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REVENUE-BASED CLUSTER ANALYSIS UNDER WARTIME CONDITIONS: FINANCIAL PROFILES AND LOCAL TAX-BASE IMPLICATIONS IN THE BEREHOVE TERRITORIAL COMMUNITY

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**КЛАСТЕРНИЙ АНАЛІЗ НА ОСНОВІ ЧИСТОГО ДОХОДУ ВІД РЕАЛІЗАЦІЇ В УМОВАХ
ВОЄННОГО СТАНУ: ФІНАНСОВІ ПРОФІЛІ ПІДПРИЄМСТВ І НАСЛІДКИ ДЛЯ ПОДАТКОВОЇ
БАЗИ БЕРЕГІВСЬКОЇ ТЕРИТОРІАЛЬНОЇ ГРОМАДИ**

The article examines the transformation of the local entrepreneurial environment under martial law and the associated intensification of firms' financial heterogeneity, which constrains the use of averaged indicators when assessing business financial standing and the tax capacity of a territorial community. The study aims to develop an empirically grounded typology of enterprises in the Berehove territorial community based on statistical grouping by net sales revenue in 2024 and to interpret the resulting groups in terms of the structure and risks of the local tax base. The empirical foundation comprises data on legal entities in the community compiled from the Opendatabot database. The methodological framework includes stepwise clustering (segmentation) with internal homogeneity controlled by the coefficient of variation (CV), analysis of revenue dynamics for 2020–2024, matching revenues with net financial results and employment indicators, and comparing the

derived business profiles with trends in the community's fiscal and tax revenues in 2021–2024. The findings reveal a high degree of asymmetry in the distribution of revenues and profitability and the emergence of typical segments with distinct financial profiles. Budget revenue dynamics in 2021–2024 exhibit an overall upward trend accompanied by a deceleration of growth rates in 2024, as well as an increasing role of local taxes and fees as a stabilizing factor of the revenue base. Scientific novelty lies in testing an approach to statistically controlled grouping of highly heterogeneous local data using the CV criterion and in linking firm-level financial profiles with the community's fiscal and tax parameters. The practical relevance of the results is associated with the applicability of the proposed typology to targeted business support, monitoring taxpayer concentration risks, and strengthening the evidence base for local fiscal policy decisions. The proposed segmentation can also serve as an analytical basis for identifying 'formal presence' enterprises (registered but economically inactive) and refining community-level risk diagnostics under crisis conditions.

У статті досліджено трансформацію локального підприємницького середовища в умовах воєнного стану та пов'язане з нею посилення фінансової неоднорідності підприємств, що обмежує використання усереднених показників під час оцінювання фінансового стану бізнесу й податкової спроможності територіальної громади. Метою дослідження є формування емпірично обгрунтованої типології підприємств Берегівської територіальної громади на основі статистичного групування за показниками чистого доходу від реалізації у 2024 р. та інтерпретація отриманих груп у контексті структури й ризиків місцевої податкової бази. Емпіричну основу становлять дані щодо юридичних осіб громади, сформовані за матеріалами бази "Opendatobot". Методичний інструментарій охоплює поетапне кластерування (сегментацію) з контролем внутрішньогрупової однорідності за коефіцієнтом варіації (CV), аналіз динаміки доходів за 2020–2024 рр., зіставлення доходів із чистим фінансовим результатом і показниками зайнятості, а також порівняння сформованих підприємницьких профілів із динамікою бюджетно-податкових надходжень громади у 2021–2024 рр. Отримані результати засвідчують високий рівень асиметрії розподілу доходів і прибутковості та формування типових сегментів із відмінними фінансовими профілями. Динаміка бюджетних надходжень у 2021–2024 рр. характеризується загальною висхідною тенденцією за одночасного уповільнення темпів приросту у 2024 р., а також зростанням ролі місцевих податків і зборів як чинника стабілізації доходної бази. Наукова новизна полягає в апробації підходу до статистично контрольованого групування високогетерогенних локальних даних із використанням критерію CV та у поєднанні мікрорівневих фінансових профілів підприємств із бюджетно-податковими параметрами громади. Практичне значення результатів полягає у можливості застосування запропонованої типології для таргетованої підтримки бізнесу, моніторингу концентраційних ризиків у структурі платників та підвищення обгрунтованості управлінських рішень у сфері місцевої фіскальної політики. Запропонована сегментація може також слугувати аналітичною основою для виявлення підприємств із "формальною присутністю" (zareєстрованих, але економічно неактивних) і уточнення ризик-діагностики на рівні громади в кризових умовах.

