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Review of the doctoral dissertation

‘Productivity drivers: implications for Brazil’s development - evidence from the selected countries’

Subject of the review

The subject of this review is the doctoral dissertation ‘Productivity drivers: implications for Brazil’s development - evidence from the selected countries’ prepared at the Faculty of Economics, University of Gdańsk, under the guidance of the dr hab. Teresa Kamińska, professor of the University of Gdansk and Doctor Małgorzata Zielenkiewicz.

The evaluation is based on the formal resolution of the Council of the Faculty of Economics, University of Gdańsk. The criteria for assessing the achievements corresponding to doctoral degree are based on the Act as of March 14, 2003 for degrees and titles in the field of arts (Law No. 65, item 595, with amendment).

1. Assessment of the literature achievements on the topic of the dissertation

The PhD thesis presented for this review (‘Productivity drivers: implications for Brazil’s development - evidence from the selected countries’) is the result of literature review on the main productivity drivers of G7, EU-11, and BRICS countries and of the empirical identification of the productivity drivers that Brazil’s economy should focus.

The author starts from the economic issue: poor performance of Brazilian economy due to the lack of productivity. This topic has been investigated by Brazilian researchers and policymakers and by the most important institutions of the world — the Organization for Economic Cooperation and Development (OECD), the World Bank, and the International Monetary Fund (IMF). All these entities agree that Brazil’s lack of productivity is hindering this country’s growth and economic development.

In this context, the PhD student considers that Brazil’s economy urgently needs to boost productivity. Therefore, examination of those economies that have succeeded in improving productivity is necessary. This work considers G7 economies (as the benchmarks in terms of productivity), BRICS economies (as the examples of powerful emerging economies), and the EU-11 economies, assuming they have historical similarity to Brazil. Comparing these economies may provide essential knowledge for Brazilian policymakers in part of productivity. These comparisons may also reveal leverage points for intervention.

The driving question of this research is related to what Brazilian policymakers might learn about productivity drivers in other countries. The general assumption is that Brazil can enhance its productivity by taking advantage of the knowledge gained by examining the experiences of other countries. The aim is to expand the body of knowledge about productivity enhancements and offer recommendations to Brazil’s policymakers.



In this scope, the author investigated three different groups of countries: G7 countries (Canada, France, United States, United Kingdom, Germany, Japan, Italy), because these are the most industrialized and developed economies in the world; BRICS countries (Brazil, Russia, India, China, South Africa) that were previously selected by the Report 'Building Better Global Economic' (O'Neill, 2002) issued by Goldman Sachs, which predicted that the BRICS countries would shortly be among the largest economies in the world; and the EU-11 economies (Croatia, Latvia, Bulgaria, Lithuania, Romania, Hungary, Slovenia, Czech Republic, Estonia, Slovakia, and Poland) because these countries have historical similarity to Brazil regarding the transition these countries faced moving from socialism, which is somewhat similar to Brazil's shift from the military regime to a new federal constitution that was signed back in 1988, thus declaring Brazil a free capitalist economy. The literature review was conducted for the period of 1990–2019 (30 years); however, empirical studies were done for the period of 1990–2017 (28 years) due to data availability limitations.

From a deeper literature review on the main productivity drivers in the selected countries, the author provided a list of productivity drivers to serve as lessons in furthering Brazil's development. The literature review made it possible to put forward the hypotheses to be tested for statistical significance and be compared to a benchmark economy, allowing the author to draw relevant conclusions.

The combination of literature review analysis and own empirical evaluation based on practical expectations confirms the scientific value of the reviewed doctoral dissertation.

2. Structure and contents of the dissertation

The reviewed work has the total of 258 pages, including 204 pages of the text, 50 pages of bibliography, 2 pages with the list of figures, 2 pages with the list of tables.

The overall structure of this work is correct and complies with the put forward research goals. This work consists of an introduction, the presentation of the structure of the dissertation, four chapters and the final section with conclusions. The content of the doctoral thesis is organized to follow the logic of literature review, main assumptions, methodology, empirical findings and comments.

