” and “CEE/EU” (difference 0.003; $p = 0.940$), which warrants separate interpretation. The interpretation of the identified typology rests on two complementary

mechanisms. First, post-Soviet countries retain a substantial volume of shadow economy (estimated at 30-45% of GDP in Ukraine), which systematically “washes out” incomes from household surveys. The shadow economy has a multi-level structure: from the micro level (informal employment, untaxed earnings) to the macro level (offshore structures of large businesses, tax minimisation schemes). All these components are invisible to survey methodology. Second, the concentration of capital in the form of assets of oligarchic structures (financial-industrial groups, offshore structures) remains imperceptible to survey methodology but is fully accounted for under DINA through reconciliation with national accounts.

The opposite mechanism is observed in Latin American countries. Brazil and Colombia exhibit very high survey-based Gini coefficients (0.52-0.56), leaving little room for additional detection of hidden inequality – survey methodology already captures the bulk of stratification. It explains why, despite a formally lower inequality gap (0.138 for Brazil), the overall level of inequality is substantially higher than in post-Soviet countries. This counterintuitive feature underscores the importance of jointly analysing the absolute level of inequality and its “visibility” to statistical instruments – two indicators that do not always correlate. The institutional pattern of the inequality gap discussed above addresses the question of how concealed income concentration is from traditional surveys. No less important is the complementary question – how this concentration is distributed over time and across population groups within Ukraine. Answering it requires moving from aggregated Gini coefficients to the share-based distribution of national income across quantile groups.

The within-group heterogeneity deserves separate comment. Romania’s relatively high IG (0.184) – above the CEE/EU average – reflects the country’s specific transition path, with later EU accession (2007) and a persistent shadow economy estimated at 25-30% of GDP, which is closer to post-Soviet than to Western CEE patterns. Colombia (0.177), while located within Latin America, shares with post-Soviet countries a substantial concentration of wealth in informal and unmeasured channels, which inflates its IG above the Latin American average. Ukraine’s position is the mirror image: the country belongs institutionally to the post-Soviet group but exhibits an IG closer to the CEE/EU range. Several explanations are plausible: Ukraine’s shadow economy, although large in absolute terms, is partly captured by the State Statistics Service through its higher-quality household survey instruments compared with Georgia or Moldova; the WID data for Ukraine are frozen after 2019, which may underestimate the recent expansion of hidden inequality; Ukraine’s pre-war income concentration, while substantial, may be lower in DINA terms than in countries with deeper oligarchic capture such as Georgia. These factors suggest that Ukraine’s institutional belonging to the post-Soviet group is grounded in historical and economic structure rather than in the average level of its inequality gap alone.

Analysis of the share-based distribution of national income across quantile population groups (Fig. 2) reveals the dramatic transformation of 1990-1995, which became decisive for the subsequent trajectory of the Ukrainian economy. In 1990, the income distribution

retained a Soviet egalitarian character: the top 10% share stood at 24.7%, the bottom 50% at 27.7%, and the middle 40% at 47.7%. It corresponded to a declaratively socialist distribution model and was close to Scandinavian indicators. This structure was consistent with administratively compressed wage differentials and limited capital income dispersion characteristic of centrally planned economies. By 1995, the structure had polarised sharply: the Top 10% share rose to 53.6% (a 28.9-percentage-point increase in 5 years), the bottom 50% fell to 16.5% (an 11.2-point decline), and the middle 40% to 29.9%. This transformation reflects the combined effects of price liberalisation, privatisation, and the emergence of concentrated capital ownership during the early transition recession. Importantly, this shift represents a discrete institutional shock rather than a gradual evolutionary adjustment, effectively redefining the baseline structure of income distribution for the post-transition period. The 1995 stabilisation crisis and the subsequent period of macroeconomic consolidation partially corrected the distribution; however, it did not return to Soviet proportions. As of 2019, the income structure looks as follows: Top 10-33.1%, Middle 40-44.3%, Bottom 50-22.6%. It implies a relatively stable top-to-bottom ratio of 1.46, which has remained broadly unchanged over the last decade. In comparative perspective, this places Ukraine close to countries such as the Czech Republic (1.14) and significantly below high-inequality economies such as Brazil (5.63) and Colombia (7.84). Such positioning suggests that, under consistent measurement approaches, Ukraine does not belong to the group of extreme-inequality economies, despite a relatively high inequality gap under alternative estimation frameworks. A notable feature of Ukrainian distributive dynamics is their relative stability over 2000-2019. Unlike several transition economies where inequality continued to rise after the initial liberalisation shock, Ukraine exhibited a prolonged plateau in the income share of the top decile at approximately 33-35%. This pattern suggests the emergence of a constrained distributive equilibrium shaped by incomplete institutional reforms and the coexistence of formal and informal economic structures. At the same time, this stability should not be interpreted as convergence toward equality, but rather as a locked-in configuration of post-transition distributive relations.