Key words: entrepreneurial sector, territorial community, tax base, local taxes, fiscal sustainability, cluster analysis, statistical grouping, coefficient of variation, martial law.

Ключові слова: підприємницький сектор, територіальна громада, податкова база, місцеві податки, фіскальна стійкість, кластерний аналіз, статистичне групування, коефіцієнт варіації, воєнний стан.

GENERAL STATEMENT OF THE PROBLEM AND ITS CONNECTION WITH IMPORTANT SCIENTIFIC OR PRACTICAL TASKS

Martial law in Ukraine has triggered an abrupt transformation of the local entrepreneurial environment. Disparities in economic activity have intensified; revenue and profitability have become more volatile; employment parameters have shifted; and relocation dynamics-

together with the phenomenon of enterprises' "formal presence" (registration without systematic business activity)-have become more pronounced. In border territorial communities, these effects are additionally shaped by spatial-economic features and the predominance of small and microbusinesses, increasing internal heterogeneity among economic entities. Under such conditions, reliance on aggregated mean indicators to

assess enterprise financial standing is methodologically constrained: extreme values and high dispersion distort generalized estimates and reduce analytical usefulness. From a scholarly perspective, this motivates the development and empirical testing of statistical grouping methods capable of structuring highly heterogeneous enterprise datasets and producing interpretable typologies of financial profiles under crisis conditions. From an applied perspective, such structuring improves community-level decision-making regarding: (i) assessment of the capacity and risks of the local tax base; (ii) identification of enterprise groups for targeted support; (iii) monitoring relocation effects and anomalies driven by a small number of high-revenue entities; and (iv) formulation of tax-relevant recommendations aimed at sustaining economic activity and employment. Consequently, cluster-based profiling of enterprise financial indicators during wartime serves as both an analytical instrument and a practical mechanism for strengthening local economic and fiscal planning.

FORMULATION OF THE OBJECTIVES OF THE ARTICLE (TASK STATEMENT)

The purpose of the article is to provide a quantitative structuring of for-profit legal entities operating in the Berehove territorial community under martial law by applying one-dimensional clustering based on net revenue in 2024, using a within-cluster homogeneity criterion $CV \leq 30\%$. The study further aims to develop and interpret financial profiles of the identified clusters using the dynamics of revenue, net financial results, approximate profitability, and employment over 2020–2024, and to substantiate generalized tax-policy-oriented recommendations at the community level.

ANALYSIS OF THE LATEST RESEARCH AND PUBLICATIONS

Numerous domestic and international scholars have addressed enterprise and MSME functioning under crisis and wartime shocks, the use of statistical grouping methods (including clustering) for heterogeneous financial data, and fiscal determinants of local budget capacity and tax-base formation. UNDP [15] provides empirical context for MSME performance in Ukraine during wartime, documenting business suspension and recovery dynamics and identifying key constraints (demand conditions, logistics, labor availability, access to finance). The methodological foundations of clustering as a tool for uncovering latent structure in heterogeneous datasets are systematized by Jain A. K. [7], while the applied relevance of cluster-based financial profiling is supported by Wang Y.-J., Lee H.-S. [17], and Bolos M.-I. et al. [3]. For dispersion-based homogeneity criteria, Moore et al. [10] demonstrate the informational value of the coefficient of variation (CV) as an indicator of reliability/dispersion in empirical estimates, supporting CV-oriented thresholds when forming analytical groups.

