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Review of the Doctoral Dissertation by Etienne Gatera entitled: „The Impact of Economic Development on the Second Demographic Transition (SDT) in Sub-Saharan Africa (SSA): The Case of Rwanda Prepared under the supervision of dr hab. Sławomira Kurka, prof. UKEN.

1. Law basis

The goal of this review is to evaluate whether the presented dissertation meets the requirements necessary for the conferral of a doctoral degree, as stipulated by the Polish Higher Education and Science Law (Dz.U. 2023.742 with later amendments). Specifically, per Article 187 of this law, a doctoral dissertation must: 1) Demonstrate the candidate's comprehensive theoretical knowledge in the discipline(s) concerned; 2) Exhibit the candidate's ability to independently conduct scientific or artistic research; 3) Present an original solution to a scientific problem, original application of research findings in economic or social domains, or an original artistic accomplishment.

2. Information About the PhD Student

Etienne Gatera completed his doctoral studies in 2024 at the University of the National Education Commission in Krakow, specializing in socio-economic geography and spatial economy. He holds a bachelor's degree in development studies from the National University of Rwanda (2011) and a master's degree in economics (international business) from the University of Economy in Bydgoszcz (2019). The candidate has authored four scientific articles. Of these, three were published in Poland: two in journals affiliated with his home university and one in 'The New Educational Review' (indexed in the Scopus database). The fourth article appeared in the 'Journal of Sustainable Business and Economics', which, to the best of my knowledge, is not indexed in prominent databases or listed in the 2024 polish ministerial journal ranking. Mr. Gatera's academic portfolio also includes participation in three conferences (Poland, Germany, and Austria) and two research trips—one to the University of Ghana and another to the University of Rwanda.

3. Subject and Content of the Thesis

The reviewed dissertation is structured into eight chapters and spans 161 pages, including annexes. The primary aim of the study is to explore what the author describes as the "early traces" of the Second Demographic Transition (SDT) in the context of Rwanda's economic development. Rwanda serves as a case study for Sub-Saharan Africa (SSA), being a country with one of the lowest fertility rates in this region. The author posits two research hypotheses: first, that early traces of the SDT are evident in Rwanda, and second, that three key factors—education, healthcare, and labor force—play a pivotal role in driving the SDT in Rwanda.

The dissertation's research segment is preceded by a literature review, where the author elaborates on the concept of SDT, providing an overview of SDT studies in Europe, SSA, and specifically Rwanda. The third chapter details the research methodology and data, discussing the collection of both primary and secondary data. The author explains the sample size calculation for the survey and the questionnaire's construction, including sampling principles and data collection methods.

Chapter four presents the cultural context of demographic processes in Rwanda. The subsequent three chapters comprise the analytical and research core of the dissertation, characterizing Rwanda's socio-economic features, identifying spatial patterns of fertility through spatial autocorrelation methods, and analyzing economic indicators considered critical for the SDT in Rwanda. The research concludes with an analysis of survey results conducted among 1,067 women aged 15–49. The final chapter offers conclusions and a discussion.

4. Evaluation of the Dissertation

4.1. General Theoretical Knowledge of the PhD Student

Based on the literature review and the methodological section of the dissertation, I conclude that the PhD student has adequately mastered the theoretical knowledge related to the topic of the research problem. In the theoretical chapter, the author demonstrates knowledge of SDT occurring in both developed and developing countries, including Sub-Saharan African countries. Drawing on an extensive literature base (the bibliography includes over 200 sources), the author has identified economic factors that, according to existing research, play a key role in the SDT process. Subsequently, he selected three of these factors for his study: the level and accessibility of education, access to healthcare, and the structure and accessibility of the labor market.

The author's solid theoretical background is further evidenced by the methods employed in the dissertation. The use of both quantitative and qualitative methods demonstrates the candidate's strong grasp of research tools in socio-economic geography. While the methods employed may not be the newest or most original, they align well with the research trends within our discipline. Among the shortcomings, I would point to the lack of broader references to demographic processes observed on other continents. It is unfortunate that the author did not dedicate more space to analyzing selected examples from Asia, which are likely more closely aligned with demographic transitions in Africa than those in Europe. Furthermore, the lack of a broader African context remains puzzling. This includes references to North African countries, where demographic processes unfold somewhat differently than in Sub-Saharan Africa (SSA). Finally, I found the choice of Kenya and Ethiopia as comparative examples for demographic processes in SSA to be somewhat unclear. Why did the PhD student not choose other examples, such as Nigeria, the largest country in this group, or Namibia, which seems to be at a similar, if not more advanced, stage of SDT compared to Rwanda? Including such examples could have provided a valuable comparative backdrop and perhaps facilitated a better understanding of the processes occurring in Rwanda.