From a theoretical perspective, this empirical regularity raises a fundamental question regarding whether the long-run evolution of income distribution in Ukraine follows the canonical Kuznets mechanism, implying a systematic relationship between economic development and inequality, or whether it reflects a structurally different trajectory characteristic of transition economies. In other words, it remains to be determined whether the observed distributive stability is consistent with an inverted U-shaped relationship between inequality and income, or whether it indicates a deviation from the classical Kuznets hypothesis driven by institutional persistence. Addressing this question requires moving from descriptive analysis to formal econometric testing. If inequality dynamics are primarily governed by income level alone, Ukraine should converge toward the downward-sloping segment of the Kuznets curve as development progresses. However, if structural and institutional factors dominate, the

relationship may deviate significantly from this pattern. To empirically distinguish between these alternatives, the next section tests the Kuznets hypothesis using panel data across countries at different levels of economic development, thereby situating Ukraine within a broader comparative framework of inequality-development relationships.

Testing of the Kuznets hypothesis was conducted using panel data for 10 countries over 1990-2020 (218 observations), with real GDP per capita (PPP, constant 2021 prices) as the measure of economic development. The estimation results for the pooled OLS and fixed-effects models are presented in Table 2.

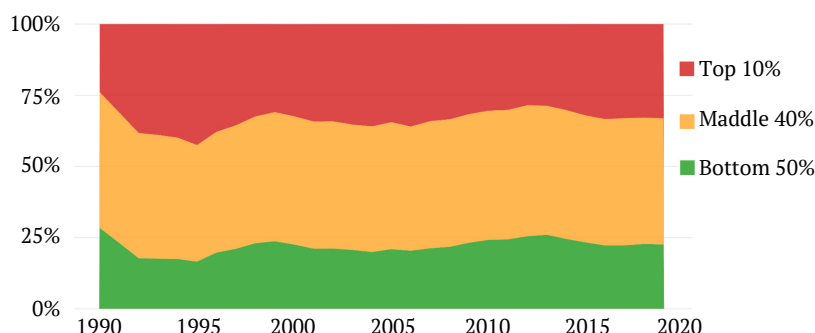


Figure 2. National income distribution by population groups in Ukraine (1990-2019)

Source: prepared by the author

Table 2. Estimation results of the Kuznets model: $Gini = \beta_0 + \beta_1 \cdot \ln(GDP) + \beta_2 \cdot \ln(GDP)^2 + \varepsilon$

Variable	Pooled OLS		Fixed Effects		Random Effects	
	Coef. (SE)	p-value	Coef. (SE)	p-value	Coef. (SE)	p-value
(Intercept)	-6.251 (1.835)	0.001 ***	-	-	3.894 (0.677)	<0.001 ***
$\ln(GDP)$	1.439 (0.379)	<0.001 ***	-0.726 (0.141)	<0.001 ***	-0.712 (0.141)	<0.001 ***
$\ln(GDP)^2$	-0.078 (0.020)	<0.001 ***	0.037 (0.007)	<0.001 ***	0.036 (0.007)	<0.001 ***
Diagnostics:						
R^2	0.172		0.164 (within)		0.163 (overall)	
Adj. R^2	0.164		-		0.156	
N	218		218		218	
Turning point, \$ PPP	10,452	(peak $\cap$)	20,964	(min $\cup$)	21,288	(min $\cup$)
Hausman test: χ^2			FE vs RE: 1.623	p = 0.444		
Specification conclusion					RE (preferred)	

