
Relative Assessment of the Financial Situation of Households in Small Towns in Poland

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Abstract:

Purpose: The research aimed to assess the financial situation of small-town households relative to those in larger cities

Design/Methodology/Approach: The study drew on unpublished microdata from the Household Budget Surveys (HBS) conducted between 2015 and 2022 by the Central Statistical Office (CSO) in Warsaw, Poland. Representative samples included approximately 30,000 households each year. Urban households were categorized by the size of their residence area. The relative advantage of each class was computed for each dimension of the financial situation and then synthesized into a relative index for each analyzed year.

Findings: The research revealed that, at the start of the study period in 2015, small-town households had relatively the worst financial situation. During the pre-pandemic years (2015-2019), a clear convergence emerged among urban households of different classes. Notably, the financial situation of small-town households experienced the most significant improvement.

However, the outbreak of the pandemic in 2020 reversed this trend, causing a deterioration for households in small, medium, and large cities. In contrast, very large cities and metropolises saw a relative improvement. Throughout the pandemic years (2020-2022), changes in the financial situation of the analyzed household classes were minimal, with the most notable being the continued improvement for small-town households.

Practical Implications: Diagnosing the financial situation of households is crucial for assessing economic activity, crisis management, household economic development, and national economic growth. This study also highlights the developmental potential of small-town households. The improvement in their financial situation relative to other urban households indicates better living conditions in economic terms for small-town households. Additionally, it shows the impact of the pandemic and government protective measures on the financial situation across different size classes. The findings can assist local or central authorities and financial institutions in better managing urban development and maintaining economic stability, ensuring appropriate living conditions for city residents.

Originality/Value: The added value of this research lies in using a relative synthetic index to assess the financial situation of urban households by city size classes. The index synthesized various dimensions of the financial situation for a selected class relative to all

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other classes combined. The paper also includes source code in the R environment for the relative synthetic index. Additionally, the research drew on large databases encompassing over 200,000 records.

Keywords: Urban households, financial situation of households, small towns, relative taxonomy.

JEL Code: D12, D14, G51.

Paper type: Research article.

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1. Introduction

In 2016, there were 919 cities in Poland, of which 700 (76.2%) were small towns with populations up to 20,000 (Miasta w liczbach, 2016). Approximately 60% of Polish population lived in cities, with one in five residing in a small town. Heffner (2016) and Bański *et al.* (2024) emphasize the role of small towns as local development centers, which realize crucial economic roles for their rural hinterland, and structure the environment and operations of local communities. In the era of globalization and the growing influence of major urban centers in metropolization processes, several of the traditional functions of small towns have been taken over by larger ones. Sarzyński (2018) notes that this represents a shift in the relationship between small towns and rural areas, linking the latter more closely with large cities.

Small towns settled within the shade of sprawling conurbations suffer adverse effects from the operation of modern multifunctional centers for commerce, services, and recreation located on the outskirts of large cities. This negative imprint affects mainly commercial and service establishments, where the decline of local trade and service centers often leads to reduced revenues, foreclosures, the depreciation of fixed assets, urban space degradation, and a subsequent lack of local investments (Czarnecki, 2012; Heffner and Twardzik, 2013; Heffner, 2016).

The main social cost of these economic effects is the lack of local employment, which results in the outflow of primarily younger populations (Heffner, 2016). Research by the Polish Economic Institute (Dębkowska *et al.*, 2020) indicates that rural flight and the aging problems of small towns in Poland are compounded by a lack of development strategies. Smaller towns require greater investment and vision from their leaders to improve the quality of life for their residents.

As highlighted in their research by Kaczmarek and Kaczmarek (2024), scientific studies have focused more on the impact of globalization, and the social and technological innovations in large cities. However, with the intensification of the adverse effects of these changes on neighboring small towns, concepts of economic growth in these areas also began to emerge. Recent years brought proposals of new development theories for small towns, along with suggestions for improving the conditions and quality of life for residents. The latter included the ideas of eco-city, smart city, and green city (Pickerill, 2013; Hulicka, 2023; Roszkowska and Wachowicz, 2024; Trindade *et al.*, 2017).

One of the most innovative is the slow city, which minimizes environmental impact, preserves local traditions, encourages active community engagement in local governance, and fosters economic resilience by supporting local businesses and promoting a circular economy. These principles aim to create a more balanced, fulfilling, and sustainable urban living experience (Kaczmarek and Kaczmarek, 2024). Research by Korcelli-Olejniczak (2020) and Józefowicz (2024) also highlights the need to enhance the competitiveness of the economic functions of small towns, the operation of public institutions, and the improvement of residents' quality of life.