The fiscal and institutional preconditions of local revenue capacity and local tax-policy constraints are discussed by Tulai O. et al. [14], Glushchenko J. and Kozhalina N. [5], Khodan M. and Burtnyak I. [8], and Sidelnykova L. and Zosymchuk V. [20]. Empirical evidence on the rela-

tionship between macroeconomic shocks, tax revenues, and budget dynamics is provided by Bacho et al. [1]. Complementing this perspective, [2] analyzes how enterprise relocation reshapes Transcarpathia's business environment and affects local fiscal outcomes, thereby informing the interpretation of structural change and outlier behavior in micro-regional enterprise datasets.

At the same time, a gap remains in developing and empirically validating a reproducible micro-regional approach that, through statistically controlled (CV-oriented) clustering, identifies homogeneous enterprise groups and links their structure to the formation, risks, and capacity of the local tax base under wartime conditions.

SUMMARY OF THE MAIN RESEARCH MATERIAL

The analysis is based on an original enterprise dataset constructed through primary data collection initiated in late 2024 and finalized in August 2025. Access to enterprise financial data in Ukraine depends significantly on legal status. Financial statements of legal entities are available through several platforms (often as paid services). Data collection was performed using the Opendatabot [12] platform.

The finalized dataset contains $n' = 230$ legal entities, representing approximately 13% of the total population of registered organizations in the community. Non-profit entities (educational institutions, civil organizations, charitable foundations, public institutions, etc.) were excluded from the analysis.

A critical feature of the data is pronounced heterogeneity. In 2024, only $n' = 75$ enterprises reported positive net revenue; 155 out of 230 reported zero revenue. Because revenue-based clustering requires variation in the clustering variable, the group with zero revenue in 2024 was not included in cluster formation and is treated as a distinct category in interpretation (formal presence / inactivity).

Clustering was performed in one dimension using net revenue in 2024. Enterprises were sorted in ascending order of revenue, and a greedy sequential segmentation approach was applied [4]: clusters were formed from consecutive observations until the within-cluster dispersion reached a threshold. Within-cluster relative dispersion was operationalized via the coefficient of variation:

$$CV_k = \frac{\sigma_k}{\mu_k} \cdot 100\% \quad (1),$$

where μ_k denotes the average revenue of cluster k , and σ_k represents the within-cluster sample standard deviation. If adding a new enterprise would have caused CV_k to exceed the 30% threshold, the cluster was closed at the previous observation and a new cluster was initiated. This procedure resulted in 14 clusters (K1-K14), each satisfying the criterion $CV_k \leq 30\%$.

Cluster profitability in 2024 was approximated using a profit-rate measure [16]:

$$PR_k = \frac{\text{net income}_k}{\text{sales revenue}_k} \cdot 100\% \quad (2),$$

Table 1. Cluster analysis of enterprises based on net revenue between 2020 and 2024 (n = 230, n'=75)

Cluster	Average net revenue (thousand UAH)					Number of enterprises operating in the examined cluster (pcs)				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
K1	–	–	–	221 755,8	703 511,5	0	0	0	1	1
K2	–	–	18 529,3	72 322,7	136 465,8	0	0	2	4	4
K3	467 467,0	388 196,0	44 446,2	54 093,2	47 627,2	2	3	4	5	5
K4	6 105,3	9 335,4	12 408,1	27 471,2	21 920,7	4	2	6	6	7
K5	346,6	7 618,2	5 304,5	12 426,3	6 201,9	2	1	9	12	12
K6	–	26,0	312,1	1 013,2	1 667,5	0	2	5	5	8
K7	950,9	1 306,3	242,8	1 223,9	664,5	2	2	3	3	4
K8	1 120,5	268,8	434,2	684,2	296,1	1	1	3	4	8
K9	–	63,5	89,5	140,0	143,2	0	2	2	2	5
K10	–	30,0	30,0	78,0	60,0	0	0	1	1	1
K11	37,9	22,2	50,0	104,3	27,7	1	5	8	8	9
K12	–	10,3	12,6	140,0	12,4	0	2	3	4	5
K13	–	45,9	6,3	3,8	5,3	0	2	3	3	3
K14	–	15,0	11,0	0,5	0,5	0	1	1	1	1

Source: Authors' compilation.

where both numerator and denominator are computed as cluster means. This proxy is interpretable as an approximate net margin at the cluster level but becomes unstable when average revenue is extremely small; such cases are explicitly flagged.