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. SE – standard error; within R^2 – share of within-country variation explained by the fixed effects model. Peak ($\cap$) – maximum of the curve, interpreted as confirmation of the inverted U-shape of Kuznets; minimum ($\cup$) – minimum of the U-shape (anti-Kuznets), characteristic of within-country dynamics. Period: 1990-2020. Number of countries: 10. Dependent variable: Gini coefficient (survey-based, World Bank); independent variable: natural logarithm of GDP per capita (PPP, constant 2021 international \$; WDI, series NY.GDP.PCAP.PP.KD). The Hausman test results ($\chi^2 = 1.623$; $p = 0.444$) do not reject the null hypothesis of random effects, formally justifying the Random Effects specification as the basis for further interpretation. The RE model produced the following estimates: the coefficient on $\ln(GDP)$ equals -0.712 ($SE = 0.141$; $p < 0.001$), and the coefficient on $\ln(GDP)^2$ equals $+0.036$ ($SE = 0.007$; $p < 0.001$), with a turning point at $GDP \approx 21,288$ USD PPP. In form, this is a U-shaped (anti-Kuznets) relationship that virtually coincides with the results of the Fixed Effects model

Source: calculated by the author based on World Bank (2024), WID.world (n.d.)

This closeness of RE and FE estimates is an important analytical finding: it indicates that within-country variation dominates between-country variation in this sample. It means that the global Kuznets regularity (inverted U-curve) revealed by pooled OLS is not confirmed in Ukraine sample when the panel data structure is correctly controlled for. The pooled OLS result, in this light, should be interpreted with caution. It rather reflects a

compositional effect – the fact that current sample simultaneously includes countries with low inequality and middle development (CEE/EU), countries with high inequality and middle development (Latin America), and countries with diverse development patterns. Averaging these heterogeneous cases creates the appearance of an inverted U-curve, which disappears when country effects are controlled for (Fig. 3).

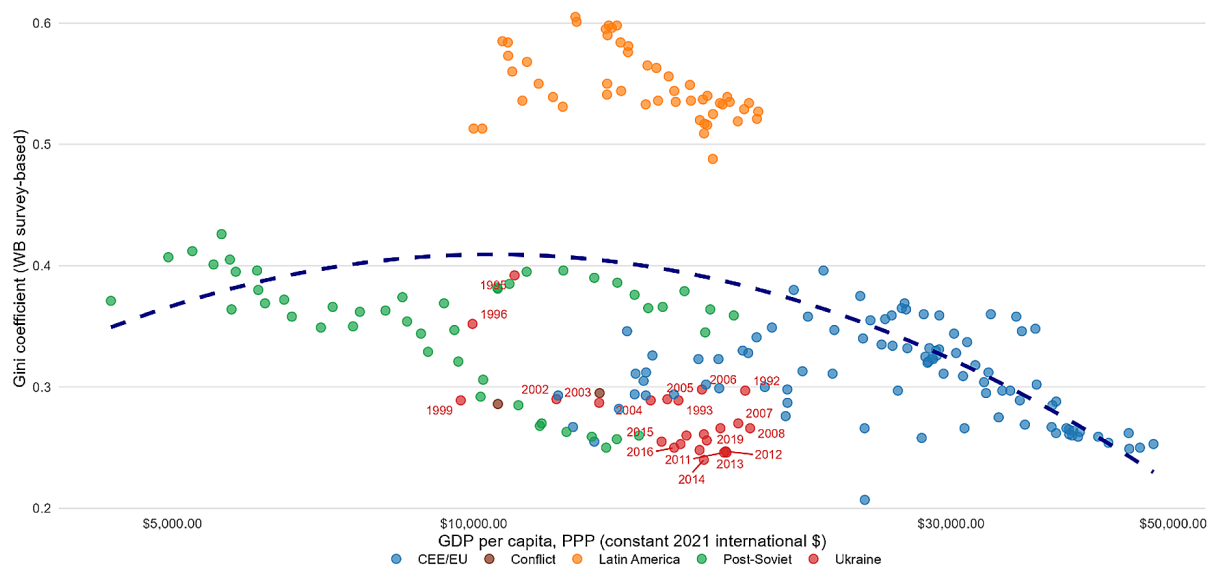


Figure 3. The Kuznets hypothesis: Gini vs GDP per capita (1990-2020)

