

TAXES IMPOSED ON FARMS IN THE EUROPEAN UNION – A SYNTHETIC APPROACH

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Abstract

The main purpose of this paper is to assess the level of taxes imposed on farms in European Union countries. Due to multidimensional nature of the issue under consideration, the level of EU farm taxation was assessed with taxonomic methods (structural classification methods). The empirical study was based on 2013–2015 FADN data. To illustrate the differences between taxes imposed on farms in EU countries, a multidimensional analysis based on the Ward's method was performed. To interpret the results of classification results, characteristic features were identified in typological classes. For that purpose, the pseudo-test of differences of means was calculated. Based on this study, the level of farm taxation was found to differ significantly across European Union countries. Countries with high farm taxation levels accounted for around one third of the examined population. The highest taxation burden was observed in Dutch, Italian and Danish farms, whereas the lowest taxes were imposed on British, Lithuanian, Slovenian, Swedish and Irish farms. However, some patterns were revealed by the empirical study. Farms dealing with higher taxation levels were economically stronger and usually had a small area of agricultural land. They followed an intensive production strategy and demonstrated higher management efficiency, as reflected by several aspects, including the relatively small share of EU operating subsidies in family farming incomes.

Keywords: agricultural tax, European Union, farm, taxation, taxes

JEL classification: H21, Q14, Q18

1 Introduction

As a basic tool of the government's financial system, taxes contribute to fiscal and socio-economic objectives. In many European Union (EU) countries, the commitment to non-fiscal objectives is of essential importance for the development of preferential taxation systems targeted at selected economic sectors. This includes agriculture which is particularly sensitive to changes in economic conditions (Rajaraman, 2004; Soliwoda & Pawłowska-Tyszko, 2014). In European Union countries, agricultural taxation is of major importance for the competitiveness of economic operators active in the agriculture sector. However, EU countries differ in terms of agricultural taxation policies in place. Literature in this field presents different views on what should be the basis for taxation in agriculture (Anderson & other, 2002; Veen & other, 2007). Several options are adopted, thanks to which the fiscal burden of a farm is determined. These include, first of all, methods for determining the tax on the basis of the value of the land, the area of the land, the methods based on the concept of income or on the amount of the rent on lease. The solutions adopted for the agricultural taxation model may support the farming activities, be neutral or hamper the development of specific economic sectors (Wasilewski & Ganc, 2012; Pawłowska-Tyszko, 2013).

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2 Data and methods

The empirical study was based on average figures from 2013-2015 FADN data (Farm Accountancy Data Network, 2017). To illustrate the differences between taxes imposed on farms in EU countries, a multidimensional analysis based on the Ward's method was performed. The taxonomic analysis enables the assessment of differences between objects (e.g. countries) described with a set of diagnostic features. As a result, the objects are clustered by similarity of development levels, and are grouped by properties into homogeneous classes. Taxes imposed on farms in EU countries were analyzed in the following steps:

Step 1. Selecting the sub-features illustrating the levels of taxes imposed on farms in EU countries, based on substantive and statistical grounds. The following indicators were taken into consideration to assess the level of taxes imposed on farms: taxes per hectare of agricultural land utilized by the farm (EUR/ha) (x_i);

ratio of taxes to total labor inputs (EUR/AWU⁴) (x_2); ratio of taxes to total assets (EUR/EUR 1,000 of total assets) (x_3); and share of taxes in the family farming income (%) (x_4). The indicators listed above were based on FADN SE390, defined as “Farm taxes and other dues (not including VAT and the personal taxes of the holder) and taxes and other charges on land and buildings. Subsidies on taxes are deducted.” (Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej – Państwowy Instytut Badawczy [IERiGŻ-PIB], 2016, p. 28). Considering the statistical grounds, i.e. the high variability of simple features and their poor mutual correlation, all of them were used in the classification process.

Step 2. Normalizing the values of diagnostic features with the classic standardization procedure (Wysocki, 2010):

$$z_{ik} = \frac{x_{ik} - \bar{x}_k}{s_k} \quad (1)$$

with: x_{ik} – value of feature k in object (country) i ($i = 1, \dots, N$, $k = 1, \dots, K$);

\bar{x}_k – arithmetic mean of feature k ;

s_k – standard deviation of feature k .

Step 3. Classifying the EU countries using the Ward’s method. The hierachic cluster analysis based on the Ward’s method means grouping the units closest to each other until a homogenous cluster is created. The distance between units is estimated with the analysis of variance so as to minimize the sum of squared deviations inside the clusters (Everitt et al. 2001). To determine the number of classes, the agglomeration graph was analyzed.

