



REVIEW

For Public Defense of Doctoral Dissertation

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Dissertation: Circular Economy Development in the European Union, supervised by Prof. Dr. George Mengov

Doctoral Student: Reni Ivanova Pantcheva

1. Professional Profile

PhD candidate Reni Pantcheva's CV shows a clear focus on academic pursuits. She graduated from the First English Language High School in Sofia with a gold medal and then successively completed a bachelor's and master's degree at the Faculty of Economics of Sofia University - "Economics" and "Energy Markets and Services", respectively. Throughout her studies, she has consistently excelled, appearing on the Dean's List (2015, 2017) and receiving a Certificate of Excellent Results in 2021. From July 2021, she is a full-time PhD student in the Department of Industrial Economics and Management at the Faculty. She has relatively short professional experience as an assistant to a project manager, selection manager and inspector of information activities. I know Reni Pantcheva personally, as she participates in a scientific project which I am managing, and we have a joint publication indexed in the prestigious international scientific database Web of Science. My impressions of her are consistently excellent.

2. Overview of the Dissertation

The dissertation consists of 130 pages of main text, bibliography and list of publications. The structure of the dissertation work is logical, with the results divided into three chapters, which successively fulfill the set goals and tasks (pp. 5-6). The introduction convincingly presents the relevance of the topic as well as the main research topic. It also includes comprehensive explanations of the object and subject of the study. The scientific apparatus is adequate to the goals and tasks and is well chosen.

Chapter One, Concepts of the Circular Economy, is essentially an overview. They outline the theoretical foundation on which the subsequent research is based. The emergence of the circular economy concept is examined, as well as the main strategies and business models that characterize it. The chapter also reviews a set of circular economy metrics. The reviewed literature is significant in volume and scope and shows that the author of the dissertation work knows and confidently works with the main approaches, theories, methods and indicators in the field of research.

The second chapter "Institutional framework of the transition to a circular economy in the EU" presents the European legislation in the field of the circular economy, as well as the European framework for monitoring the transition to it. The second chapter is significantly smaller in volume compared to the first (18 pages compared to 28 pages) and meaningfully belongs to the overview part. Data on the dynamics of key indicators of the circular economy at three different points in time (they do not coincide for the different indicators) are briefly presented in Figures 2 to 6. A check in the Eurostat database shows that for a large part of these indicators there is annual data, and it remains unclear to the reader why these three points are chosen starting from 2015 (sometimes 2016) and ending in 2020 (in some cases 2021). On the other hand, the indicators themselves are not fully described. The review of the data in Sections 3.1.1, 3.2.1 and 3.3.1 partially attempts to address this, but fails to do so fully.

The third chapter "Investigating the impact of macroeconomic and social factors on the transition to a circular economy in the EU" is essentially the main contributing chapter of the dissertation. Three main aspects of the transition to a circular economy are considered here – degree of recycling (Section 3.1), degree of circularity (Section 3.2) and consumption of renewable energy (Section 3.3). Each of these aspects has been developed in detail and conscientiously, and each of them could serve as the basis of a separate study or chapter of a dissertation. In this sense, their compact presentation in one chapter should be admired, but should not mislead the reader - the amount of research work invested in it is more than significant. The *recycling rate* was examined using a panel regression model (Table 3). It is noteworthy that the dissertation reports results from a mixed panel regression model estimated by the method of least squares.

The dynamics and factors affecting the *degree of circularity* of an economy (Section 3.2) presents detailed and interesting results. Here, the doctoral candidate works with logarithmically transformed data, correctly presenting their correlation matrix (Table 5). A set of tests are reported to give confidence in the correct choice of panel specification. Table 8 presents the results of Granger causality testing, and the dissertation deserves admiration for the conscientious and detailed approach. Ultimately, Table 9 shows compelling research results. Two panel regression specifications are calculated (mixed model according to MLS and panel with fixed effects). Both models confirm the importance of GDP per capita, R&D expenditure and

resource productivity indicators. Ecotax revenues also reach statistical significance in model 2. The unusually high value of the adj. R^2 (0.929) is striking, and I would recommend that it be commented on further. The discussion of the results obtained is detailed and useful.

The *consumption of renewable energy* is the focus of the third research direction in the dissertation. The doctoral student makes a detailed preliminary review of the data (Table 11 and Figs. 15, 16 and 17), examines their correlations (Table 12) and correctly accounts for the problems that could arise given the high values of some correlations. Granger causality tests are correctly reported (Table 13). The dissertation reports the results of 12 panel models, 6 of which are fixed effects and the remaining 6 are estimated using fully modified least squares. The set of different models gives additional confidence in the robustness of the results. The research done here is excellent from an econometric point of view, but it also leads to a series of important substantive conclusions. The importance of a large part of the examined indicators is emphasized, as the level of economic development and R&D expenditures have the expected relatively large positive and statistically significant coefficients.