In the introduction, the PhD student justified the selection of the issues to be considered and correctly defines the scientific problem along with the corresponding research questions. He formulated the main goal, and its refinement, auxiliary goals as well as the hypotheses. In addition, he justified the scope of research, research methods to be used and described the contents of the individual chapters that refer to specific research tasks. The approach to the above issues confirms good understanding of the literature on the discussed issues and of the practical expectations. The content of the chapters is coherent and subordinated to the achievement of the work objectives and of the hypotheses' verification.

In Chapter 1, the PhD student introduces the theoretical framework, defining the theories underlying productivity in this research. From the multitude of definitions, the PhD chose one, providing solid arguments for this choice. Under this approach, productivity is defined as the capacity of an economy to produce goods efficiently; productivity determines the living standards of a nation's citizens. Furthermore, what determines the production of goods in an economy depends on the number of production factors and the capacity to organize them efficiently. This definition is one of the most common ones and is also used by the OECD and the Report Productivity Measurement and Analysis (Fabricant, 2009). With some variations, many other works are also based on this definition (Rostas & Mills, 1954; D. W. Jorgenson & Griliches, 1967a; Samuelson, 1983; (Helliwell, 1984; Gordon, 1985; Levinsohn & Petrin, 2003).

This chapter also highlights the production function and the related concepts that can be derived from that. Additionally, this section explains productivity drivers, main measurements and methods, TFP, labor productivity, and capital productivity. Total factor productivity is affected by many variables, such as technological and managerial innovations, cultural factors, competition, investment in more productive sectors, economic policies in relation to crediting and many others. Conversely, other sets of factors affect TFP negatively, like failing to allocate capital efficiently, restrictive labor practices ordered by unions, hard environmental regulations, the absence of not healthy workers, the presence of low-skilled workers, restrictions against innovation, etc. Thus, TFP has become a measure capable of explaining a significant part of the differences between underdeveloped, developing, and developed countries. It is considered that differences in TFP explain the primary difference between the development of these countries. Finally, this chapter defines the dependent and independent variables and the reasons they were chosen. From the economic theory, one can derive some essential productivity measures. Labor productivity (LP), Capital productivity (KP), and Total Factor Productivity (TFP) are the most relevant measures of productivity for this research. LP measures the amount of wealth creation per worker. KP measures the amount of wealth creation per unit of capital invested. TFP measures the efficiency with which all inputs are combined to produce goods – it is also seen as an economic measure of technical progress.

In Chapter 2, the author presents the literature review providing important findings regarding productivity drivers in the selected countries. These findings on G7, EU-11, and BRICS countries were referenced to select a benchmark economy for comparison with Brazil's numbers. A comprehensive literature review covering a large range of discoveries about all the countries was completed in order to learn how countries have organized policies and actions to improve productivity.

The review considers the research from 1990 to 2019, examining published works, which were selected, based on date and relevance, from the top 500 scientific articles for each country. Each paragraph intends to contain a singular study finding, not necessarily related to the anterior or posterior findings, but logically exposing productivity drivers found for the same country. From this knowledge, the author extracted a list of the main productivity drivers to be the reference for the lessons learned by Brazilian policymakers. Separate evidence from many studies was provided for Canada, UK, France, Germany, Italy, Japan, EU-11 countries (Poland, Slovakia, Czech Republic, Estonia, Slovenia, Romania, Hungary, Lithuania, Bulgaria, Latvia, Croatia) and other BRICS countries (Russia, India, South Africa, China).

The evidence was organized as an evidence map (p. 158) and filtered by a Pareto chart (p. 159), allowing the author to find the most relevant productivity drivers and make it possible to narrow down the list of drivers to a countable number of the most important variables. Differences in history provide reasons for differences in productivity drivers' roots. These differences are important in this study because the main objective is to learn the lessons on productivity drivers. Therefore, countries and blocks were separated, and the evidence was counted. The productivity drivers were organized into a diagram by affinity, adding the quantity of evidence found for the sum of subjects with affinity. The Pareto chart was selected to separate the most relevant productivity driver groups to be observed. The use of a Pareto chart allowed the author to sum up the evidence (the number above each bar in the chart) and organize the productivity drivers by importance, reducing the total number of productivity drivers to four main groups.