Employment was assessed using the reported number of employees in 2024 at the cluster level (mean, min, max), to support the interpretation of enterprise scale and labor-market relevance. To connect enterprise structure to fiscal capacity, local budget tax revenues (general and special funds combined) were summarized by category for 2021—2024, with year-on-year changes reported in percent.

In 2024, the 230 enterprises generated 1.7 billion UAH in net revenue, with an average of 23.1 million UAH per enterprise. However, only 75 enterprises reported any revenue, implying that a substantial share of legal entities did not conduct productive activity during the year, while a small number exhibited exceptionally high values. Accordingly, dispersion was extreme (reported CV = 371.5% for revenue in 2024), and similar patterns were observed for other indicators and earlier years. This confirms that simple averages would be analytically misleading and supports the use of CV-controlled clustering.

In defining the research methodology, we aimed for homogeneity and allowed a maximum relative dispersion of 30% within enterprise groups, forming clusters accordingly.

The 30% upper threshold for relative dispersion was not an arbitrary choice; rather, it aligns well with quality categories commonly applied in economic statistics. Several European statistical offices—such as the Statistical Office of the Republic of Slovenia [18] in its business tendency and foreign trade surveys—classify the reliability of estimates based on the coefficient of variation (CV). Indicators with a CV below 15% are considered sufficiently accurate; estimates falling within the 15—30% range are published with reduced accuracy or warning labels; while estimates with a CV above 30% are deemed too unreliable and are generally not published or are marked with cautionary notes.

A similar principle is applied in labor market and household surveys. For example, the methodological

guidelines of the UK Labour Force Survey [11] set a recommended publication threshold at a relative dispersion of around 20—25%, whereas Canadian guidelines [13] along with those of other national statistical offices, consider CV values in the range of 15—35% to fall into a use with caution category, with values above 30—35% frequently classified as too unreliable and therefore suppressed or published only with explicit warnings [9]. A regional industry report [6] on the economic analysis of the legal sector even treats CV values of 5—10% as reasonably precise, which further suggests that the 30% threshold represents the upper bound of what can still be considered acceptable.

Lowering the relative dispersion threshold would have caused the dataset to fragment into micro-clusters of only a few units, thereby reducing the generalizability of the economic conclusions.

The average revenues of the clusters span an extremely wide range: in the case of the K1 cluster, which consists of a single enterprise with exceptionally high revenue, the value reaches 703.5 million UAH, while in the lowest clusters (K12-K14) the average turnover amounts to only a few thousand hryvnias. In addition, there is another category—namely the 155 enterprises out of 230 that reported no revenue in the examined year. Due to the absence of performance data, this group was not included in the cluster analysis.

The intermediate clusters are concentrated within the typical revenue ranges of micro and small enterprises in Transcarpathia: in clusters K3-K5, average revenues fall between 6 and 48 million UAH, while in K6-K9 and K11 average values range between 26,000 and 1.7 million UAH. The clusters are presented in the Table 1 below: the left section shows the average revenues for 2020—2024, while the right section displays the number of enterprises included in each cluster.

It can be observed that the largest cluster size is 12 enterprises, while several clusters contain only one or a few firms. Since the clustering was performed using 2024 revenue data, earlier years display a certain degree of "emptying," meaning that enterprises with the revenue levels characteristic of a given cluster were either not present or were present in smaller numbers in previous

Table 2. Dynamics of clusters between 2020 and 2024 (n = 230, n'=75)

Cluster	Change in revenue compared to the previous year (in %)			
	2021	2022	2023	2024
K1	-	-	-	217%
K2	-	-	290%	89%
K3	-17%	-89%	22%	-12%
K4	53%	33%	121%	-20%
K5	2098%	-30%	134%	-50%
K6	-	1100%	225%	65%
K7	37%	-81%	404%	-46%
K8	-76%	62%	58%	-57%
K9	-	41%	56%	2%
K10	-	-	160%	-23%
K11	-41%	125%	109%	-73%
K12	-	23%	1012%	-91%
K13	-	-86%	-39%	39%
K14	-	-27%	-95%	0%

Source: Authors' compilation.

years. This observation is particularly true for cluster K1, which in 2024 consisted of a single enterprise with a revenue of 703.5 million UAH. The second-largest enterprise in the same year recorded 136.5 million UAH, meaning that the leading firm constituted an extreme outlier relative to all other clusters.

