

EXPLORATORY FACTOR ANALYSIS IN EXPLAINING SHORT-TERM HOUSEHOLDS FINANCIAL SECURITY

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Purpose: The aim of the analysis is to detect and identify the fundamental factors determining the short-term financial security of the household within the concept of households financial fragility and to present the observable variables in the form of synthetic factors.

Design/methodology/approach: In the analysis of the diagnostic features of the studied phenomenon, factor analysis was used, which also included the related analysis of principal components, encompassing a group of methods that enable the reduction of the set of diagnostic features to the smallest number of collective synthetic variables that are consistent within groups but different between groups.

Findings: The application of factor analysis enabled the detection of synthetic factors from a significant number of variables analyzed. Based on a review of the literature related to the short-term financial security of the household, these factors were interpreted in the context of the analyzed phenomenon.

Research limitations/implications: The basic problem in the conducted analysis is the limited availability of detailed data allowing for an in-depth analysis of the phenomenon of financial vulnerability of households.

Practical implications: Identifying the fundamental factors determining the analyzed phenomenon of financial vulnerability of households may provide an incentive for further discussions and indicate the direction of further, in-depth analyses within the framework of the presented conclusions.

Social implications: The conclusions from the analysis allow to understand the key factors that may determine the short-term financial security of a household, what may determine the type of actions taken by public authorities, and thus into greater financial stability of the entire household sector.

Originality/value: The study allows to indicate key diagnostic features determining the phenomenon of short-term financial security of households, which is analyzed within the framework of the concept of household financial vulnerability (fragility). The analysis is based on the available data set of the Eurostat database. The results of the analysis fit into the overall research on the phenomenon of financial fragility and can be a contribution to further discussion and further in-depth analyses.

Keywords: short-term household financial security, financial fragility (vulnerability), exploratory factorial analysis.

Category of the paper: Research paper.

1. Introduction

The level of financial security household security is determined by the ability to meet needs, especially basic needs. In the short term, the financial security of a household is captured by the concept of financial fragility (vulnerability). Within this concept, households that are overly indebted are considered to be vulnerable, but they are also characterized by the inability to cope with monthly expenses and a persistent imbalance in their budget, arrears in utility bills, difficulties in shopping for groceries or paying rent (Anderloni et al., 2012). Azzopadi et al. (2019) additionally draw attention to the fact that the lack of short-term financial fragility of a household may also result from factors other than debt, such as: low income and low overall level of wealth, suboptimal management of household finances and economic shocks.

Further extending the concept of financial fragility (vulnerability), financially vulnerable consumers are also considered to be those who are unable to cover unexpected expenses quickly (even if they are small) or, conversely, those households whose income is sufficient to cover only previously planned expenses (Torricelli et al., 2012). This means that even with a high credit burden, but in the absence of unforeseen events, such households do not have financial problems. Thus, financially vulnerable households can be considered to be those that are not indebted, but have no financial reserves (or a low level of them), as well as households with positive or even significant assets but low liquidity. Therefore, in this approach, financial fragility of a household can be treated as the inability to cope with unexpected expenses due to an insufficient level of liquid assets (Torricelli et al., 2012). This extends the financial sensitivity analysis based on debt analysis to include assets held and their liquidity level (Ampudia, Vlokhoven, Żochowski, 2016).

In the broadest sense, financial fragility is measured by consumers' inability to meet household needs, cope with unexpected expenses, and survive in the event of a crisis (Daud et al., 2018) or macroeconomic shock (Jappelli et al., 2013). In this sense, non-indebted consumers are also considered financially vulnerable when they are unable to meet unexpected expenses, whether due to insufficient savings or the inability to access emergency funds from any source (Lusardi et al., 2011). Lusardi et al. (2011) defined financial vulnerability as "the ability to obtain funds for an unexpected expense of 2,000 USD in one month regardless of the source of financing", which is supposed to indicate an individual's ability to cope with an unfavorable financial situation. This approach constitutes a kind of "index of the resourcefulness" of households in coping with shocks, taking into account not only their wealth, but also, for example, the ability to rely on a network of family and friends, or to seek and take up additional work (Demertzis et al., 2020), which may result from and be related to cultural conditions (Azzopardi et al., 2019). In this case, attention is also drawn to the fact that financially vulnerable households are not necessarily poor (Hasler et al., 2019), which means that the problem of financial fragility may also concern well-off households with a stable