Source: prepared by the author

Under the RE specification, Ukraine (GDP $\approx$ 17,000 USD) is positioned before the minimum of the U-curve ($\sim$ 21,300 USD), i.e., potentially in a zone where further GDP growth may be accompanied by rising inequality. This result does not contradict but rather confirms the article's central thesis: the automatic decline in inequality with GDP growth does not occur, and achieving inclusive development requires targeted institutional reforms. The wartime shock of 2022+ dramatically illustrates this conclusion – despite the relative stability of GDP per capita, inequality doubled due to institutional (not purely economic) factors. The classical Kuznets pattern emerged under conditions of peacetime and gradual structural change. The 2022 wartime shock created qualitatively different conditions in

which traditional economic relationships may lose force. The most dramatic empirical finding of the study is the unprecedented rise in the Gini coefficient in Ukraine due to the full-scale war. According to World Bank Listening to Ukraine data, the coefficient rose from 0.256 (2020, State Statistics Service) to 0.41 (2023, L2UKR) and further to 0.50 (2025, L2UKR) – effectively doubling in five years. Such a pace of inequality growth has no analogues in the European region in recent history. For comparison, during the 2008-2009 global financial crisis, the largest Gini increase in Europe was recorded in Latvia (from 0.33 to 0.38) and Spain (from 0.31 to 0.35) – that is, 0.04-0.05 points. The Ukrainian wartime shock amounts to 0.24 points, which is 5-6 times larger.

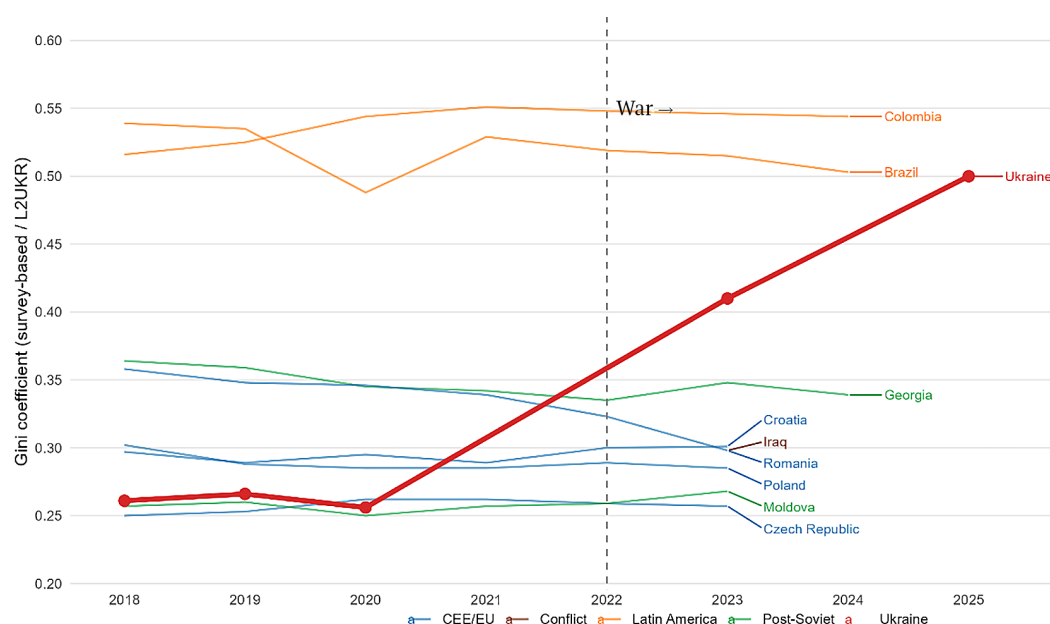


Figure 4. Wartime inequality shock in Ukraine in the context of 9 countries (2018-2025)