Small towns in Poland are grappling with the dual challenges of halting depopulation due to the country's demographic crisis and stemming the tide of young residents migrating to larger urban centers. Furthermore, these towns struggle to provide access to an attractive job market dominated by public service employment or micro-enterprises in the service and trade sectors. To understand the living conditions of residents in these small towns, it is essential to assess household financial situations comprehensively. This assessment should include examining income, expenses, savings, and the ability to manage household budgets, with particular attention to fixed expenditures.

The primary objective of the conducted research was to assess the financial situation of households residing in small towns relative to all other urban households and to observe its changes from 2015 to 2022. The conclusions regarding household finances thus covered the period before (2015-2019) and during the COVID-19 pandemic (2020-2022). The study evaluated the financial situation multidimensionally, using a relative synthetic indicator and drawing on non-identifiable individual microdata from the Household Budget Surveys (BBGD) conducted by the Central Statistical Office in Warsaw (GUS). Each year, these surveys included over 30,000 households.

The study conducted by the authors aimed to answer the following research questions:

RQ1: Did the changes in the relative synthetic indicator of the financial situation for small-town households show convergence with other urban households?

RQ2: *Did the financial situation of small-town households worsen during the COVID-19 pandemic?*

Assessing the relative financial situation of small-town households and its long-term changes is a significant research topic. This analysis also helps to measure the efforts of these towns in providing residents with an adequate standard of living. The extensive research period, which includes the duration of the COVID-19 pandemic in Poland, also enabled the evaluation of the crisis's impact on the financial situation of small-town households.

Moreover, this study addresses a research gap concerning the insufficient analysis of the financial situation of small-town households, particularly in terms of their adaptability, income levels, consumption patterns, and economic inequalities. By examining these aspects, the research provides a comprehensive understanding of the financial dynamics in small towns, highlighting both challenges and resilience in the face of economic pressures.

2. Literature Review

Numerous academic studies emphasize that evaluating household financial situation requires analyzing income levels, consumption expenditures, savings, debt, and accumulated financial or tangible assets that serve as a financial cushion against income-expenditure shocks (Świecka and Musiał, 2016; Zalega, 2018; Rólczyński, 2023; Korzeniowska *et al.*, 2023; Mazurek-Krasodomska, 2011; Głowicka *et al.*, 2024). Similarly, the National Bank of Poland (Kolasa, 2017) assesses household finances in sections dedicated to income generation, private consumption, savings and investments, and assets and liabilities.

The concept of household financial situation is not precisely defined in the literature, often being intuitively understood and narrowly reduced to analyzing income or expenditure levels. While examining household income or current consumption is important, it does not reveal the full picture of their financial situation. It overlooks savings behaviors and investment activities, essential for assessing long-term stability.

Research by Wereda and Prokopowicz (2017) and Szustak *et al.* (2021) indicates that saving financial surpluses enables households to create reserves for the future, forming the basis for long-term development and increasing their resilience to economic shocks. Savings also allow households to accumulate capital that can be passed on to future generations, supporting their better start and ensuring a higher standard of living. As highlighted by Wołoszyn and Głowicka-Wołoszyn (2015), accumulated savings strengthen family financial stability, acting as a buffer during economic uncertainty. In a broader context, on a macroeconomic level, household savings constitute a significant source of capital in the economy, forming the foundation for investments that directly contribute to economic growth.

The debt level of a household relative to its income is a crucial indicator of its financial situation, particularly regarding debt servicing capacity. While debt can be beneficial when it supports investments, excessive debt imposes a financial burden that limits the household's ability to respond flexibly to changing conditions (Grzywińska-Rapca *et al.*, 2023).

Evaluating the financial situation of households remains an important research topic. It serves as a basis for assessing households' economic activity and investment potential and as an indicator of the risks that financially weak households may pose to the economy (French and Vigne, 2019).

3. Research Methodology

The assessment of the financial situation of households drew on individual, non-identifiable microdata from the Household Budget Surveys (BBGD)⁴ conducted by the Central Statistical Office (GUS) in Warsaw from 2015 to 2022. Each year, these surveys covered over 30,000 households. The subjects of the study were individual urban households, analyzed in groups differentiated by the size of residence area (Zeszyt metodologiczny 2018):

- small towns – with up to 20,000 inhabitants,
- medium towns – with 20,000 to 99,000 inhabitants,
- large towns – with 100,000 to 199,000 inhabitants,
- very large towns – with 200,000 to 499,000 inhabitants,
- metropolises – with at least 500,000 inhabitants.