I am aware that this is a delicate matter, but I also missed an attempt to address the events of 1994, which undoubtedly had an impact on Rwanda's demographic structure. While I am uncertain of their relevance to the subsequent demographic processes, it seems that this topic warranted inclusion in the analyses.

4.2. Independent Research Skills of the PhD Student

In my opinion, the PhD student demonstrates sufficient ability to conduct independent scientific research. The study conducted as part of the dissertation is well-designed, and its results are presented in a manner comprehensible to the reader. The objective of the work, research questions, and hypotheses are formulated in a clear and specific manner. As a result, the defined research problem—identifying the phenomenon of SDT in Rwanda and illustrating the significance of selected economic indicators in this process—is precise. However, the justification for selecting the three indicators leaves something to be desired. The author presents three groups of factors related to fertility levels in Figure 2.4 (page 28) but does not convincingly explain why only three of these factors were selected for the study, while others were omitted.

The research process comprises three main parts: a) identification of the SDT phenomenon in Rwanda and its intranational diversity; b) examination of the relationships between SDT and selected economic indicators; c) analysis of the survey results.

Each part requires separate discussion and evaluation:

a) The first part of the study includes two main tasks. In the first, the PhD student illustrates selected demographic and socio-economic indicators and the dynamics of their changes over the past several decades. This provides a necessary introduction, allowing the reader to familiarize themselves with key information about Rwanda. The inclusion of brief descriptions of other SSA countries appears unnecessary, especially since this information is not utilized in the study.

In the second part, using spatial analysis methodology, specifically Local Moran's I, the PhD student examines the spatial correlation of fertility. I have some concerns regarding the evaluation of this analysis. I am not a specialist in spatial analysis methods, but I am not fully convinced of the justification for its application. First, I am unclear about the author's objective in conducting this analysis. Second, there is a lack of discussion of the results obtained. What new insights does this analysis contribute to the study? Examining the spatial variation in fertility as shown in Figure 5.12 allows for similar conclusions without employing spatial autocorrelation methods. My concerns are not only methodological but also conceptual.

Significant doubts arise regarding the application of the method to such a small number of spatial units (fewer than 30). The principles of this method require a significantly larger sample size. Since Local Moran's I is applied to geographical units, it is necessary to correct the p-values (e.g., using the Bonferroni test) to avoid false positive results. Third, Local Moran's I is a permutation measure, and several thousand permutations are typically performed to assess significance. The study does not indicate how many permutations were planned for this research.

b) The second part of the study focuses on discussing three selected economic indicators: the level of development and accessibility of education, healthcare, and the labor market. While this descriptive analysis is sound, its reception is occasionally disrupted by the unclear formatting of tables. Although individual indicators are discussed in great detail, I found the lack of an attempt to show their connection with the examined SDT phenomenon to be a shortcoming. I acknowledge that this is a challenging task, but there are several statistical methods available that could have been employed to formally investigate these relationships.

c) The third part presents the results of the author's survey research. The effort involved in preparing and conducting the survey deserves recognition. The survey is directed at women aged 15–49, with the questions designed to elicit specific behaviors that directly relate to fertility and indirectly indicate the SDT process and its spatial differentiation in Rwanda. The

construction of the questionnaire and the selection of questions are appropriate and well-prepared. However, the study raises some methodological concerns.

While the author correctly calculates the sample size statistically, a common error often encountered in geographical studies is not avoided. The sample is calculated as representative of the entire country. The author then proportionally divides this sample across each region of the country and compares results for these regions in the outcome section. Such an analysis would only be valid if the sample size (representative) were calculated separately for each region, which would naturally result in a significant increase in the sample size and necessitate much larger survey efforts.

The second methodological error, in my view, is related to the randomness of the research sample. Proper social research, as expected at the doctoral level, requires a random sample. The author does not mention this procedure, which leads me to conclude that no sampling procedure was performed. Consequently, even if the study is limited to women within a specific age range, the results cannot be generalized, nor can they serve as evidence of the presence or absence of the SDT phenomenon in various regions of the country.