Source: prepared by the author

Comparing Ukraine's wartime trajectory with all countries in the sample (Fig. 4) demonstrates how exceptional this case is. No other country in the sample over the corresponding period exhibited Gini growth exceeding 0.02 points. Ukraine started at the level of CEE/EU countries (0.256 in 2020, close to the Czech Republic at 0.262 and Poland at 0.285) and, within five years, approached Latin American states, where Colombia has 0.544, and Brazil has 0.503. Should the 2023-2025 trend persist, in the next 2-3 years, Ukraine may surpass even Brazil in inequality, reaching levels of ultra-high inequality seen in countries such as Namibia (0.59) or South Africa (0.63). The structural drivers of the wartime shock are revealed through additional analysis of L2UKR data. First, real incomes of households at the bottom of the distribution (Q1-Q2) in 2024 declined relative to 2020, while incomes of the top quintile (Q5) grew the most rapidly (World Bank, 2025). This asymmetry alone is sufficient to explain the rise in the Gini coefficient from 0.25 to above 0.40.

Second, the share of households in the bottom quintile (B20) reporting labour income as a source of household earnings declined from 66% (2020) to less than 25% (2024). Three of every four poorest households thus lost access to the labour market during the wartime period and depend entirely on social transfers, humanitarian assistance, or non-monetary survival mechanisms (World Bank, 2025). In contrast, in the T20 group, employment rates remained high and stable throughout the observation period. The asymmetric character of the labour shock is the most important structural factor of wartime inequality, since it affects not only current incomes but also the capacity of lower deciles to restore their position after the war ends. Loss of labour activity over an extended period creates the well-known "scarring effects" – long-term negative consequences for human capital and employment opportunities. Third, sectoral wage differentiation in 2024 reached unprecedented levels. According to data from the State Statistics Service of Ukraine, in Q4 2024, the average wage in air transport was 54,600 UAH, in the IT sector 57,500 UAH, in education 14,300 UAH, in healthcare around

17,000 UAH, and in arts and culture 14,000-16,000 UAH. The gap reaches 3-4 times that amount. Agriculture, meanwhile, demonstrated one of the fastest growth rates – +33-43% year-over-year – but even with this growth, the sector's wage (around 20,000 UAH) remained substantially below the "new economy". This sectoral gap is closely correlated with the geographic one: "upper" sectors are concentrated in large cities and in the West, while "lower" sectors are in regions that suffered the greatest destruction (World Bank, 2025). The most concerning is the dynamics of education and healthcare. These sectors are critical for long-term human capital development but are funded on a residual basis under the wartime budget. In the future, this will create a serious challenge for the country's recovery and for maintaining the quality of education and healthcare amid low wages in those sectors.

The gender dimension of the wartime shock also deserves attention, although it cannot be fully analysed without microdata and has obvious empirical manifestations. The mobilisation of predominantly men changed the structure of households – a large proportion of families now have one adult (a woman) as the main earner and decision-maker. Payments to military personnel, which substantially exceed peacetime wages, redistributed part of family incomes, but simultaneously created a group of households without a primary male breadwinner and without substantial payments (families of mobilised persons from low-paid occupations). This phenomenon requires further research with microdata. Up to this point, the analysis of wartime shock has focused on the distribution of income across population groups. No less informative is the analysis of the functional distribution – the ratio between labour compensation and capital income – which is usually considered a more stable indicator of economic structure. Particular attention is warranted for the analysis of the functional distribution of income and the labour share in GDP. As shown in Figure 5, Ukraine exhibits a dynamic of this indicator that is unique within the studied group of countries, especially during the wartime period.

