R E F E R E N C E

By: Prof D.Sc. Zhelyu Vladimirov, professional field 3.7 "Administration and management"

On: dissertation work of Mihaela Angelinova Angelova on the topic "Satisfaction and active life of people in Europe aged 50 and over: factors, reasons and data-based policies", for the award of the educational and scientific degree "Doctor" in professional direction 3.8 "Economics", doctoral program Data Science

Reason for the review: Order РД 38-283/03.06.2024 г. of the Rector of Sofia University "St. Kliment Ohridski"

1. Information about doctoral student

Mihaela Angelova graduated from the "Romain Rolland" High School with teaching of foreign languages in the city of Stara Zagora with English and German. He holds a master's degree in Urban Planning from the Faculty of Architecture of the University of Architecture, Construction and Geodesy, Sofia (2006-2012) and a master's degree in "Big Data Modeling in Business and Finance" from the Faculty of Economics of Sofia University "St. Kliment Ohridski" (2018-2020). Subsequently, he also participated in a summer school on research methods (2020, 2022).

In the period 2012 - 2021, she worked as an Urbanist and "Strategic Planning" expert in the private sector on a number of projects related to integrated urban development in partnership with various municipalities and public institutions in Bulgaria. Since March 2021, she is a full-time PhD student at the Faculty of Economics in the Data Science field and, in parallel, works as a validator of credit risk assessment models at KBC Global services. At the end of 2021, she initiated the signing of a partnership agreement between Sofia University and his employer. From then until now, she has participated in the implementation of a number of partner initiatives, incl. video productions with a focus on the partnership between the university and business.

As a doctoral student in the Faculty of Economics, she leads seminars in Statistics in English for students in the "Accounting, Finance and Digital Applications" bachelor's program and participates in expert groups for open procedures for accreditation of doctoral programs in several Bulgarian universities. In the last two years, she has also been a guest lecturer at the master programme "Artificial Intelligence for Business and Finance", where she presents features of working with the data of the SHARE project. As a part-time teacher, she is also involved in the video project "Time Capsule", aimed at preserving the history of the Faculty of Economics.

As a PhD student and researcher on the SHARE project, she presents the results of his research at several prestigious international scientific conferences. She has gone through a number of trainings and is the winner of several awards, the last of which is a special award in the national competition "Young Economist" 2023. She is a member of several professional organizations and holds a number of certificates for completed courses in both her educational fields. He speaks English and German.

2. General characteristics of the presented dissertation work

The presented dissertation consists of an introduction, three chapters, a conclusion, an author's reference with main contributions, publications on the dissertation, participation in conferences related to the presentation of the results of the dissertation, noted citations in scientific articles, acknowledgments, bibliography and seven appendices with a volume of 303 pages, and without the appendices and bibliography – of 257 pages. Of total, 238 sources are used, all in English. The text contains 20 tables and 75 figures.

In the **Introduction,** the topicality of the issues related to well-being, active life and inequalities among older people aged 50 and over in European countries is revealed. This is an extremely important problem given the global aging of the population in developed countries, in particular in Bulgaria. The process poses numerous challenges to the economic, social and health systems of these countries. Hence the main aim of the dissertation, namely: "Investigating the factors of satisfaction and active life of people aged 50 and over in Europe before and after the outbreak of the global pandemic of COVID-19 and creating proposals for social policies aimed at each factor" (p. 19). This objective is specified in three groups of tasks, each of which contains from three to five sub-tasks. The **object** of the research is the respondents - persons aged 50 and over in Europe, included in the two waves of the survey under the SHARE project (wave 7, conducted before and wave 8, conducted after the Covid-19 pandemic). The study concerns **change** in life satisfaction factors before and after the pandemic, changes in active life factors before and after the pandemic, and inequalities in the well-being of these respondents after the outbreak of the pandemic.