In general, the presented results are interesting and significant and clearly demonstrate that the doctoral student has mastered not only the topic under consideration, but also the necessary econometric tools for conducting high-level research.

3. Evaluation of Scientific and Applied Contributions

The contributions in the dissertation work are sufficient in quantity and quality and fully meet the requirements for obtaining the doctoral degree. They are largely correctly described, and I accept the following as contributions:

- A positive statistically significant relationship between the degree of recycling and the degree of circularity on the one hand and a set of explanatory variables on the other hand is derived in an econometric model;
- The appropriateness of using the renewable energy consumption share indicator as a measure of the circularity of the economy is justified and its main drivers are investigated;
- Four main models of transition to the circular economy in the EU are formally derived with the help of cluster analysis.

In this sense, I fully accept contributions #3, #4 and #5 of the thesis, and partially accept the claims of contributions #1 and #2.

4. Critical Comments and Recommendations

Specific critical remarks and recommendations are made above in relation to the relevant chapters. Two considerations of a more general nature are also worth noting:

- The indicators used should be discussed in more detail in Chapter Three. This would allow an understanding of their interrelationships, as well as a more critical assessment of the applicability of some indicators of the circularity of the economy. It is of particular importance to consider the extent to which explanatory variables really drive levels of circularity, or whether we observe these dynamics simply as a function of economic development combined with policy decisions.
- The dissertation unequivocally shows that the doctoral student has mastered the theory and tools needed to work at a high level in the field of economics and management. A natural next step is the development of a more critical approach to the already presented scientific results and conclusions, which will allow one to clearly outline one's own scientific opinion in the field.

I emphasize that the comments made do not diminish the value of the results obtained and should be considered primarily as potential directions for future research.

5. Evaluation of Publication and Compliance with Minimum National Requirements

Doctoral student Reni Pantcheva presents evidence of **significant publication activity** on the topic of the dissertation, as follows:

1. Pantcheva, R., & Mengov, G. (2022). Recycling Rate in Europe: Econometric modeling and dART clustering analysis. *2022 International Conference Automatics and Informatics (ICAI)*, 179–182. doi:10.1109/icai55857.2022.9960075. The article is indexed in SCOPUS.
2. Pantcheva, R. (2023). Circular Use of Materials: Drivers of the Circularity Rate in the European Union. *Economic Studies (Ikonomicheski Izsledvania)*, 32(3), 148–161. The article is indexed in SCOPUS.
3. Pantcheva, R. (2023). Circular Economy Awareness in Bulgaria. *Yearbook of the Faculty of Economics and Business Administration*, 22(1), 109–124.
4. Pantcheva, R. (2024). Economic and Social Drivers of Renewable Energy Consumption in the European Union: An Econometric Analysis. *Economic Studies (Ikonomicheski Izsledvania)*, in press. The study is indexed in SCOPUS.

Here it should be noted that three of the four publications are indexed in the world-renowned scientific information database Scopus, which shows the high level of the conducted research. In addition, Ms. Pantcheva has participated with a report in four specialized scientific conferences. Based on the presented evidence, it can be concluded that doctoral student Reni Pantcheva not only **meets, but significantly exceeds the national minimum requirements for obtaining the degree of "Doctor"** (Article 12 of the ZRASRB/DASRBA, Article 35 of the Regulations for the Implementation of the ZRASRB/DASRBA and Art. 1a, para. 1 of PPZRASRB/DASRBA).

6. Evaluation of the Dissertation Summary

The dissertation summary presents the main results of the dissertation in a detailed and comprehensive manner.

7. Conclusion

The dissertation is a thorough and conscientious scientific study that clearly demonstrates the deep theoretical knowledge of the doctoral student, as well as the skills for conducting independent scientific research at a high level. The text contains scientific results, which represent an original contribution and meet the minimum requirements of the Development of the Academic Staff in the Republic of Bulgaria Act (ZRASRB/DASRBA) and the Regulations for the Implementation of the Act. I believe that the presented dissertation fully meets the requirements of Art. 6, para. 3 of ZRASRB/DASRBA and I give my **positive consideration for the dissertation text**. It is with strong conviction that I recommend that the respected scientific jury award the degree of Doctor in Professional Field 3.8 Economics to doctoral student Reni Pantcheva.

Chair of the Scientific Jury:

Prof. Anton Gerunov, Ph.D., D.Sc.

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