Given the multidimensional nature of the assessment, we identified a set of partial (unidimensional) indicators. These indicators, also known in literature as diagnostic variables, provided the foundation for the construction of synthetic index and included:

- real equivalent⁵ disposable income (PLN per equivalent person),
- real equivalent consumption expenditures (PLN per equivalent person),
- savings rate⁶ (%),
- share of non-essential expenses in household budget, i.e., all consumption expenditures excluding food, non-alcoholic beverages,

⁴The databases of individual, non-identifiable microdata were made available for a fee by the Central Statistical Office in Warsaw.

⁵Equivalence scales enable the comparison of incomes and expenditures between household with different sizes and demographic compositions (Dudek, 2011). The EUROSTAT recommended modified OECD scale accounts for economies of scale by assigning a weight of 1 to the first adult in the household, 0.5 to each additional adult, and 0.3 to children.

⁶The household savings rate is defined as the ratio of the difference between disposable income and expenditures to disposable income (Wołoszyn, Głowicka-Wołoszyn, 2015).

- housing, and energy (%),
- percentage of households that expressed satisfaction with their financial situation, describing their budget constraints as: “we can afford some luxury”, “we have enough for many things without special saving”, or “we have enough for daily needs, but we need to save for major purchases” (%).

This construction used a multidimensional method of relative taxonomy (Wydymus, 2013; Lira *et al.*, 2014; Głowicka-Wołoszyn *et al.*, 2018; Lira, 2019). The method forms the synthetic index from relativized values of partial indicators, providing a comprehensive assessment of the financial situation of a selected group of households (residing in cities of a specific size) in relation to all other household groups combined. The relative synthetic index can also be perceived as a measure of financial disparities between a given group of households and others. The values of the index were calculated for each year of the study period, which helped tracking changes in the financial disparities..

Depending on the value of the relative synthetic index, one could determine:

- a better relative financial situation for the selected group of households in a given year if the index value was less than 1,
- a worse relative financial situation for the group if the index value was greater than 1,
- an identical relative financial situation for the given group if the index value was equal to 1.

A decrease in the value of the relative synthetic index of the financial situation over successive years indicated an improvement in the relative financial situation of the selected group. Conversely, an increase in its value signified a deterioration in the financial situation.

The first step in constructing the synthetic index involved relativizing the values of individual partial indicators for each pair of residence area classes in each year:

$$d_{(b/c)jt} = x_{bjt} / x_{cjt} \quad (1)$$

where: $b \neq c$, $b=1, \dots, n=5$, $c=1, \dots, n=5$, and x_{ijt} represents the aggregated value of the j -th partial indicator ($j=1, \dots, m=5$) in the i -th residence area class ($i=1, \dots, n=5$) in year t ($t=1, \dots, 8$), where $t=1$ corresponds to the year 2015).

The relativized values of the j -th partial indicator in year t for all residence area class pairs are in matrix $\mathbf{D}_{jt}$:

$$\mathbf{D}_{jt} = \begin{bmatrix} 1 & d_{(2/1)jt} & \dots & d_{(5/1)jt} \\ d_{(1/2)jt} & 1 & \dots & d_{(5/2)jt} \\ \vdots & \vdots & \ddots & \vdots \\ d_{(1/5)jt} & d_{(2/5)jt} & \dots & 1 \end{bmatrix} \quad (2)$$

As a side note, the individual elements of $\mathbf{D}_{jt}$ can also be interpreted as percentages:
 $\delta_{(b/c)jt} = (d_{(b/c)jt} - 1) \cdot 100\%.$ (3)

Positive values of the indicators $\delta_{(b/c)jt}$ indicate a relative advantage of class b over class c in terms of the j -th partial indicator in year t .