Therefore, this enterprise had to be treated separately due to its exceptional value. In November 2025, we examined this company in more detail and found that it was a relocated enterprise which operated in Zaporizhzhia prior to 2023 and subsequently returned its headquarters to its original location by 2025. As a result, the enterprise will no longer appear in the statistics of the following period, and the corresponding cluster will also disappear unless a new enterprise of similarly high revenue enters the dataset.

Table 2 reports the year-on-year changes in mean cluster revenues. Patterns differ substantially across clusters, reflecting wartime volatility, possible composition changes within clusters, and non-linear recovery trajectories.

In the case of cluster K1, only two years can be compared, during which revenue more than doubled. For cluster K2, revenue in 2023 was also more than twice the previous year's level, although this dynamic weakened in 2024.

Cluster K3 shows greater variability: enterprises here tend to have been operating for a longer period, and growth

occurred only between 2022 and 2023, while the other years exhibited declines of varying magnitude.

Enterprises in cluster K4 generally performed well, with the only collective downturn occurring between 2023 and 2024.

Cluster K5 is the largest homogeneous group, yet displays highly diverse annual results: a twentyfold increase in 2021 compared to the previous year, a decline in 2022, slight growth in 2023, and another decline in 2024. It is important to examine the firms in this cluster individually, as significant shifts likely occurred among key actors due to relocation processes and other forms of corporate fluctuation.

In cluster K6, average revenue drops considerably compared to the previous cluster, and annual fluctuations are also substantial. However, a positive trend is visible: the cluster's average performance increased every year. Clusters K7 and K8 are similar in magnitude to the preceding cluster, yet annual performance varied strongly in both cases. The K9-K14 range comprises the poorest-performing clusters, showing negative tendencies both in absolute revenue levels and in annual dynamics.

In the next step of the analysis, we examined the net income of enterprises by cluster. To compare revenue and profitability, we also calculated profit ratios, that is, the net profit margin. The higher the percentage value for a given enterprise-and, by extension, for the cluster-the

Table 3. Cluster analysis of enterprises based on profitability and profit rate in 2024

Cluster	Number of elements	Average revenue (UAH)	Minimum revenue (UAH)	Maximum revenue (UAH)	Difference	Average net income 2024 (thousand UAH)	Profit rate approximation (%)
K1	1	703 511 500	703 511 500	703 511 500	0	16 024,4	2,3
K2	4	136 465 750	114 748 800	161 787 000	47 038 200	5 439,95	4,0
K3	5	47 627 160	29 296 700	60 983 200	31 686 500	7 633,84	16,0
K4	7	21 920 714	14 151 000	28 168 600	14 017 600	3 174,26	14,5
K5	12	6 201 875	3 258 900	8 258 600	4 999 700	562,77	9,1
K6	8	1 667 500	938 400	2 478 700	1 540 300	-610,5	-36,6
K7	4	664 450	463 100	893 700	430 600	3,5	0,5
K8	8	296 063	175 500	408 500	233 000	-14,8	-5,0
K9	6	131 621	73 800	160 000	86 200	11,56	8,8
K10	1	60 000	60 000	60 000	0	-	-
K11	10	26 830	16 500	38 000	21 500	1,54	5,8
K12	5	12 420	8 000	16 400	8 400	-85,4	-687,3
K13	3	5 333	4 000	7 000	3 000	0	0,0
K14	1	500	500	500	0	-	-

Source: Authors' compilation.