The author has set as an additional goal the identification of different aging profiles among the target group during the pandemic and an analysis of the inequalities in well-being between their different groups. The defended thesis is that "A comprehensive understanding of the complex of factors that influence the satisfaction and active life of people aged 50 and over in Europe in different European countries is a prerequisite for the preparation of knowledge-based socio-economic policies". This thesis is specified in three main and one additional hypothesis. The verification of the hypotheses is based on the author's methodology, including various statistical tests and analytical techniques.

3. Evaluation of the obtained theoretical and scientific-applied results

Chapter One contains four sections. Based on the literature review, in the **first section**, various definitions of the factor "satisfaction with life" are derived, the available metrics are shown, as well as the factors affecting this satisfaction and its change. The main four definitions are summarized on pp. 31-32, and their advantages and disadvantages are indicated. All these definitions were used to fulfil the respective research tasks and sub-tasks. The most frequently used indicators for measuring satisfaction are indicated on p. 33, and the thesis applies a measurement approach based on the third indicator (the OECD Better Life Index).

The literature review in the **second section** regarding life satisfaction factors includes 106 articles, 75 of which are from the last 10 years (Table 1, p. 35). These factors relate to the socio-economic, demographic and personality characteristics of the respondents. These are socio-economic status, income, age, education, working or not working, married or in a partnership, state of health, free time, social contacts, physical activity, housing conditions, type of residence, country of residence, sports, outdoor activities, cultural commitments, presence of children or grandchildren and others. All or most of these factors are revealed to undergo significant changes during the global pandemic. This pandemic has a direct impact on life satisfaction by increasing anxiety and stress. The main results of the literature review on this topic are documented in the scientific publication of Angelova (2024).

Based on the literature review, the factors for active life of people aged 50 and over in Europe are revealed in the **third section**. A systematic review of 48 scientific articles was performed, 39 of which are from the last 10 years (Table 2, p. 45). These factors overlap somewhat with satisfaction factors, but there are also differences. These include age, gender, marital status, income, education, general health, retirement, functional capacity, physical performance, digital technology, area of residence, loneliness, obesity, pet ownership, and more. The negative impact of loneliness on the physical and mental health of the respondents is outlined, as well as the importance of various psychological and social factors. The positive influence of daily physical activity on the health and self-esteem of older people has been shown. However, this physical activity is severely limited during the pandemic. The main results of this review have found a place in the scientific publication of Angelova (2021).

The **fourth section** presents findings from previous research on inequalities among older people and different aging profiles in European countries. The analysis is based on 49 scientific articles, including 39 from the last 10 years (Table 3, p. 54). Different approaches to the segmentation of the elderly and different aging profiles have been consistently revealed. In previous studies, different numbers of clusters were obtained, most often three, but in some of them even five. Various forms of inequalities are shown in terms of employment, income, education, health, social inclusion, gender, ethnicity, country of residence, etc. Of particular interest are digital inequalities, which are proving increasingly important for the integration of older people into societies. These results are presented Angelova's paper (2024) accepted for publication in the AIP Conference Proceedings.

The **second chapter** includes the research methodology. The structure, content and significance of the SHARE project are briefly presented, with Bulgaria being included only in the surveys of wave 7. The requirements for the longitudinal research on the data of this project are explained in six steps (Fig. 1, p. 64). The creation of synthetic binary characteristics of various indicators such as aging of people, change in work situation, family status, income level, education, personal and health characteristics, and others is outlined. Also explained is the factor analysis model for grouping different numbers of questions, the selection of target and predictive characteristics of a baseline model on wave 7 data and its testing on wave 8 data, the identification of additional factors and their changes before and after the pandemic. This methodology is proposed to investigate both life satisfaction and active life factors of people aged 50 and over in Europe before and after the global pandemic.

Based on the obtained factors, it is indicated how the cluster analysis is implemented, the selection of the optimal number of clusters; the selection of predictive features through the Chi-square test and two-dimensional box plots; algorithm for selecting the best predictive features (Best subset selection and Lasso); modelling methods such as logistic regression, decision tree and others. All calculations were done on RStudio. This methodology is put into practice in Chapter 3.