The elements of $\mathbf{D}_{jt}$ are then averaged:

$$\mathbf{D}_{jt}^* = \mathbf{A} \cdot \mathbf{D}_{jt} \quad (4)$$

where the averaging matrix $\mathbf{A}$ is defined as:

$$\mathbf{A} = \begin{bmatrix} 0 & \dots & \frac{1}{(m-1)} \\ \vdots & \ddots & \vdots \\ \frac{1}{(m-1)} & \dots & 0 \end{bmatrix} \quad (5)$$

The elements located on the main diagonals of matrices $\mathbf{D}_{jt}^*$ represent the average relative advantage of the i -th class over other classes. They form columns of matrices $\mathbf{W}_t$ for the respective years:

$$\mathbf{W}_t = \begin{bmatrix} w_{11t} & w_{12t} & \dots & w_{1mt} \\ w_{21t} & w_{22t} & \dots & w_{2mt} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1t} & w_{n2t} & \dots & w_{nmt} \end{bmatrix} \quad (6)$$

One can notice that elements of this matrix can be expressed as:

$$w_{ijt} = \frac{1}{n-1} \sum_{c \neq i} d_{(i/c)jt} = \frac{x_{ijt}}{n-1} \sum_{c \neq i} 1/x_{cjt} = x_{ijt} / H_{c \neq i}(x_{cjt}) \quad (7)$$

In other words, they are the original values of partial indicators, normalized by the harmonic mean of corresponding values for other classes from the same year. The harmonic mean used in the method is less affected by large outliers than the arithmetic mean, as it gives more weight to smaller values, making it a better choice when outliers could skew the results.

To evaluate each class with respect to all partial indicators collectively, reciprocal

elements of $\mathbf{W}_t$ are averaged over all partial indicators to form the taxonomic relative indicator for each year:

$$S_{it} = \frac{1}{m} \sum_j \frac{1}{w_{ijt}} \quad (8)$$

All calculations were performed in the tidyverse dialect of R and the code is available in the **Appendix**.

4. Research Results and Discussion

For each group of urban households categorized by city size, relative synthetic indicators of their financial situation were determined for the years 2015-2022 (Figure 1, Table 1). The data revealed that the most stable yet diverse assessment of household financial situations occurred between 2015 and 2017. During this period, households in metropolitan areas enjoyed the best financial situation, as indicated by the lowest relative indicator values.

However, their situation slightly worsened compared to other types of urban households between 2015 and 2017, with a relative indicator increase of 0.04. Additionally, households in very large cities with populations between 200,000 and 499,000 also demonstrated a financial advantage over other classes. The relative indicator values for this group fluctuated slightly between 0.93 and 0.98 during 2015-2017.

Smaller cities enjoyed lower relative financial assessment of its households (Figure 1, Table 1). Those in the smallest towns with populations up to 20,000 were in the relatively worst financial situation during this period, with the highest synthetic indicator values around 1.15. Similarly, households in medium-sized cities had synthetic indicator values slightly above 1, approximately 1.1, and those in large cities had values around 1.05. However, all were still lower than for smallest towns households.

Between 2017 and 2019, there was a noticeable convergence in the financial situation across the different city size categories (Figure 1, Table 1). In 2019, the smallest range of synthetic indicator values was recorded, ranging from 0.96 to 1.05. These values, being close to 1, indicated a high degree of similarity in the financial assessments among the various household categories.

Notably, the relative financial situation of households in small towns was very similar to that in large cities, with both being most comparable to the other groups (indicator values were 1.009 and 1.005, respectively, and closest to 1). In 2019, a better relative financial situation was observed in medium-sized cities and metropolises, while a worse relative situation was noted in very large cities.

Throughout the pre-pandemic period, from 2015 to 2019, a convergence in the

financial situation of households across the city size categories was observed. There was a deterioration in the relative financial assessments of households in city size classes where the relative financial situation was initially better, and an improvement in classes where the 2015 assessments indicated a worse financial situation (Figure 1, Table 1).

The most significant deterioration in the relative financial situation was noted in metropolises, where the relative indicator value increased by 27.7%, from 0.75 in 2015 to 0.958 in 2019. Conversely, in small towns, where the financial situation of households was the worst in 2015 compared to all other urban households, the greatest improvement was recorded—a decrease in the indicator value by 13.8% (from 1.17 in 2015 to 1.009 in 2019).