financial situation that have faced sudden, unforeseen events that dramatically change their life and material situation. O'Connor et al. (2019) noted that also wealthy households may find themselves in such a situation due to poor financial management of the household, excessive consumerism or unsuccessful investments. The problem of financial fragility is raised here to the risk that a given person will not be able to maintain current standard of living, which does not have to, but may be directly related to falling into poverty or being unable to meet basic needs (O'Connor et al., 2019).

Short-term financial security (financial fragility) is shaped by a number of diverse microeconomic factors, that can be divided into three main groups: socio-demographic (e.g. age, gender, level of education), economic (e.g. level of debt, income, accumulated assets) and behavioral (financial knowledge and behavioral aspects of individuals' behaviors and decisions regarding how to make decisions under conditions of risk and uncertainty) (Fernandez et al., 2024). It is worth noting that the level of financial knowledge and the possibilities of using it in managing personal finances, are increasingly being considered as a factor reducing the risk of losing short-term financial security by a household (Wittmann, Paulus, 2008; Anderloni et al., 2012; Giarda, 2013; Ksendzova et al., 2017; Meriküll, Rõõm, 2017; Hasler et al., 2018, 2023; Azzopardi et al., 2019; Hasler, Lusardi 2019; Clark et al., 2021; Sekita et al., 2022). While such financial knowledge may be necessary for making good financial decisions, knowledge alone does not necessarily lead to good decisions. This is because the use of financial knowledge may be limited not only by the lack of practical skills necessary to use it, but also by behavioral factors such as impulsiveness and lack of self-control, or lack of trust in financial institutions and the environment in which decisions are made (Kempson et al., 2013). For this reason, the concept of financial knowledge has been extended to financial literacy, which is accompanied by the ability to use it. The movement towards an expanded concept of financial literacy, which includes behavior and the interaction of knowledge, skills, and attitudes, but also takes into account the influence of the surrounding environment on people's ability to achieve positive outcomes in managing household finances. In this context, the term "financial capability" is increasingly used, which better captures the complexity of decision-making processes and financial management (Kempson et al., 2013).

In summary, there is no commonly accepted concept in the literature regarding short-term financial security expressed in the concept of financial fragility (Fernández-López et al., 2024), which is why this problem is considered multifaceted, complex, dynamic, and above all ambiguous (Ali et al., 2020). At the same time, understanding this phenomenon is crucial due to its broad social and economic consequences at the micro and macro levels. Short-term financial security is associated with a lack of savings and liquid assets, and hence excessive exposure to external risk and a focus on short-term "survival". A number of factors may underlie good personal financial management, the most important of which seem to be those related to knowledge and behavioral aspects of individual activity.

2. Methods

Factor analysis was used in the paper. It is the group of methods that allows for reducing a group of diagnostic features into the smallest possible number of sets that are consistent within groups but different between groups. Factor analysis also includes the related analysis of principal components, which is referred to as factor analysis in the narrow sense or factor analysis (Balicki, 2013). Additionally, this type of factor analysis used to describe and explain the complexity of phenomena and variables is called exploratory factor analysis (Balicki, 2013). It is used to analyze data without prior assumptions as to the number or nature of factors.

The factor analysis procedure has been comprehensively described in the literature (e.g. Czopek, 2013; Balicki, 2013; Gatnar, Walesiak, 2004). The main stages of the analysis are outlined below. At the first stage, the available data was subjected to diagnostics in order to check the possibility of conducting factor analysis. For this purpose, the Kaiser-Mayer-Olkin tests and the Bartlett test were used. Within the first criterion, the test value was checked, the results of which are in the range from 0 to 1. It is suggested that this measure should not be lower than 0.5 (Malarska, 2005). The closer the value to 1, the more justified it is to conduct factor analysis. Bartlett's test is a statistical test checking the assumption of no correlation between variables (<0.05).