Step 4. Creating and identifying the types of level of taxes imposed on farms in the EU. The types were identified by specifying the basic descriptive statistics (intra-class mean values). To interpret the results of classification results, characteristic features (both active and passive) were identified in typological classes. For that purpose, the *pseudo-test of differences of means* was calculated as follows (Lebart et al. 1995, 1998; Wysocki, 2010):

$$t_{ck(d)} = \frac{\bar{x}_{ck} - \bar{x}_k}{s_{ck}} \quad (2)$$

The test value measures the distance between the class mean $RPR^{-0.12}$ and the general mean $NCE = 2.96 * NGMWE^{0.74} *$ of feature k ; the distance unit is the standard error of the class mean;

$$s_{ck}^2 = \frac{N - N_c}{N - 1} \cdot \frac{s_k^2}{N_c}$$

⁴ The Annual Work Unit is equivalent to 2120 working hours per year [IERiGŻ-PIB, 2016, p. 4, 7].

is the variance of means in the case of sampling of N_c objects of class c ($c = 1, \dots, C$) without replacement;

The test value measures the distance between the class mean (\bar{x}_{ck}) and the general mean (\bar{x}_k) of feature k ; the distance unit is the standard error of the class mean; s_k^2 – is the empirical variance of feature k in the population; $\frac{N - N_c}{N - 1}$ is the finite population N correction factor.

The distribution of class means is approximated with the normal distribution (at a 0.95 confidence level). Therefore, the mean value of a specific feature in the class is assumed not to differ from the general mean within the limits of the standard error of the mean ranging from -1.96 to +1.96. Such a feature is not considered to be a characteristic feature. The greater is the absolute value of the test for a feature, the more characteristic is that feature. The values of the *pseudo-test of differences of means* were the basis for identifying the characteristic features in typological classes with the use of the following scale (Wysocki, 2010):

1. $t_{ck(d)} \in (-\infty; -3 > v < 3; +\infty)$ – very high intensity of feature k in class c ; the feature is highly characteristic (in positive or negative terms);
2. $t_{ck(d)} \in (-3; -2 > v < 2; 3)$ high intensity of feature k in class c ; the feature is medium characteristic (in positive or negative terms);
3. $t_{ck(d)} \in (-2; 2)$ average intensity of feature k in class c ; the feature does not stand out and is not characteristic.

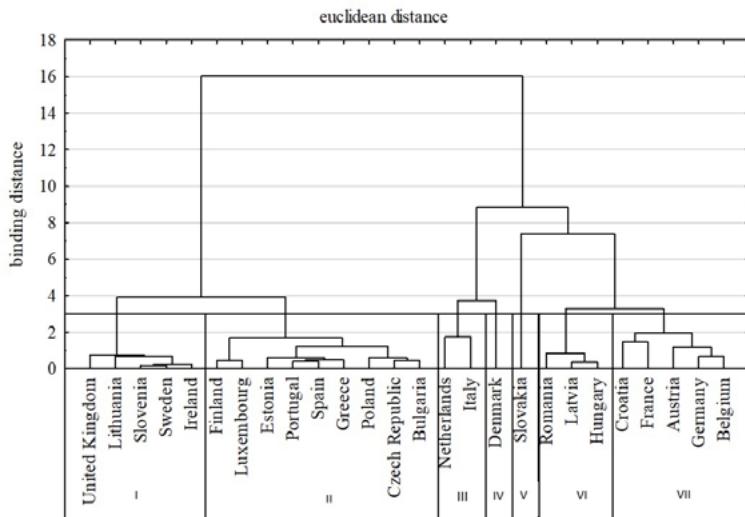
3 Results and Discussion

The typological study based on the Ward's method enabled the identification of seven typological classes of farms in EU countries, differing by taxation levels (Figure 1). To identify the separated typological classes, the mean values of features involved in the typological classification (active features), which reflect the level of farm taxation, were calculated. The explanation of the dispersion of farm taxation levels in EU countries was supported with the analysis of selected passive features describing the following, without limitation: use and efficiency of productive inputs; production intensity; and level of EU payments disbursed to farms (Table 1). The characteristic (active and passive) features in the separated typological classes were identified by analyzing the value of the *pseudo-test of means* (Table 2).

As shown by the study, the highest levels of farm taxation were reported in EU countries which formed classes 3, 4 and 7, while the lowest levels were experienced in countries which formed classes 1, 2 and 6 (Figure 1, Table 1). Class 3 was composed of Dutch and Italian farms with the highest level of taxes per hectare of

agricultural land and per agricultural AWU. In the period under consideration, a taxation of nearly EUR 118 per hectare of agricultural land (compared to the EU average of barely EUR 25 per ha) and nearly EUR 1,645 per AWU (compared to the EU average of EUR 604.4 per AWU) was imposed on that group of farms. The class was composed of small farms with high productivity rates. This is reflected by the highest labor profitability ratio (over EUR 22,500 per AWU compared to the EU average of EUR 1,300 per AWU) and the lowest share of subsidies in the family farming income (barely 28% compared to the EU average of 131.5%) of all classes identified.