The **third chapter** contains the research itself, analysis of the obtained results, summary and discussion of them. Factors of satisfaction have been consistently explored before and during the pandemic; factors for active living before and during the pandemic; the picture of different aging profiles in Europe is presented and an analysis of inequalities in the well-being of different groups is carried out.

The Wave 7 characteristics used for the 'life satisfaction' factors are given in Appendix 2, and the Wave 8 characteristics used in Appendix 4. The different modules are united by the unique respondent number. A number of variables such as age, marital status, education, income, and others were dichotomized. Factor analysis for “life satisfaction” generated four factors (Active Life, Optimism, Depression and Morbidity), which were then dichotomized into two categories. The baseline model contains three additional dichotomized synthetic variables. The additional variable “aging” captures the effect of an increase in the age of respondents between the two survey waves. Corresponding factor analysis equations for “life satisfaction” before, during, and after the pandemic are shown (p. 101).

The distribution of wave 7 and wave 8 respondents by country, age group, marital status, current work situation is given (Fig. 8 to Fig. 11). The correlation matrices and graphs for the formation of the respective four factors on the data from the two waves are shown. The distribution of the results of these factors for different countries before and during the pandemic are given in the corresponding figures (from Fig. 21 to Fig. 28). A comparison was also made between the levels of these factors mainly by country. Results show, for example, that elderly people in Bulgaria are among the most pessimistic in Europe before and during the pandemic, as well as being among the most depressed (p. 120).

The analysis of the determinants of the target characteristic "satisfaction with life" from the two waves of the SHARE research shows that X1 cannot be rejected (Table 4, pp. 125-130), although the weight of the various factors before and during the pandemic changes (Table 5, pp. 131-137). Based on the results obtained, the second X2 cannot be rejected either (Fig. 34 and Fig. 35). Hypothesis X3 also receives support insofar as the data show a change in life satisfaction factors after the outbreak of the pandemic (Table 6, pp. 140-142 and Table 7, pp. 144-146). These changes refer to marital status no longer being a determinant, as well as average income, while the influence of education and an active life grows. The results of the logistic regression (post-Covid model on wave 8 data) are presented in Table. 8 (pp. 147-150).

A similar analysis was conducted on the “active life” factors of older people from Europe with data from both waves of SHARE. The active life factor is dichotomized into two categories - active and inactive respondents. The corresponding figures show the distribution of respondents by country, age group, average age by country and health status (from Fig. 37 to Fig. 40). Correlation matrices and graphs for the formation of the corresponding four factors (Incidence, Active Life, Depression, and Covid-related Stress) on the wave 8 data are shown. The distribution of the scores of these factors for different countries during the pandemic are given in the respective figures (from Fig. 50 to Fig. 53). Analysis of "active life" factors before and during the pandemic shows that X1 cannot be rejected (Table 9, pp. 179-183 and Table 10, pp. 184-186). Based on the obtained results, the second X2 cannot be rejected either (Fig.56, p. 187). Hypothesis X3 also receives support insofar as the data show a change in active life factors after the outbreak of the pandemic (Table 11, pp. 188-190 and Table 12, pp. 191-193). The results show that the lack of social contacts with relatives and the lack of social contacts with friends, neighbours, colleagues are defined as the strongest factors for inactivity during the pandemic (Table 13, pp. 197-199).

For inequalities in the well-being of people aged 50 and over in Europe, seven wave 8 modules were used, and three main clusters were identified. The cluster analysis uses three factors (Illness, Optimism and Active Life) (Table 14, p. 203-204). The distribution of respondents according to these factors is presented in the corresponding figures (from Fig. 58 to Fig. 60).

The first cluster or aging profile is named "Sick Old Retired Pessimists." These respondents appear very ill, have limited mobility, show a moderate level of activity, a large number have no friends, and less than half use the Internet regularly. They are the biggest pessimists in the sample. The second cluster is called "The Poor Inactive Antisocial Disaffected Provincials." Respondents from this cluster are among the least educated, most inactive, most unsocial and most digitally excluded in the sample. A negative attitude towards life dominates among them. Cluster 3 is of the "Affluent Digital Satisfied Healthy and Educated Optimists" whose characteristics are given in the name itself. The differences between these clusters are presented in Table. 15 (p. 217-296), which is a reason to accept X4.

