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Summaries of Doctoral Theses

DETERMINANTY DOCHODÓW ROLNICZYCH W REGIONACH UNII EUROPEJSKIEJ PO 2003 ROKU (DETERMINANTS OF AGRICULTURAL INCOME IN EUROPEAN UNION REGIONS AFTER 2003)

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Substantiation for the selection of the topic

Agricultural income belongs to fundamental analytical categories in agricultural economics. Providing adequate levels of income is, in fact, a prerequisite for the development of the whole sector, as well as of related branches. In some European countries (e.g., in the Netherlands), it was possible to solve the problem of disparity between agricultural incomes compared to incomes in other sectors of the economy, however, on average in the European Union, labor compensation in agriculture accounts for 42-54% of compensation in the economy in total.

The very notion of agricultural income is, however, difficult to define. When we limit ourselves to agricultural income only, it is possible to analyze various income categories, such as: value added, gross and net farm family income, agricultural entrepreneurial income, and entrepreneur's profit. The selection of a specific category may have a significant impact on the study results obtained, so it should be well-grounded. The selection of an adequate source of statistical data is also of key

importance. The field of observation of the FADN (Farm Accountancy Data Network) database, gathering accounting data for representative farms all over the EU, covers only farms which are "economically viable" and generate, in total, more than 90% of the production value in the EU (in Poland, this percentage is about 50% of all farms). It can be assumed that maximizing farm income is the fundamental objective of the functioning of these entities, hence, they were the subject of studies as part of this doctoral thesis.

Based on reviews of both domestic and foreign literature, it is possible to define three basic research perspectives with regard to agricultural income. These perspectives are as follows: macroeconomic (the impact of macroeconomic variables on the evolution of agricultural income is analyzed), "technical" (improvement in the productivity of production factors resulting from technical progress or changes in resource relations as a direct determinant of agricultural income), and endogenous (microeconomic) (measures taken at farm level – farm practice – and their impact on income obtained). The thesis matched the third identified current of studies, which seems to be the least discussed in the literature, especially in domestic literature.

Regardless of the research perspective adopted, it must be remembered that despite the existence of the Common Agricultural Policy (CAP), farms in European Union regions function in highly diversified environments, as shown by differences in the natural and climatic conditions and economic relations (e.g., agrarian structure, capital/labor ratio) including the varied productivity of production factors (labor, land, and capital). This may result in different paths of growth in agricultural income in individual groups of regions.

The heterogeneity of the conditions for the functioning of agriculture in the European Union has an impact on the evolution of the dynamics of structural changes, which results in different agricultural development types and models in individual regions. In this context, a research problem appears, which is summarized in a question – what areas of activity of farms are of key importance for increasing their income in the specific productivity and resource conditions? Of a potentially different nature are, in fact, paths of growth of income in areas dominated by small farms, poorly equipped with the capital factor, and other paths in the case of the dominance of large and capital-intensive farms.

As opposed to many other studies, this thesis focused mainly on income-oriented measures which are undertaken at the level of individual farms. The natural and macroeconomic environments are a background for the analysis, while what was analyzed in the empirical layer were mostly the activities of a farmer whose objective is to maximize income.

Aims and hypotheses of the thesis

The main aim of the thesis was to identify determinants of farm income in EU regions at the level of FADN representative farms, while taking into account differences in resource relations and the productivity of production factors (i.e., labor, land, and capital). To achieve the main aim, it was necessary to attain the five specific objectives which were directly related to the individual stages of studies:

- operationalization of the "agricultural income" term as well as identification and classification of potential determinants of income based on literature studies;
- inclusion of the problem of resource relations and the productivity of production factors in the theory of agricultural development models;
- designation of clusters of FADN European Union regions with similar resource relations and the productivity of production factors in agriculture;
- evaluation of the level and dynamics of basic agricultural income categories and evaluation of the financial situation of farms in FADN regions;
- evaluation of correlations between the level of farm income and its determinants – identification of differences in the direction and strength of impact of identified determinants on the level of income in individual groups of regions.

The main hypothesis was formulated, according to which resource relations and the productivity of production factors in agriculture in EU regions differentiate the impact of individual determinants on the level of farm income. To make it more precise, the following four partial hypotheses were also formulated:

- H1: farms in regions with high labor productivity are characterized by higher labor profitability but, at the same time, by a less favorable financial situation;
- H2: improvement in financial indices (regarding debt and efficiency of operation) and limitation of the share of external costs have a stronger impact on the growth in income in regions with relatively low capital productivity than in other groups of regions;
- H3: intensification of production and growing investments in relation to the consumption of assets have a stronger impact on growth in farm income in regions with the lowest land productivity, on average, than in other groups of regions;
- H4: increase in the level of production specialization and the growing use of subsidies have a stronger impact on the growth in income in regions with relatively low labor productivity than in other groups of regions.