Then, two criteria were used to extract the component variables. The first is the Kaiser criterion, which suggests extracting as many factors as the eigenvalues greater than 1 suggest for a given factor solution. The second criterion is the shape of the scree plot (based on the eigenvalues).

In the next step, a decision is made about the method of factor rotation. Rotation of the reference frame is used to determine its position that will provide the best interpretation of factor loadings from the point of view of the issue under study (Balicki, 2013). The factor matrix that we obtain as a result of the factor extraction process is called the unrotated factor matrix, while the matrix obtained as a result of the rotation procedure is called the rotated matrix. The last step is the interpretation of the obtained results. The Statistical Package for the Social Sciences (SPSS) software was used to conduct factor analysis (principal components).

Based on the literature review and substantive criteria, a set of publicly available indicators covering the year 2023, published in the European Union databases (Eurostat), was adopted for the analysis. These indicators are included in a Table 1. The analysis was limited by the availability of data. For this reason, the analysis included the following EU countries: Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Spain, Sweden.

Table 1.*List of diagnostic variables determining the financial situation of the household*

Number	Variable
X_1	Households making ends meet with great difficulty
X_2	Liabilities divided by currency and deposits
X_3	Gross debt-to-income ratio of households
X_4	Households heavy financial burden of the repayment of debts from hire purchases or loans
X_5	Arrears (mortgage or rent, utility bills or hire purchase)
X_6	Inability to face unexpected financial expenses
X_7	Overall Financial Literacy Score (out of 100)
X_8	Minimum target financial literacy (70 points or more)
X_9	Financial behaviour Average financial behavior scores (out of 100)
X_{10}	Minimum target financial behaviour (at least 6 out of 9 financially savvy behaviours)
X_{11}	Financial Knowledge Scores (out of 100)
X_{12}	Minimum target financial knowledge (5 out of 7 financial knowledge question)
X_{13}	Financial Resilience score (out of 100)
X_{14}	Financial Attitudes Scores (out of 100)

Source: Eurostat database.

3. Results

The results of the K-M-O test and Bartlett's test are presented in Table 2. The values of the measures allow to conclude that it is possible to conduct exploratory factor analysis.

Table 2.*Kaiser-Mayer-Olkin test and Bartlett's test*

KMO measure		0,512
Bartlett's Sphericity Test	approximate chi-square	327,032
	df	91
	significance	< 0,001

Source: Own calculations.

As a next step, actions were taken to isolate factors (components) using an exploratory factor analysis procedure known as the principal components method.

Using the principal components method, it was possible to isolate four uncorrelated factors (Table 3), rank them according to the variance they explained, and obtain information on the percentage of variance explained by the four factors whose eigenvalue was greater than 1 (Kaiser criterion).

The designation of newly extracted factors (components), that are characterized by eigenvalues higher than 1, means that they explain more variance than a single variable from the original set of variables. This criterion is commonly used due to its simplicity. At the same time, the second criterion in the form of a scree plot (Cattell's) allowed us to confirm the number of synthetic variables at the level of four. This plot was not included in the study due to the unambiguous confirmation of Cattell's criterion, as well as the requirements regarding the volume. According to the Kaiser criterion, four factors (components) are taken into account in further analysis.

Table 3.*Total explained variance before extraction*

Component	Initial eigenvalues		
	total	% variance	% cumulative
1	6,026	43,040	43,040
2	2,085	14,896	57,937
3	1,994	14,243	72,179
4	1,311	9,364	81,543
5	0,899	6,422	87,965
6	0,627	4,481	92,446
7	0,506	3,616	96,062
8	0,258	1,841	97,903
9	0,177	1,261	99,165
10	0,074	0,525	99,690
11	0,029	0,208	99,898
12	0,011	0,076	99,975
13	0,002	0,015	99,989
14	0,001	0,011	100,000

Source: Own calculations.

In the next step, the orthogonal Quartimax rotation (Table 4) was used, which is used in factor analysis and principal component analysis to simplify the interpretation of factors by rotating them. Table 4 contains the strength of the factors, i.e. the percentage of variability of all factors (components) explained by the cumulative percentage. These factors (components) can explain 81.5% of the variability of all diagnostic features.