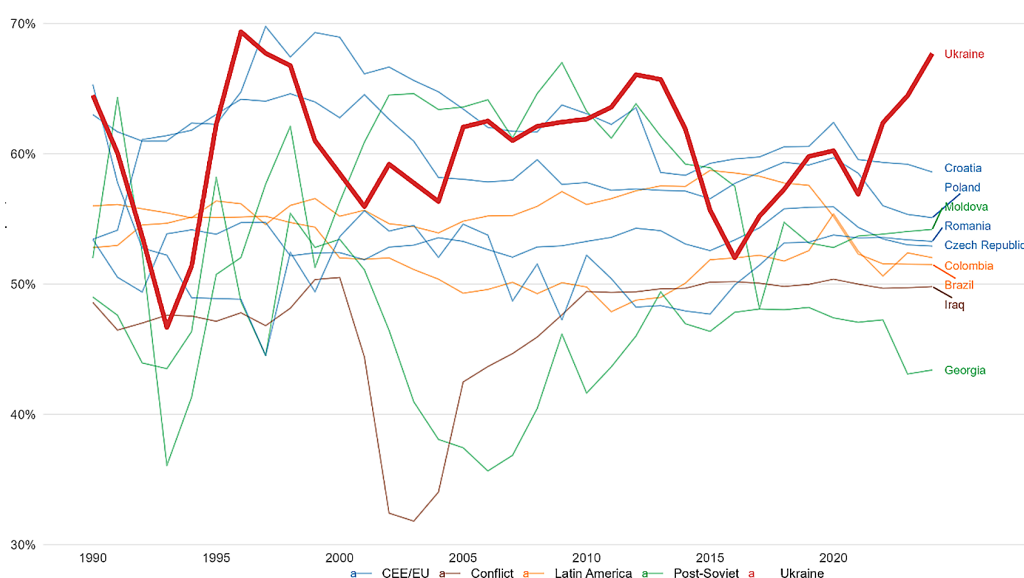


Figure 5. Labour share in GDP: Ukraine in the international context (1990-2024)

Source: prepared by the author

The overall mean labour share for Ukraine over 1990–2024 is 60.4%, with substantial variability (standard deviation 5.1 percentage points). The lowest value (46.7%) falls in 1993, the period of hyperinflation. Particularly noteworthy is the wartime period: following the trough in 2015–2016 (around 52–55%, linked to the Donbas crisis), the indicator rose sharply to 67.7% in 2024 – the highest value for Ukraine since 1998 and one of the highest in the entire country sample. It sharply contrasts with the global long-term trend of declining labour share observed in developed economies since the 1980s (Karabarbounis & Neiman, 2014). This result creates a paradox: formally, the labour share of GDP increased, which is traditionally associated with reduced functional inequality, while personal inequality (Gini) doubled. The resolution of the paradox lies in the structure of wartime redistribution: budget expenditures on defence and payments to military personnel constitute the main channel of increased labour share, alongside a collapse of business profits due to capital destruction and market losses. Within labour incomes, however, radical polarisation is observed: military pay raises the average wage, while civilian sectors (especially those affected by the war) remain low.

This phenomenon substantially distinguishes Ukraine from the “normal” long-term trend of declining labour share observed in Brazil, Colombia, and Georgia. It also calls into question the traditional interpretation of labour share as a measure of functional inequality – under wartime conditions, this indicator does not reflect the real balance between capital and labour, but rather serves as a proxy for budgetary transfers. This result has important methodological implications for further research. In countries undergoing major macroeconomic shocks, the labour share should be interpreted cautiously and considered alongside other distributional indicators. Summing up the analysis of the wartime shock, one can formulate the thesis of a “dual transformation” of the Ukrainian distributional situation. First, a dramatic rise in personal inequality has occurred, bringing Ukraine closer to Latin American standards. Second, an unusual (though possibly temporary) reversal of functional inequality has taken place toward an increased labour share. These two transformations simultaneously reflect the specifics of a wartime economy: large-scale budgetary transfers for defence create a substantial group of high-income recipients while asymmetrically affecting the civilian population. After the end of the war, this situation will inevitably change: the return of military personnel to civilian life, recovery of the private sector, and changes in the structure of budgetary expenditures – all these processes will shape a new distributional situation, which can be analysed only after some time has passed.

The findings of the present study can be situated within an expanding body of contemporary research on income inequality, labour markets, and the distributional consequences of war. Particularly informative for benchmarking are studies published in the last five years that directly address either the Ukrainian case or methodologically comparable contexts. Several recent contributions analysed the Ukrainian labour market under wartime conditions and provided important corroboration of these findings on the asymmetric distributional shock.

V. Koziuk & A. Kremez (2023) examined the differentiation of income distribution in Ukraine during the war and post-war period. They concluded that the war has accelerated income polarisation through divergent sectoral trajectories – a conclusion fully consistent with current decomposition of the wartime shock by sector. Their analysis, however, was based on aggregated Derzhstat data and did not employ the alternative-source comparison developed in this study; consequently, the magnitude of the shock they document (a moderate widening of the income gap) is substantially smaller than DINA-informed estimate. This contrast reinforces central methodological argument: survey-based statistics alone tend to understate the true scale of wartime inequality.