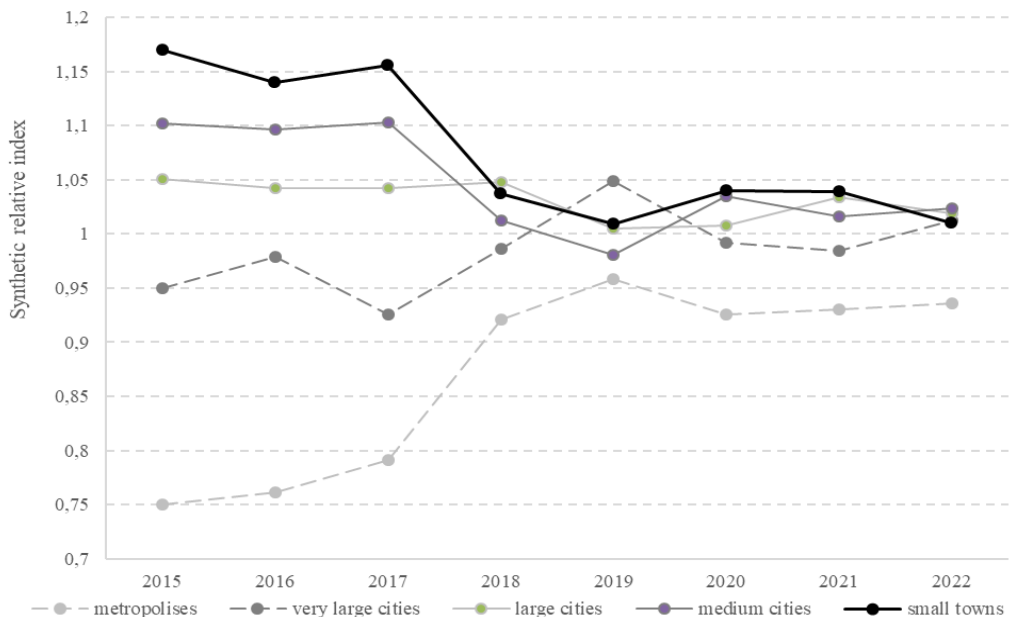
The outbreak of the pandemic in 2020 led to a slight deterioration in the relative financial assessments of households living in small, medium, and large cities from the 2019 levels. However, there was an improvement in the relative financial assessments in very large cities and metropolises.

As noted by Wołoszyn (2020), the largest cities, with well-developed technical, social, and scientific infrastructure, serve as centers of the modern economy and areas with a large supply of high-quality human capital.

Following the outbreak of the pandemic, businesses in the largest cities found it easiest to adapt to new conditions, moving its employees to work remotely. Additionally, the pandemic accelerated the development of digitization, which favors higher-paying professions (Stantcheva, 2022). The Devire report (2021) indicates an increase in salaries despite the crisis in the IT, construction, real estate, e-commerce, and digital marketing sectors.

During the pandemic period in Poland, from 2020 to 2022, there were no significant changes in the relative financial indicators across the city size categories. The most notable change concerned the financial situation of households in small towns. Between 2020 and 2022, this group experienced a 2.9% decrease in the relative indicator value.

Since the relative indicator value in small towns was above 1 in 2020, its decrease indicated a further improvement in the financial situation of these households. By 2022, the financial situation in small towns was very similar to that in medium, large, and very large cities. Only the financial situation of households in metropolises with at least 500,000 inhabitants was relatively better compared to other urban household groups (Figure 1, Table 1).

Figure 1. The relative synthetic index of the financial situation assessment for urban households in 2015-2022

Source: Authors' calculations based on non-identifiable microdata from BBGD (2015-2022).

Table 1. The relative synthetic index of financial situation of urban households in Poland and its changes during the pre-pandemic and pandemic periods

Class of place of residence	Synthetic relative index								Changes in the value of the synthetic relative index (%)	
	before the pandemic					pandemic period			before the pandemic	pandemic period
	2015	2016	2017	2018	2019	2020	2021	2022	2019/2015	2022/2020
metropolises	0,750	0,761	0,791	0,921	0,958	0,926	0,93	0,936	27,7	1,1
very large cities	0,950	0,979	0,926	0,986	1,049	0,992	0,984	1,012	10,4	2,0
large cities	1,051	1,042	1,042	1,048	1,005	1,008	1,034	1,019	-4,4	1,1
medium cities	1,102	1,096	1,103	1,012	0,981	1,035	1,016	1,024	-11,0	-1,1
small towns	1,170	1,140	1,156	1,037	1,009	1,040	1,039	1,010	-13,8	-2,9

Source: Authors' calculations based on non-identifiable microdata from BBGD (2015-2022).

The improvement in the relative financial situation of small towns households was grounded in the increase of their income levels. Notably, in the period before the pandemic, small towns experienced the highest growth in real disposable incomes, an increase of 30.5%. During the pandemic, in almost all city size classes, there was

only a 1-2% change in the relative household income levels. The only exception were large cities with populations between 100,000 and 199,000, which reported a significant 7% decrease (Table 2).

Moreover, throughout the analyzed period, small town households recorded the highest increase in the savings rate and in the percentage expressing satisfaction with their financial situation. Additionally, between 2015 and 2022, those households experienced the smallest decline in income share allocated to non-essential expenses, that is, other than food, housing, and energy (Table 2).