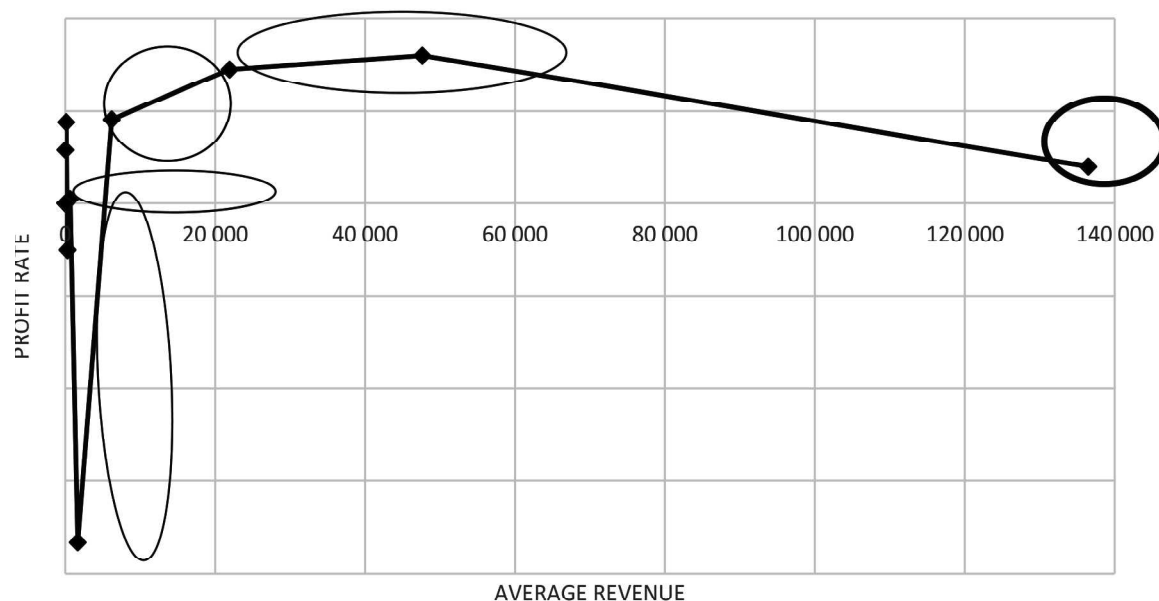


Fig. 1. Profit rate map of the Berehove micro-region in 2024 (n = 230, n'=75)

Source: Authors' compilation.

more efficiently the enterprise (or cluster) manages its costs, or, from another perspective, the more profit it is able to generate relative to its revenue. The results are presented in Table 3, which displays cluster-level outcomes for the year 2024.

Table 3 provides a summary of the number of enterprises within each cluster, the average, minimum, and maximum revenue values, the difference between the latter two, as well as the average net income and profit ratio for 2024.

The highest net income (16 million UAH) was achieved by the enterprise in the exceptionally outstanding K1 cluster. Although this value significantly exceeds the average net income of all other clusters, its net profit margin—that is, the profit ratio—amounts to only 2.3%. The best-performing cluster is K3, where a 16% revenue-based profit was recorded in 2024. This is followed, slightly behind, by cluster K4 with 14.5%, and cluster K5 with 9.1%.

A negative profit ratio indicates that the enterprise group performed at a loss in the given year. This applies strongly to cluster K6, and to a lesser extent to cluster K8. Cluster K12 also exhibits substantial losses; however, its indicator becomes extremely negative because the average revenue is minimal. Therefore, this case requires separate evaluation, as the profit ratio cannot be reliably interpreted.

Figure 1 illustrates the cluster map based on profitability. The vertical axis shows the net profit relative to revenue, while the horizontal axis displays the average revenue of each cluster.

The diagram does not include the extreme K12 case, as excluding it allows for a clearer evaluation of the remaining clusters with respect to revenue and

profitability. Another special case is cluster K1, which, despite its high revenue, exhibits low profitability. Clusters K3 (16%) and K4 (14.5%) consist of medium-revenue but highly profitable enterprises. Clusters K5 (9.1%), K9 (8.8%), and K11 (5.8%) represent enterprise groups that achieved moderate profitability despite low revenue levels. In clusters K7 and K13, low average revenues are accompanied by nearly zero profit. Clusters K8 and K6 are loss-making; however, the extent differs: cluster K8 shows relatively small losses, whereas cluster K6 has a significantly higher loss ratio.