The structure of the thesis and research methods

The thesis is composed of an introduction, five chapters, summary, and annex. The first and second chapters include literature studies, which attempt to determine differences in research perspectives concerning determinants of agricultural income (chapter one) and in an approach to the issue of agricultural development types and models (chapter two). Particular emphasis was put here on studies contained in reputable bibliographic databases such as Scopus.

Chapter three, in its first part, presents the description of FADN regions in terms of relations between production factors and their partial and total productivity. Also, the total factor productivity (TFP) indices were calculated, using both the frontier methods (Malmquist indices) and non-frontier methods (Tokarski index). The definition of the dominant types of farming in FADN regions (the second part of the chapter) was possible thanks to the use of Ward's cluster analysis in combination with the procedure of testing the significance of differences in mean values of variables used. Finally, the dynamics of productivity indices in individual clusters of regions were calculated.

Chapter four evaluates the financial and income situation of farms in static and dynamic terms (using the TOPSIS-CRITIC method) and points to its relations with the productivity of production factors. These relations were evaluated using parametric and non-parametric correlation coefficients. In order to enhance the analysis, the paper examined the financial efficiency of generating farm income using the non-parametric DEA method and the sources of farm profitability using the logarithm method.

Studies on the relations between the level of farm income and its determinants are undertaken in chapter five. The most important research method, from the viewpoint of achieving the main objective and verifying the partial hypotheses, were panel regression models. What was used, were fixed effects models and the within-between model, being an extension of the random effects model. These models allow for capturing the effect of impact of an independent variable on a dependent variable within, and between analyzed entities in a given period. The dependent variable was a logarithm of labor compensation (LC). This category illustrates total income divided among persons employed on a farm (farmer, their family and potential external workers) and is used in reports, *inter alia*, by the European Commission (DG AGRI). The logarithms of indices, used in the studies as independent variables, represent selected areas of the theoretical model of maximising farm income.

The subjective scope of the dissertation included representative farms in FADN regions of the European Union. The objective scope, in turn, included farm incomes and their determinants in representative FADN farms. The time perspective was determined by a period from the EU enlargement in 2004 to 2015. The spatial scope, in turn, included 115 FADN regions in the EU which belonged to the EU over the analysed period. For technical reasons, in the case of certain empirical analyses, this scope had to be slightly limited, as noted in individual fragments of the thesis. The main data sources were the FADN databases and the Economic Accounts for Agriculture, being a part of Eurostat.

The most important study results and conclusions

Owing to the cluster analysis, four clusters of FADN regions, differing in terms of the dominant type of farming, have been determined. Certain northern regions of Italy and Benelux formed a cluster where the remarkably intensive type of farming was dominant (A). In a large part of Western Europe (in particular, the British Isles, Scandinavia, northern Germany and France), farming is of an industrial nature (B) – dominant are large, capitalized farms with very high labor productivity values, but with low capital productivity. In central and southern Italy, Greece, Portugal and coastal regions of Spain, the characteristic Mediterranean type was dominant (C), whose distinctive feature are small and medium-sized farms, with low labor productivity, but with high capital and land productivity values. On the other hand, in Central and Eastern Europe, but also in southern France or central Spain, family and/or extensive farming (D) is predominant.

The results of estimates of econometric models allowed the author to conclude that intensification, understood as the growth in expenses for fertilizers and plant

protection products, did not translate into a growth in income in regions dominated by industrial farming. However, this does not mean that expenses in other areas should not be increased – here, we are talking mainly about other expenses directly related to specific production types. Just like in other groups of regions, a factor serving to increase income was a higher level of specialization. On the other hand, a problem for farms in these regions may be the dependence on subsidies. The growth in subsidies translated most, against a background of other clusters, into growth in income in the light of within-between models, but a high level of subsidies in relation to production (subsidization rate) had a strong negative impact on the level of income. Farm managers in this group of regions should pay close attention to their financial structure and asset rotation. The estimated models do not allow to conclude unambiguously on the role of long-term debt, but an overall high level of debt, understood as an assets-to-equity ratio, was a strongly negative determinant of income, while growth in income was stimulated by a higher share of current assets. Therefore, farm managers should put an emphasis on limiting the level of fixed assets which may encumber a farm, reduce its flexibility, and make it difficult to make quick and right decisions. The rational use of assets, understood through the prism of sales-to-assets (or sales-to-equity) ratio, had a positive impact on the level of income in all clusters, but in the cluster in question, the marginal effect was the strongest. Referring to one of auxiliary questions, asked in the introduction to the thesis, it can be said that the growth in the use of subsidies, as well as management of the assets and cost structure, are not, admittedly, the only areas having an impact on the income of these farms, but they are elements of particular importance for farms functioning in regions dominated by industrial farming.