The **third section** of this chapter presents a summary and discussion of the survey data on life satisfaction, active living, and aging profiles (clusters). The results obtained are extremely relevant, with the most significant predictor of the behavior of older Europeans emerging as a link between life satisfaction and country of residence. This is because the country of residence absorbs the effect of many other factors such as air cleanliness, environment, traffic, noise, crime, etc. Also very important is the additional factor in the post-Covid model – the regular use of the Internet, which is positively correlated with life satisfaction (p. 227).

In terms of active life, the results show that having a partner, being employed or retired, and having a high income are positively associated with being active. During the pandemic, social distance and the lack of electronic contacts are among the main risk factors for inactivity.

The three main clusters in terms of respondents' well-being inequalities again show a close relationship with the country of residence - in countries with a higher standard of living people are healthier, better educated, highly active and satisfied, but also with other factors such as employment level, education, health status, etc.

The subsections of this section also point out limitations of the study, such as unbalanced sampling with respect to the target variables of life satisfaction and active living, small samples for some countries, and subjectivity in respondent responses. The results of this analysis are in Angelova's paper (2024) accepted for publication in the AIP Conference Proceedings.

The conclusion represents a recapitulation of the conducted research, indicating the results supporting the relevant hypotheses and some research perspectives in this area.

4. Evaluation of theoretical and scientific-applied contributions

Six contributions have been made by the author, with which I agree.

- Based on a literature review, methodological guidelines are systematized with basic steps for conducting a longitudinal study on SHARE data;
- An author's methodology was created to identify changes in the factors of satisfaction and active life of people aged 50 and over in Europe, which can be used as an algorithm to extract knowledge from data in order to create better social policies;
- A complex structure of factors influencing the life satisfaction and active life of people aged 50+ in a normal situation and during the pandemic has been identified;
- New knowledge is added regarding the significant changes in the mindset of people aged 50 and over in Europe since the pandemic and the likely reasons for this;
- The results of the study are a starting point for creating proposals for social policies, as the author presents detailed proposals for such policies;
- An up-to-date segmentation of the same elderly respondents was carried out and the different aging profiles during the global pandemic were revealed, as a basis for segment-oriented strategies to deal with crisis situations

5. Evaluation of dissertation publications

On the topic of the dissertation, the candidate has 3 publications in journals indexed in Scopus. As shown, most of the content of the dissertation was tested in these publications. In addition, the first publication already has 8 citations, four of which are in journals indexed in Scopus/WoS.

6. Evaluation of the summary (autoreferat)

The summary (autoreferat) has a volume of 55 pages, reveals the main points of the dissertation work and as such meets the requirements.

7. Critical notes, recommendations and questions – I have no critical notes on the text of dissertation

8. Conclusion

The dissertation shows that the PhD student has done significant work in analysing the relevant literature and professional processing of longitudinal data from the SHARE project. A large number of factors were used to examine the target variables, and highly relevant results were obtained. In this case, I can only point to the relationship between life satisfaction and country of residence as the most significant predictor of the behavior of older Europeans. The three clusters in terms of respondents' well-being inequalities again show a close relationship with the country of residence. Unfortunately, the elderly in Bulgaria is among the biggest pessimists in Europe before and during the pandemic, as well as among the most depressed.

The text shows a very good knowledge of the researched issues, a correct presentation of the theoretical approaches and reference to the information sources. The obtained results outline the significance of the derived factors for a more accurate assessment of life satisfaction, active life and inequalities among people aged 50 and over from Europe. With this work, the doctoral student demonstrates the qualities of a serious researcher with a responsible attitude to scientific activity.

All this gives me reason to propose to the esteemed jury to award Mihaela Angelinova Angelova the educational and scientific degree "Doctor" in professional direction 3.8 "Economics", doctoral program Data Science.

20.07.2024
Sofia

Reviewer:
Prof DSc Zhelyu Vladimirov