Table 4.*Total explained variance after extraction, before and after rotation*

Component	Sums of squared charges after extraction			Sums of squares of charges after rotation		
	total	% variance	% cumulative	total	% variance	% cumulative
1	6,026	43,040	43,040	4,397	31,407	31,407
2	2,085	14,896	57,937	2,479	17,705	49,113
3	1,994	14,243	72,179	2,329	16,637	65,750
4	1,311	9,364	81,543	2,211	15,794	81,543

Source: Own calculations.

Thanks to rotation and calculation of factor loadings, it is possible to determine to what extent a given variable represents the extracted factor (component). The interpretation is as follows: the higher the factor loading value, the more it represents the new factor (component) and shows a stronger relationship with the new factor. The cut-off point was assumed to be 0.5. The matrix of rotated components is presented in a Table 5.

Table 5.*Rotated matrix*

Variable	Component			
	1	2	3	4
X_9	0,980	-0,012	-0,089	0,031
X_{10}	0,980	-0,011	-0,088	-0,019
X_8	0,849	0,228	0,432	-0,045
X_7	0,734	0,413	0,302	0,075
X_4	-0,594	-0,240	0,149	0,261
X_{13}	0,582	0,130	0,315	-0,389

Cont. table 5.

X_3	0,326	0,842	0,117	-0,046
X_2	-0,100	-0,834	-0,070	0,122
X_6	-0,304	-0,643	-0,055	0,395
X_{14}	0,484	0,518	0,116	-0,022
X_{11}	0,190	0,141	0,965	-0,013
X_{12}	0,081	0,132	0,965	-0,079
X_5	-0,158	-0,145	0,040	0,961
X_1	-0,126	-0,192	-0,120	0,938

Source: Own calculations.

Based on the factor loadings determined in the rotated matrix (Table 5), the results were interpreted. The first factor is defined by the variables: Financial behavior (X_9 and X_{10}), Financial Literacy (X_7 and X_8), Households heavy financial burden of the repayment of debts from hire purchases or loans (X_4) and Financial Resilience (X_{13}). This factor can be defined as "Financial behavior and competences". The second factor is defined by the variables: Gross debt-to-income ratio of households (X_3), Liabilities/Currency and deposits (X_2), Inability to face unexpected financial expenses (X_6), Financial Attitudes Scores (X_{14}). This factor can be captured as "Financial situation". The third factor is defined by the variables: Financial Knowledge Scores (X_{11}) and Minimum target financial knowledge (X_{12}). This factor is defined as "Financial knowledge". The fourth factor can be termed "Financial difficulties" and is defined by Arrears (mortgage or rent, utility bills or hire purchase) (X_5) and Households making ends meet with great difficulty (X_1).

4. Discussion

What is noteworthy in the obtained results is the fact that they are consistent with the theoretical achievements to date in the field of analyses of short-term financial security of households. This concept is based on the entirety of household behaviors and decisions in the area of broadly understood household financial management (see: Lusardi, 2019; Hasler, Lusardi, 2019; Lusardi, Hasler, 2020), which in turn are based not only on financial knowledge, but above all on the ability to use it, awareness of one's own financial situation and the consequences of decisions made (see: Graham, Isaac, 2002; Clark, 2021). It is financial education (see: Lusardi, Mitchell, 2014; Allgood, Walstad, 2016) that translates into the possibility of maintaining short-term financial resilience, including through the use of available institutional and legal solutions.

5. Summary

Practical understanding of financial dependencies, together with the ability to use the knowledge contained in the concept of financial literacy and awareness of the consequences of financial decisions made, seems to be crucial in the process of explaining the short-term financial security of a household. The obtained results encourage further in-depth research and discussions, but also emphasize the importance of behaviors based on financial literacy in managing household finances. This in turn encourages the creation of programs and trainings supporting this process and increasing the financial knowledge and awareness of individuals, which can increase the financial security of the entire household sector. At the same time, attention was drawn to the basic limitation in the analysis of the discussed phenomenon resulting from the availability of detailed and longitudinal data. The fact that the problem of financial fragility of households is considered a complex and multi-faceted problem also does not facilitate the analysis.

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