In regions where the type of farming known as "Mediterranean" was implemented, the financial management of a farm was less important, although a booster of income could be a growing current assets-to-total assets ratio. These farms should use external production factors to a larger extent and increase direct expenses (exclusive of plant protection products and fertilizers). Farms in the Mediterranean Basin should specialize in selected labor-intensive types of production related to creating the high level of value added. Similarly to the cluster dominated by industrial farming, also in the case of the Mediterranean type, a significant determinant of income was efficient asset rotation.

In the cluster of regions dominated by extensive and/or family farming, financial management may play a relatively important role, manifesting itself mostly through the prism of debt control. On the one hand, what has been identified as a booster of farm income in this cluster was a growing level of replacement, which entails investments. On the other hand, the negative impact of both the level of debt and the share of long-term debt was observed. Therefore, an optimal farm development strategy would be based mainly on own funds, although this may be difficult to implement in practice. Referring to another question posed in the introduction, it can be stated that the path of intensification, as a farm income growth strategy, was applicable in this cluster. Important boosters of income were the growing indirect consumption per hectare, increased use of external production factors and,

in the light of the within-between models, also inputs of fertilizers and plant protection products. Also, positive effects on the growth in income were brought by specialization and the high share of payments to public goods in subsidies in total. The results of modeling for this cluster, on the one hand, attest to a need to recapitalize and modernize farms and, but on the other hand, point to the role of searching for a more precise and dominant type of farming. An indication here may be advantages with regard to sustainable agriculture.

Based on empirical analyses, it was concluded that the highest labor productivity was observed in the cluster of regions dominated by industrial farming. In this cluster, high values of labor profitability were also noticed (in the case of value added per FTE, these values were the highest) and, at the same time, the financial situation in the light of the value of the synthetic indicator was relatively the least positive in both analyzed sub-periods (2005-2007 and 2013-2015). Therefore, the first partial hypothesis has been confirmed.

The lowest average capital productivity values were observed in the cluster dominated by industrial farming. Also, in this cluster, the negative effect of debt understood through the prism of an assets-to-equity ratio and the positive effect of efficient asset rotation were particularly strong against a backdrop of other clusters. However, no significant impact of limiting the share of costs of external production factors was noticed, hence the second partial hypothesis may be confirmed only in part.

The lowest average productivity of the land factor has been observed in the cluster with the dominance of extensive and/or family farming. What was identified in this cluster, was the positive impact of the level of replacement (investments in relation to depreciation) and of the growth in expenses, including traditionally understood intensification, i.e. fertilizers and plant protection products. Nevertheless, the stronger impact of these variables was observed in the cluster dominated by industrial farming where, on average, land productivity values were higher. Thus, the third partial hypothesis has been verified negatively.

The lowest average labor productivity in the analyzed period was observed in the cluster of the Mediterranean type. Specialization (in two of three specifications) and subsidies under the agricultural policy were significant determinants of farm income in these regions, however, the strength of impact of these factors in other clusters was higher, thus the fourth hypothesis has been verified negatively. However, identified differences in the significance and strength of impact of analyzed determinants on the level of farm income in individual clusters of FADN regions allow to conclude that the main hypothesis has been verified positively, despite the fact that some of the identified correlations were different than first assumed.

Based on the analyses carried out, it was also possible to formulate several recommendations for the agricultural policy:

- the agricultural policy at European Union level should remain common in the sense of financing and general objectives. At the same time, it should be as flexible as possible, so that farms in individual regions could implement their competitive advantages in individual types of farming;

- almost in all clusters, a significant determinant of income was the level of specialization. In the existing CAP mechanisms, in particular in schemes under the second pillar, for environmental reasons it was rather the diversification of production which was supported. It seems that it would be necessary to reconsider mechanisms supporting specialization for small and medium-sized farms. For these entities, focusing on a selected area of activity can be an opportunity to improve their income situation;
- in some regions, problems related to the negative impact of debt have been observed and, also, it has been concluded that investments have a positive impact on farm income. Thus, the agricultural policy should be geared not only towards support for small farms, which provide public goods, but should also facilitate access to funds for farms which would like to increase their activities;
- the current agricultural policy treats small farms in a preferential manner. Small farms, unless they are closely specialized, do not, however, provide sufficient income for a farm family. While not negating the policy of supporting small farms, it seems that the CAP's objective should be to stimulate the development of medium-sized farms. The appropriate design of a payment system (e.g. even stronger degressivity for the largest entities in combination with bonuses for medium-sized or small farms that want to increase their scale of production) and of an agricultural land trading system could support the development of the desirable structure of farms.

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