Chapter 3 presents the hypothesis testing of correlations between the dependent variable, productivity, and the independent variables selected from the groups of countries. These variables include human capital, investments in education, expenditure in R&D, capital formation, international exposition by trade, and governance rules. The following 15 assumptions were tested using ANOVA procedure:

- Average productivity was equal for all G7 countries in the long term.
- Average productivity was equal for all EU-11 countries in the long term.
- Average productivity was equal for all BRICS countries in the long term.
- The TFP growth (amplitude) was equal for all the countries in the long term.
- The slope in the linear regression equation was equal for all EU-11 countries in the long term.
- The explicative power (R^2) was equal for all EU-11 in the long term.
- Investments in education had no relation to labor productivity growth.
- Human capital growth had no relation to labor productivity growth.
- Labor productivity had no relation to TFP growth.
- Capital formation had no relation to TFP.
- Domestic expenditure in R&D had no relation to TFP.
- International exposition by trade had no relation to TFP.
- Corruption perception had no relation to TFP.
- The average depreciation rate of the capital stock had no relation with TFP.
- The share of labor compensation had no relation to TFP.

The average productivity (TFP) was not equal for all G7 countries in the long term, as it demonstrates statistically significant differences. The average productivity (TFP) was not equal for all EU-11 countries in the long term, as it is also showing statistically significant differences. The average productivity (TFP) was not equal for all the BRICS countries in the long term, also with statistically significant differences.

As the best performer in the period studied was Poland, it was chosen to be the benchmark for comparison with Brazil. In Brazil, education expenditure was positively related to labor productivity growth, but investments in education have been ineffective. Despite the instability and lack of uniform results, human capital in Brazil was strongly and positively correlated with labor productivity. Labor productivity in Brazil did not relate positively with TFP, as expected. Capital formation was not positively related to TFP in Brazil, because misallocation of capital was another essential root of low productivity in Brazil. R&D expenditure was inefficient since gross expenditure in R&D in Brazil was negatively related to productivity. The inefficiency of trade openness is a relevant source of productivity. International exposition in Brazil is weakly related to TFP growth. In Brazil, the perception of corruption was positively related to productivity. The average depreciation rate of capital stock in Brazil behaved contrarily to what was expected because of poor practices in capital formation, poor technical and financial resource management, and a trend of poor decision-making in capital investments. The share of labor compensation in GDP in Brazil was erratic and unstable, which suggests that poor management practices in human resources should be accounted for as another likely cause of low productivity

Chapter 4 presents the results obtained while testing the hypotheses along with discussion of those results. The author proves the understanding of the roots of low productivity growth in Brazil's economy over the last three decades. This was completed using a 'research before resolutions' approach, in which all the findings are used to explain the reasons for low productivity in Brazil's economy and to provide recommendations that may lead to more productive future for Brazil.

Qualitative and quantitative results of the research are presented and discussed. A list of the main findings and recommendations for Brazil's policymakers, as well as possibilities for future research are presented. Conclusions and references complete the work.

Qualitative results allowed the researcher build compendiums of productivity drivers — in microeconomic and macroeconomic perspectives — from 22 countries of the previously mentioned blocks. These compendiums were based on the literature review and organized according to the affinity diagram and the Pareto chart of the productivity drivers. The intention is

to offer these compendiums to policymakers and give them options for combating the root causes of low productivity in Brazil.

Quantitative results provided opportunities to improve productivity in low-productivity performers, such as Brazil, when compared to a high-productivity performer, such as Poland. This comparison allowed the researcher to diagnose the downward trend in Brazilian economy, outline the likely reasons for this trend, and highlight the crucial areas to be combated as soon as possible in order to further Brazil's development.

The contribution of this research to the field of economics is relevant because there are no recent studies comparing productivity levels on such a scale. This study sheds new light on how economies work in terms of productivity and the factor influencing it. The contribution of this research study may help amplify the knowledge about the key factors behind economic efficiency and thus allow policymakers to elaborate better policies, manage programs, choose investments, and make decisions in a more well-grounded way.

3. Critical comments

Important practical economic issues were taken up in this work. After presenting literature review and own empirical research objectives, the author uses correctly selected methods for solving the research issues and verification of the research hypotheses.

The manner in which the literature review is presented, assessments are formulated and conclusions are developed proves a good knowledge of the discussed issues. The topic is well chosen since it is oriented towards practical recommendations for improving Brazil productivity that could enhance economic development with positive effects for population well-being. Undoubtedly, the reviewed work successfully combines theoretical, methodological and empirical issues. The research problem was an ambitious challenge successfully met by the PhD student.