Aside from the reliability of the survey results, another issue is the way the analysis in Chapter 7 is conducted. The author discusses the results for individual questions step by step. Numerous methods exist that allow for more advanced analysis. It would have been beneficial to apply simple regression methods to demonstrate the relationships (and their significance) between the studied characteristics and the fertility rate. It is unfortunate that this was not done, as it could have led to different insights from those obtained.

In conclusion, I would like to draw attention to another issue, although I am uncertain of its relevance to the study. In his research on fertility and the broader SDT phenomenon, the author primarily focuses on women. Women are the lens through which access to the labor market, education, and healthcare is analyzed, and they are the respondents in the survey. I am curious, as the study does not address this, why the author overlooks the other half of society. Do the demographic, social, and economic behaviors of men not influence the SDT process? The exclusion of men may stem from cultural factors, but I would have expected this aspect to be addressed in the study.

4.3. Originality of the Research Problem

The research problem addressed by the author can be considered original from a scientific perspective. Africa, particularly Sub-Saharan Africa (SSA), remains relatively underexplored in global geography, and the demographic, social, and economic processes occurring there are intellectually intriguing. To date, relatively few research findings on the phenomenon of the

Second Demographic Transition (SDT) in this part of the world have been published. This is likely due to the fact that the phenomenon is, at best, in its initial stages. However, this does not diminish the importance of such studies.

From a cognitive perspective, and despite methodological shortcomings, the most valuable part of the dissertation is the survey research findings. In my opinion, with an appropriately tailored analytical approach, this section holds the greatest potential for publication among all parts of the dissertation.

The study's results are not groundbreaking, but they are nonetheless surprising to me. Apart from selected exceptions (e.g., South Africa), Africa is widely perceived as a continent where demographic processes are at an earlier stage than SDT. The PhD student's dissertation demonstrates that in countries like Rwanda, it is already possible to identify at least preliminary symptoms of this phenomenon. This undoubtedly adds value to the body of research on global demographic transformations.

5. Formal Evaluation of the Dissertation

I do not consider myself fully competent to evaluate the language quality of the dissertation, but it reads quite well, aided by the glossary of abbreviations used in the study. The structure of the dissertation is appropriate, with tables of contents and lists of references prepared correctly. The illustrations in the dissertation correspond adequately with the text. However, some illustrations are poorly constructed or unclear (e.g., 1.2, 1.4, 5.1, 5.3, 6.1, 6.3, 6.6). Similar issues apply to selected maps, though this could also be attributed to the fact that I received a black-and-white version of the dissertation for review.

I would also like to draw the PhD student's attention to the tables in Chapters 6 and 7. In Chapter 6, data for the two study years are mostly non-comparable, making it difficult to track changes in the studied processes. It might have been better to limit the analysis to indicators that can be directly compared. In Chapter 7, I noticed discrepancies in the total number of observations reported in the tables corresponding to different survey questions. The author does not explain the source of these discrepancies, which makes it difficult for me as a reader to follow the candidate's analysis.

6. Conclusion and Final Evaluation

My overall evaluation of the dissertation is not entirely straightforward. The dissertation has several strong points, the most notable of which include the originality of the scientific topic addressed, the coherence and appropriateness of the study design across the various stages of the research, and its solid theoretical foundation. However, I also note several substantive

shortcomings. In particular, these concern the proper application of two methods: spatial autocorrelation and survey research. In my opinion, these issues could affect the accuracy of the results presented in the dissertation.

From an editorial perspective, the dissertation is adequately prepared and is relatively easy to read. However, it suffers from numerous repetitions, particularly regarding frequent assertions that Rwanda is in the initial phase of the Second Demographic Transition (SDT), as evidenced by the level of development and access to education, healthcare, and the labor market. Although I did not count them, such statements appear at least a dozen times in various parts of the dissertation.

Taking the dissertation as a whole, I conclude that the study titled *The Impact of Economic Development on the Second Demographic Transition (SDT) in Sub-Saharan Africa (SSA): The Case of Rwanda*, prepared under the supervision of Dr. hab. Sławomir Kurek, prof. UKEN, meets the requirements set for doctoral dissertations under the Polish Law on Higher Education and Science, dated July 20, 2018, with subsequent amendments, as outlined in Article 187 of the Act (Dz.U. 2018, item 1668).

In light of the above, I recommend that the doctoral dissertation of Mr. Etienne Gatera be accepted by the Council of the Discipline of Socio-Economic Geography and Spatial Economy at the University of the National Education Commission in Kraków. I also recommend that the dissertation be admitted to public defense and further stages of the doctoral process.