A. Giacomo *et al.* (2026) provided a comprehensive analysis of the wartime Ukrainian labour market, documenting an unprecedented compression of formal employment alongside a sharp rise in informal and military-related earnings. Their findings complement current results on the collapse of the B20 labour-income share (from 66% in 2020 to under 25% in 2024) and lend external validity to the “scarring effects” mechanism that was identified. A. Tsapin & O. Zholud (2025) and A. Tsapin (2026) corroborated this picture from the firm-level perspective, showing that corporate employment and wage dynamics during the war exhibit pronounced sectoral and geographic heterogeneity. Their evidence on the divergence between “war-resilient” and “war-affected” sectors directly underpins observation of the 3–4 times wage gap between aviation/IT and education/healthcare/agriculture.

O. Cheromukhina & Y. Chaliuk (2022) provided an early assessment of the wartime labour market, focusing on internally displaced persons and the disruption of regional production networks. Current analysis confirms and extends their findings on the geographical concentration of labour market shocks by linking sectoral wage data with regional patterns of destruction. I. Tsymbaliuk *et al.* (2023) analysed migration trends and unemployment indicators during the war, identifying mass external migration as a structural driver of labour-market disequilibrium. While their study did not directly measure income inequality, their evidence on emigration-induced labour shortages helps explain why the labour share in GDP paradoxically rose during the wartime period – a finding central to this work.

A broader theoretical perspective is offered by T. de Vries & A. Toda (2022), who examined capital and labour income Pareto exponents across countries and over time. Their finding that capital income concentration is systematically higher than labour income concentration in transition economies is directly relevant to current interpretation of the inequality gap as a measure of “hidden” wealth concentration that escapes household surveys. Their cross-country evidence supports current claim that DINA-based estimates capture a structurally important component of inequality that survey methodology misses. S. Braun & J. Stuhler (2023) investigated the long-term labour market consequences of exposure to war, demonstrating that war-induced disruptions produce persistent negative effects on individuals’ lifetime earnings – empirical support for the “scarring effects” interpretation that was applied to the Ukrainian B20 trajectory. While their study

examined Second World War cohorts in Germany, the parallels with the contemporary Ukrainian case are striking: an entire cohort of working-age individuals risks long-term marginalisation from the formal labour market, with consequences extending well beyond the war's conclusion.

The regional dimension of inequality in Ukraine was systematically studied by K. Huk & A. Zeynalov (2022), who documented substantial regional disparities and their relationship with economic growth. Their pre-war evidence on persistent regional gaps provides important baseline context for understanding the territorial dimension of the wartime distributional shock identified in this study. The wartime period evidently amplified the pre-existing regional disparities they documented, transforming them into a structural feature of the wartime economy. Beyond the Ukrainian context, the broader empirical literature on inequality measurement provides further validation. R. Steenbrink & A. Skali (2026), leveraging WID data on 165 countries between 1995 and 2019, found a statistically significant negative association between wealth inequality and economic growth (a one-standard-deviation increase in the wealth Gini coefficient corresponds to a 0.34 percentage-point decline in growth rates). This finding directly supports the policy implications drawn from Random Effects model: the U-shaped (anti-Kuznets) relationship identified suggests that, without targeted institutional reforms, the wartime increase in Ukrainian inequality may itself constrain post-war recovery – an argument consistent with the macroeconomic evidence in authors' contribution. Taken together, the contemporary literature supports the central empirical findings of this study: the wartime shock has produced a distributional disruption of unprecedented magnitude, driven by asymmetric labour-market effects, sectoral polarisation, and pre-existing structural vulnerabilities.

■ CONCLUSIONS

The study allowed the formulation of empirically grounded conclusions regarding income inequality dynamics in Ukraine over 1990–2025. Systematic comparison of four independent data sources revealed that the methodological gap between DINA-based (mean 0.437) and survey-based (mean 0.277) Gini estimates for Ukraine averaged 0.163 points. This gap reflects not a methodological error but the actual concealment of part of the inequality in traditional household surveys, driven by the shadow economy and asset concentration in the top decile. Analysis of variance on 246 observations confirmed a statistically significant ordering of countries across four institutional groups ($F = 51.59$;

$p < 0.001$) in the hierarchy: Conflict (Iraq, 0.380) > Post-Soviet (0.186) > Latin America (0.158) > CEE/EU (0.141). Ukraine belonged institutionally to the post-Soviet group, although its empirical IG value (0.163) was lower than the group average, reflecting within-group heterogeneity. This positioning indicates that the Ukrainian case is not a methodological anomaly but reflects the broader pattern of post-Soviet institutional features, even though the magnitude of hidden inequality is somewhat smaller than in Georgia or Moldova.