Table 2. The partial indicators of financial situation of urban households in Poland and their changes during the pre-pandemic and pandemic periods

Class of place of residence	Values of partial indicators								Changes in the value of the synthetic relative index (%)	
	2015	2016	2017	2018	2019	2020	2021	2022	2019/2015	2022/2020
real equivalent disposable income (PLN per equivalent person)									(%)	
metropolises	4,114	4,146	4,299	4,494	4,703	4,812	5,044	4,733	14.3	-1.6
very large cities	3,126	3,370	3,628	3,812	4,002	3,882	4,103	3,948	28.0	1.7
large cities	2,952	3,128	3,370	3,462	3,612	3,855	3,903	3,585	22.3	-7.0
medium cities	2,811	2,997	3,190	3,371	3,555	3,637	3,692	3,674	26.5	1.0
small towns	2,625	2,912	3,039	3,212	3,424	3,562	3,616	3,477	30.5	-2.4
real equivalent consumption expenditures (PLN per equivalent person)									(%)	
metropolises	2,951	2,921	2,895	2,920	3,067	2,843	2,930	2,859	3.9	0.5
very large cities	2,324	2,405	2,533	2,690	2,674	2,407	2,574	2,586	15.1	7.4
large cities	2,215	2,303	2,404	2,324	2,365	2,291	2,315	2,241	6.8	-2.2
medium cities	2,088	2,184	2,291	2,238	2,343	2,117	2,205	2,238	12.2	5.7
small towns	1,980	2,176	2,139	2,099	2,225	2,179	2,148	2,131	12.4	-2.2
savings rate (%)									(p.p.)	
metropolises	23.9	24.9	27.4	29.9	30.3	35.5	35.0	33.8	6.5	10.6
very large cities	23.1	25.2	25.6	27.4	28.7	32.5	33.3	31.2	5.6	7.3
large cities	21.8	23.0	25.5	28.5	30.0	34.2	34.4	32.9	8.2	11.2
medium cities	22.9	25.0	25.7	28.8	30.4	35.6	35.4	33.7	7.5	10.7
small towns	21.9	23.0	26.5	30.3	30.5	33.8	34.7	33.1	8.6	10.8
share of non-essential expenses (%)									(p.p.)	
metropolises	52.7	52.2	51.6	51.3	51.6	48.7	50.2	50.0	-1.1	-3.5
very large cities	48.1	48.3	48.4	49.1	49.7	46.0	47.7	48.5	1.6	-2.3
large cities	47.7	48.0	48.2	48.6	48.1	45.6	46.4	44.9	0.5	-2.3
medium cities	47.3	47.7	47.4	46.8	47.3	44.2	45.4	44.8	0.0	-3.5
small towns	46.2	47.5	47.2	46.0	46.8	45.1	45.4	44.8	0.6	-2.4
percentage of households that make ends meet (%)									(p.p.)	
metropolises	76.6	78.9	80.7	78.8	81.7	85.3	86.4	86.0	5.0	0.7
very large cities	72.4	76.1	76.4	72.8	76.3	80.2	82.3	81.3	3.9	1.1
large cities	70.5	71.7	75.8	70.4	75.3	79.9	82.6	82.7	4.8	2.8
medium cities	72.3	75.6	76.9	70.3	75.0	80.1	82.6	81.4	2.7	1.3
small towns	70.0	72.3	76.1	70.3	77.4	81.0	82.2	82.7	7.4	1.7