Figure 2 illustrates the correlation between revenue and net income.

Placing the values of the 14 clusters on the function reveals a moderately strong linear trend between revenue and net income. This trend is disrupted by cluster K1,

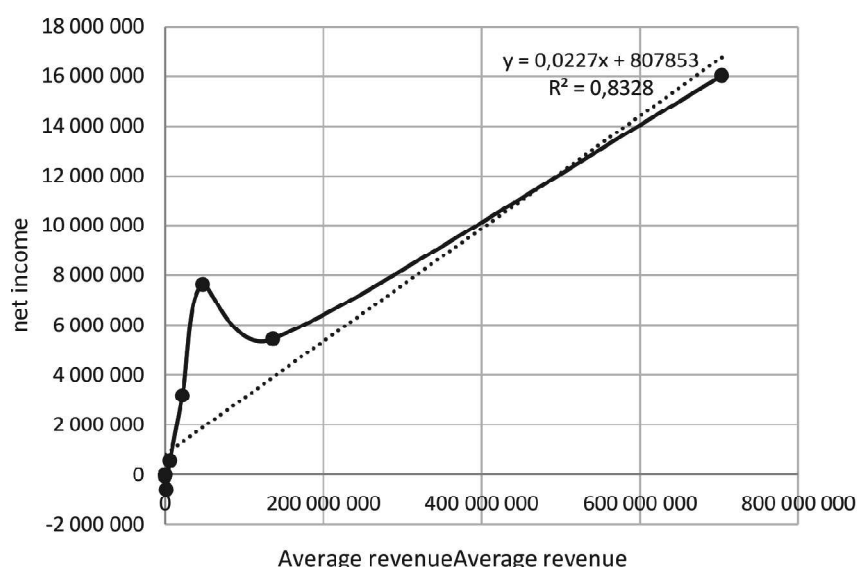


Fig. 2. Correlation between average revenue and average net profit across enterprise clusters in the Berehove micro-region in 2024 (n = 230, n'=75, k = 14)

Source: Authors' compilation.

Table 4. Cluster analysis of enterprises based on employment in 2024 (n = 230, n'=75)

Cluster	Number of enterprises (employment data available)	Average number of employees in 2024	Minimum (persons)	Maximum (persons)
K1	1	32	32	32
K2	4	62	12	87
K3	5	52,4	2	128
K4	7	20,86	0	55
K5	12	10,42	0	32
K6	8	2	1	6
K7	4	2,75	0	7
K8	8	2,38	0	6
K9	5	0,8	0	2
K10	1	0	0	0
K11	10	0,2	0	1
K12	4	0,25	0	1
K13	3	0,33	0	1
K14	1	0	0	0

Source: Authors' compilation.

which, despite its extremely high revenue, exhibits a low profit margin. Finally, the analysis is complemented by an examination of the number of employees (Table 4).

It can be observed that the highest average level of employment is found in cluster K3, yet overall it can be concluded that the Berehove territorial community has no large employers. In clusters K6-K14, employment levels decrease steadily and generally remain below 10 employees, indicating that these enterprises qualify as micro-level economic actors.

To connect enterprise structure to fiscal capacity, Table 5 summarizes tax revenues by category for the community budget (general and special funds combined).

Table 5 indicates a sustained increase in the Berehove City Territorial Community's tax revenues in 2021—2024, although growth clearly decelerated over time. Total tax revenues rose from 200,868.6 ths UAH in 2021 to 299,882.2 ths UAH in 2024. The strongest year-on-year expansion occurred in 2022 (+32.21%), followed by more moderate growth in 2023 (+9.72%) and near-stagnation in 2024 (+2.92%), suggesting a weakening revenue momentum under wartime conditions.