Testing of the Kuznets hypothesis yielded mixed results. While the pooled OLS model formally confirmed the classical inverted U-curve ($\beta_1 = 1.439$; $\beta_2 = -0.078$; both $p < 0.001$) with a peak at GDP $\approx 10,452$ USD PPP, the Random Effects specification – selected via the Hausman test ($\chi^2 = 1.623$; $p = 0.444$) – showed a U-shaped (anti-Kuznets) relationship with a minimum at GDP $\approx 21,288$ USD, virtually identical to the Fixed Effects model. This positions Ukraine (GDP $\approx 17,000$ USD) before the minimum, in a zone of potential inequality growth as GDP rises, underscoring that targeted institutional reforms – not merely economic growth – are necessary for inclusive development. The most dramatic finding was the wartime inequality shock: the Gini coefficient doubled from 0.256 (2020) to 0.50 (2025), an unprecedented phenomenon for the European region in recent history. The decomposition attributed this shock to the asymmetric collapse of labour incomes in the bottom quintile alongside rising top-decile incomes, a decline in the share of B20 households with labour earnings from 66% to under 25%, and unprecedented sectoral wage differentiation between the “new economy” and traditional sectors. These findings translate into clear policy implications: large-scale support for households that lost access to the labour market, de-shadowing of the economy combined with progressive asset taxation, and regional redistribution mechanisms within the post-war recovery program. Further research will benefit from integrating household microdata, extending panel specifications to include institutional indicators, and analysing the gender dimension of the wartime distributional shock.

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Розрив нерівності та воєнний шок: розподіл доходів в Україні

■ **Анотація.** Економічна нерівність є однією з ключових глобальних проблем, а в Україні її оцінювання ускладнюється методологічними розбіжностями, пострадянською інституційною специфікою та безпрецедентними перерозподільними наслідками повномасштабної війни, що розпочалася у 2022 році. Метою дослідження було оцінити динаміку нерівності доходів в Україні за 1990–2025 роки шляхом системного порівняння альтернативних джерел даних та міжнародного бенчмаркінгу щодо країн подібного інституційного типу. Методологічна рамка поєднувала аналітичну категорію «розрив нерівності», однофакторний дисперсійний аналіз (ANOVA) із пост-хок тестом Тьюкі HSD, моделі панельних даних Pooled OLS, Fixed Effects і Random Effects, а також тест Гаусмана для вибору моделі. Аналіз виявив статистично значущу міжгрупову типологію країн за розривом нерівності ($F = 51,59$; $p < 0,001$), у межах якої Україна (0,163) належала до пострадянської групи разом із Грузією (0,211) та Молдовою (0,185). Перевірка гіпотези Кузнеця показала, що крос-країнова інвертована U-крива (Pooled OLS, пік при ВВП $\approx 10\,452$ дол. США) не підтверджується при врахуванні панельної структури даних: модель Random Effects, обрана за тестом Гаусмана, виявила U-подібний (антикузнецівський) зв'язок із мінімумом при ВВП $\approx 21\,288$ дол. США. Коефіцієнт Джині в Україні зріс з 0,25 (2020) до 0,50 (2025), а декомпозиція показала асиметричне падіння трудових доходів у нижньому квінтілі разом зі зростанням доходів верхніх децилів як ключовий канал цього шоку. Отримані результати дозволили позиціонувати українську ситуацію не як методологічну аномалію, а як прояв інституційних особливостей пострадянського простору, що потребує системних реформ детінізації економіки та прогресивного оподаткування активів у межах повоєнного відновлення.

■ **Ключові слова:** нерівність доходів; коефіцієнт Джині; прихована нерівність; DINA; гіпотеза Кузнеця; тіньова економіка; частка праці в доходах