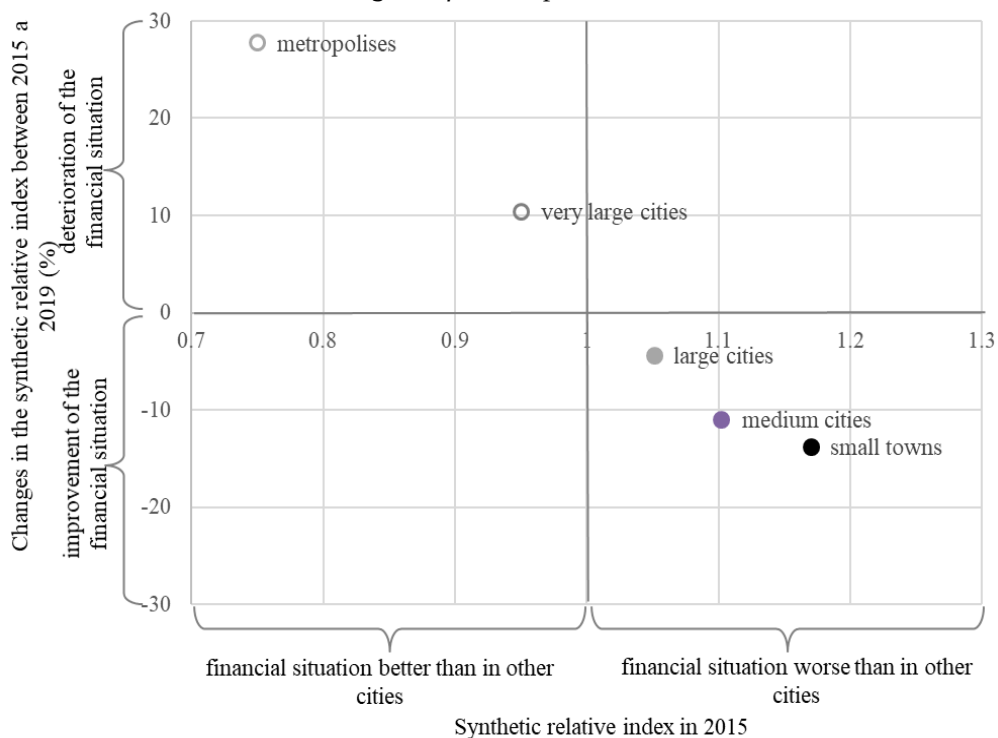
Source: Authors' calculations based on non-identifiable microdata from BBGD (2015-2022).

When analyzing the relative financial situation assessments of urban households and their changes during the pre-pandemic period, several observations can be made

(Figure 2). Firstly, in 2015, households in small towns had the lowest relative financial situation assessment (the highest value of the relative indicator). Additionally, along with households in medium and large cities, their financial situation assessment was relatively worse than that of other households (relative indicator values greater than 1).

However, from 2015 to 2019, small towns saw the most significant improvement in the relative financial situation assessment of households (the largest decrease in the value of the relative indicator).

Figure 2. The relative synthetic index of the financial situation assessment for urban households in 2015 and its changes before the pandemic

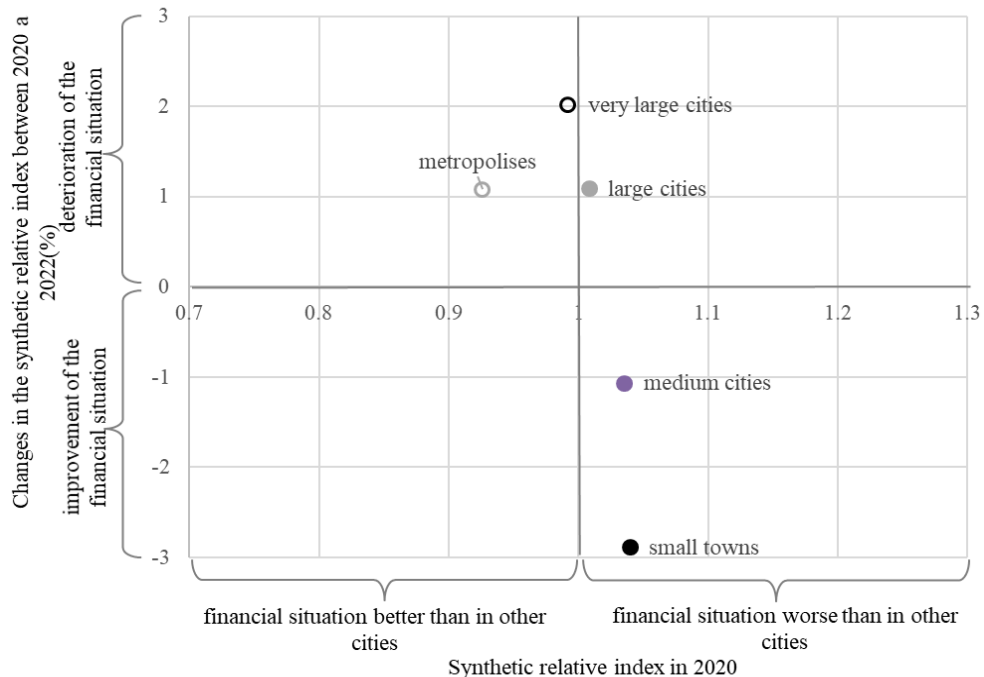


Source: Authors' calculations based on non-identifiable microdata from BBGD (2015-2022).