Notwithstanding the generally positive assessment of the dissertation, I would like to draw attention to several weaknesses of this work and to provide minor recommendations:

- ✓ limitations for each historical definition of productivity should be provided;
- ✓ in graph 2 on page 156, the author should indicate the analyzed period in the title;
- ✓ the proposed regression model displayed in graphs 2-4 and further and also in tables should be validated in terms of errors assumptions (errors independence, homoskedasticity, normal distribution);
- ✓ what does intersection mean, see Table 13 (page 158) and in the other tables? Do you refer to intercept (constant)?
- ✓ describe more the evolution of the variables in graphs 5,6, 19 from the statistical and economic points of view;
- ✓ practical comments should be added while introducing the methodology in use;
- ✓ advantages and limitations of the selected methods should be explained better;
- ✓ more comparisons between own results and those presented in the previous studies on Brazil economy should be added;
- ✓ better description of economic policies that could ensure higher productivity in Brazil should be provided stemming from own empirical findings;
- ✓ a more critical position as to some results presented in the literature review could be helpful.

4. Assessment of the formal criteria

The PhD student has fulfilled all the formal criteria. The scientific problem has been correctly defined, the proper research procedure has been used, the objectives have been accurately defined and research hypotheses have been set, the scope of work has been defined quite precisely, various methods have been used correctly. Taken together, all this directly confirms the good knowledge of the scientific toolkit.

The work is based on a well-chosen literature collection. The dissertation is properly structured. The arguments are logical and consistent, from theoretical assumptions to the empirical part and verification of theoretical hypotheses. Numerous tables, charts and maps integrated into the text make the content more readable. Fundamental and older references are combined with more recent references in the field.

I rate the reviewed work highly, which does not mean though that it is free from certain shortcomings. The title of the dissertation might be unclear for those who did not read the full text. In the title, both Brazil and other countries appear without a logical connection between these countries. From my side, I would suggest the title: *Productivity drivers for Brazil's development based on empirical evidence from other countries*. An invalid regression model should not be displayed in the main text of the dissertation (graph 29 and table 29 on page 188 indicate that the regression model is not valid). Few sentences explaining that the hypothesis was not validated would be enough. Some references are wrongly declared at the end (for example, the title is not properly presented for Vandermeulen, A. J. (1951). Criteria of 'Adequate' Governmental Expenditure and Their Implications. *The Journal of Finance*, 6(1), 19-31). Primary objective should be considered as a general objective, while minor objectives are sub-objectives that circumscribe the general one. Conclusions might be extended to provide more of author's own vision and implications. More focus could be also placed on the comparison of own results with those presented in the previous studies on Brazil.

5. Conclusions

The PhD student showed good knowledge of the examined topic overall. Combining the available knowledge with own empirical findings, he managed to solve an important scientific problem. The recommendations provided based on these empirical results can be valuable for Brazil's economy. The shortcomings indicated in this review do not undermine the importance for the overall work.

Valuable recommendations have been formulated for Brazil: investments in gross fixed capital formation should receive closer attention from both sectors; a profound review of government regulations in private and public sectors is necessary; improvement of resources management practices, effective policies to stimulate R&D investments.

The following provisions together have predetermined the assessment of this work:

- ✓ the solution for the scientific issue is provided by combining previous theoretical achievements with own empirical findings;
- ✓ the manner of presentation is clear and consistent with practical and valuable recommendations provided for Brazil's economy;
- ✓ solid theoretical knowledge of the main productivity drivers in the selected countries is demonstrated;
- ✓ the predefined objectives were achieved following the proper research procedures;
- ✓ proper research procedures and methods allowed verifying the hypotheses and formulating logical and appropriate conclusions;

After familiarizing myself with the doctoral dissertation 'Productivity drivers: implications for Brazil's development - evidence from the selected countries', I conclude that this work constitutes an original solution to a scientific problem, as well as providing evidence of the candidate's general theoretical knowledge and understanding of a given discipline of science as well as the ability to conduct independent scientific.

Also work meets all the formal requirements as defined in the Act as of 14 March 2003 on the Degrees for scientific and academic titles in art (Dz. U. 2003, No. 65, pos. 595 with amendments).

Therefore, I recommend the reviewed dissertation for admission to the public defence.

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