The revenue structure is dominated by taxes on income, profit and capital gains, which largely determined the overall dynamics. This category surged in

2022 (+54.97%), but contracted in 2024 (-7.67%), declining to 184,873.2 ths UAH—an important shift that coincides with the sharp slowdown in aggregate growth. Meanwhile, other components partially compensated for this decline. Domestic taxes on goods and services recovered after a drop in 2022 (-19.10%), increasing strongly in 2023 (+51.69%) and 2024 (+32.53%). Local taxes and fees show the most consistent upward trajectory after a slight decrease in 2022 (-2.79%), accelerating in 2023 (+26.09%) and 2024 (+24.54%) to 86,760.5 ths UAH, underscoring their stabilizing role for the community's fiscal capacity. Smaller categories (rent payments and the environmental tax) remain marginal in volume but display noticeable volatility, reflecting sensitivity to sectoral activity and administrative factors.

CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH IN THIS AREA

The revenue-based clustering results indicate that the community's tax base is structurally dual: it is shaped by a narrow group of high-turnover enterprises (K1-K2) and a broad mass of micro and small firms with low but potentially scalable activity (K5 and K9-K11), while a sizeable segment exhibits formal presence or persistently weak performance (K6, K8, K12-K14). This configuration

Table 5. Tax revenues by category and year, with year-on-year change (ths UAH; YoY, %) in the Berehove City Territorial Community budget (general and special funds combined)

Tax revenue category	2021	2022	2023	2024	YoY 22/21 (%)	YoY 23/22 (%)	YoY 24/23 (%)
Tax revenues (total)	200,868.6	265,567.7	291,378.7	299,882.2	32.21%	9.72%	2.92%
1. Taxes on income, profit and capital gains	126,538.5	196,097.0	200,234.7	184,873.2	54.97%	2.11%	-7.67%
2. Rent payments and charges for the use of natural resources	273.0	231.4	342.4	334.3	-15.22%	47.97%	-2.37%
3. Domestic taxes on goods and services	16,948.3	13,710.8	20,798.3	27,563.9	-19.10%	51.69%	32.53%
4. Local taxes and fees (total)	56,835.6	55,249.5	69,665.5	86,760.5	-2.79%	26.09%	24.54%
5. Other taxes and fees (environmental tax)	273.2	278.9	337.8	350.3	2.08%	21.12%	3.72%

Source: Authors' compilation based on [19].

implies that short-term fiscal stability may depend disproportionately on a small number of large taxpayers, increasing budget exposure to relocation shocks, reporting shifts, and temporary operational changes of outlier entities, as illustrated by the K1 case. Accordingly, tax-base risk management should integrate (i) continuous monitoring of high-revenue clusters as an early-warning mechanism (changes in registration, payroll, supply chains, and location) with (ii) diversification strategies that increase the contribution of the viable SME core. Profitability profiles suggest that clusters K3-K4 constitute the most sustainable "growth nucleus" for local economic development and future tax capacity; therefore, policy instruments should prioritize retention and expansion of these firms through targeted business services, locally tailored support programs, and facilitation of market access. In parallel, the steady expansion of local taxes and fees in 2023–2024 indicates that community-level fiscal instruments can partially offset volatility in income/profit-related revenues; thus, strengthening administration, compliance, and taxpayer services for SME clusters is likely to generate measurable fiscal returns. For low-revenue and loss-making clusters (K6, K8), support measures should be conditional and diagnostic, focusing on restoring operational viability (cost restructuring, advisory services, and access to finance) rather than providing untargeted subsidies that may preserve chronically unproductive entities. Enterprises with zero or near-zero reported revenue should be treated as a distinct governance category, requiring verification of actual activity and, where appropriate, measures aimed at formalization, de-shadowing, and registry hygiene to improve the accuracy of tax-base assessment. Overall, the proposed CV-controlled clustering framework can be institutionalized as an applied analytical module at the community level, enabling segmented policy design, more credible revenue forecasting, and evidence-based prioritization of business-support interventions under wartime uncertainty. Future research should extend this approach by incorporating multidimensional clustering (e.g., revenue, employment, and profitability simultaneously) and by testing the stability of cluster membership over time to quantify relocation-driven structural shifts in the local tax base.

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