In contrast, during the pandemic period, households in small towns had a relative financial situation assessment very similar to that of other urban households, relative indicator values being close to 1 in 2020 (Figure 3).

Furthermore, between 2020 and 2022, small town households experienced the most significant improvement in the relative financial situation assessment (the largest decrease in the value of the relative indicator).

Figure 3. The relative synthetic index of the financial situation assessment for urban households in 2020 and its changes during the pandemic



Source: Authors' calculations based on non-identifiable microdata from BBGD (2015-2022).

5. Conclusions

Undoubtedly, large and medium-sized cities play a crucial role in the socio-economic development of the country, as their realized potential ensures intelligent and sustainable growth (Strzelecka, 2017). These cities benefit from human, social, and infrastructural capital, including scientific institutions, universities, and research and development centers, which enhance their competitiveness. In contrast, small towns seek their own development paths based on local potential and identity, navigating the challenges of modern development. One effective strategy for small towns to create a competitive advantage over larger cities and secure their place in regional development is by forming cooperation networks (Kaczmarek and Kaczmarek, 2024).

In their pursuit of development and the implementation of new concepts, cities emphasize the goal of improving residents' quality of life. Monitoring household financial situation is crucial from this perspective, as it provides insights into their income status, investment opportunities, and resilience to economic crises.

Research on household financial situations revealed a significant improvement for small-town households from 2015 to 2022. At the beginning of the study period, in

2015, these households had the lowest relative assessment. However, during the pre-pandemic years from 2015 to 2019, signs of convergence emerged among all urban household classes, with the most notable improvement occurring in small-town households.

The outbreak of the pandemic disrupted this trend, deteriorating the financial situation across small, medium, and large cities, while very large cities and metropolises saw a relative improvement. Nonetheless, from 2020 to 2022, the financial situation of small-town households continued to improve, albeit not as dramatically as before.

The obtained results allowed for a positive answer to the first research question, RQ1: *Did the changes in the relative synthetic indicator of the financial situation for small-town households show convergence with other urban households?*

Only in 2020, the year the pandemic broke out in Poland, was there a slight deterioration in the relative assessment of the financial situation of small-town households. However, during the period from 2020 to 2022, their situation improved again, though not as dramatically as in the pre-pandemic period.

These results allowed for a negative answer to the second research question, RQ2: *Did the financial situation of small-town households worsen during the COVID-19 pandemic?*

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Appendix:

The function requires data either in long format, with columns
 # Year, Var, Object, Value or in wide format with columns Year,
 # Object, Var1, Var2, ...

```
relynth <- \(df, dynamic=FALSE){
  library(dplyr)
  library(tidyr)
  if(!any(names(df) == "Var"))
    df %>% pivot_longer(cols = starts_with("Var"),
```

```

names_to = "Var",
values_to = "Value") -> df

# Function to calculate the mean relative advantage
mreladv <- \(df){
  n = length(df$Value)
  D = outer(df$Value, df$Value, FUN = "/") # rel. advantage pairs
  A = matrix(1/(n-1),n,n) - 1/(n-1)*diag(n) # averaging matrix
  df %>% mutate(mRelAdv = diag(A %*% t(D))) # mean rel. advantage
}

# Version of the method (original is static)
if(dynamic){ # computes mRelAdv for all object-years
  df %>% group_by(Var) %>% do(mreladv(.)) %>% ungroup() -> W
} else { # default computes mRelAdv only for objects in a given year
  df %>% group_by(Year, Var) %>% do(mreladv(.)) %>% ungroup() -> W
}

# Synthesize the mean relative advantage over all diagnostic variables
W %>%
  mutate(reciproc.mRelAdv = 1/mRelAdv) %>%
  group_by(Year, Object) %>%
  summarise(S = mean(reciproc.mRelAdv)) %>% # the original formulation
  ungroup() %>%
  pivot_wider(names_from="Year", values_from="S")
}
# alternative, harmonic mean formulation of S:
# S = 1/mean(reciproc.mRelAdv)

# Illustrative toy data
library(dplyr)
num_years = 5
num_objects = 4
expand.grid(Year = 1:num_years, Object = 1:num_objects) %>%
  mutate(Var1 = 1 + Year + Object) %>%
  mutate(Var2 = 2 + Year + Object) %>%
  mutate(Var3 = 3 + Year + Object) %>%
  mutate(Year = paste0("Y", Year)) %>%
  mutate(Object = paste0("O", Object)) -> df

df %>% relsynth()

```