**Figure 1 Classification of European Union countries by farm taxation levels
(N = 26*, Euclidean distance, Ward's method)**



*Two countries, Malta and Cyprus, are not covered by this study due to marginal importance of local agriculture.

Source: Own study based on FADN data (accessed on December 11, 2017).

As regards the levels of active features illustrating the farm taxation levels, cluster 4, a singleton representing the Danish farms, was similar to class 3. These farms recorded the highest level of taxes per AWU (slightly above EUR 604, nearly four and a half times higher than the EU average) and a high share of taxes in the family farming income (14.6%, compared to the EU average of 5.6%). Note that these were economically strong farms with a distinctively high use of current assets per hectare of agricultural land, and the best assets-to-labor ratio of all clusters created (Table 1). Note also that in some EU countries, including

Denmark, farmers are covered by the general taxation system and may only use the tax benefits and advantages available to all taxpayers. These systems do not provide for solutions that address the specific nature of agricultural production (Pawlowska-Tyszko, 2013).

A relatively high farm taxation level was reported in group 7 composed of Croatian, French, Austrian, German and Belgian farms. In this case, the taxation level was slightly above the EU average. These farms were nearly two times larger as those found in cluster 3, as discussed above. Also, they demonstrated a minor share of EU operating subsidies in the family farming income (nearly 75% compared to the EU average in excess of 131%).

In turn, Romanian, Latvian and Hungarian farms included in class 6 reported a relatively low taxation level, except for taxes per EUR 1,000 of assets which were over EUR 4 (compared to the average level of EUR 2.5 for all EU farms). These were the economically weakest farms with poor assets-to-labor ratios. Their average economic size was EUR 34.8, compared to the EU average of nearly EUR 134. Also, they recorded a relatively low labor profitability and the lowest production intensity (measured with intermediate consumption per hectare of agricultural land) of all clusters created (Table 1, 2).

Table 1 Classification of European Union countries by farm taxation levels

Specification	Typological class							Total
	1	2	3	4	5	6	7	
Number of countries	5	9	2	1	1	3	5	26
Percentage of countries	19.2	34.6	7.7	3.8	3.8	11.5	19.2	100
Active features								
Taxes per hectare of agricultural land (EUR/ha)	4.0	11.6	117.9	48.1	12.5	13.5	36.5	24.7
Taxes to total labor inputs (EUR/AWU)	175.5	316.2	1643.8	2694.0	517.9	282.2	929.4	604.4
Taxes per EUR 1,000 of total assets (EUR)	0.4	1.9	3.3	1.9	6.2	4.1	3.6	2.5

Share of taxes in family farming incomes (%)	1.3	3.0	7.3	14.6	37.7	4.0	6.6	5.6
Passive features								
Average area of agricultural land (ha)	75.5	67.4	28.4	97.6	532.0	41.2	54.1	79.4
Average economic size of farms (EUR)	92.4	88.2	256.6	352.1	460.9	34.8	158.5	133.8
Labor profitability (EUR thousand/AWU)	12.3	11.5	22.6	18.4	1.4	7.2	16.1	12.8
Share of total taxes in operating subsidies (%)	1.2	3.0	26.1	13.2	4.4	6.3	8.9	6.4
Fixed assets per AWU (EUR thousand/AWU) (technical equipment of labor)	510.1	203.5	612.4	1438.1	84.0	72.1	269.2	334.3
Intermediate consumption per hectare of agricultural land (EUR/ha)	1170.1	1041.1	5011.9	2936.6	868.5	760.9	1813.0	1553.7
Average total labor resources (AWU)	1.6	2.1	2.0	1.7	12.4	1.6	1.9	2.3
Share of operating subsidies in family farming incomes (%)	126.6	125.5	27.9	111.1	865.1	83.7	74.8	131.5

Source: Own study based on FADN data (accessed on December 11, 2017).

Slovakian farms, which formed class 5, demonstrated a taxation level similar to those included in class 6. However, the differentiating factor was the share of taxes in the family farming income, reaching nearly 38%. Nearly seven times higher than the Union average of 5.6%, it was the highest share of all typological classes. A characteristic feature of Slovakian farms is their large average area in excess of 530 ha, and their very large economic size of EUR 460.6 (more than three times higher than the EU average). At the same time, due to high intermediate consumption, costs of exogenous factors and depreciation, the incomes of Slovakian farms are often negative or relatively small (Table 1).

The largest cluster was class 2, composed of Finnish, Luxembourgian, Estonian, Portuguese, Spanish, Greek, Polish, Czech and Bulgarian farms (Figure 1). The differentiator of this typological class was a low level of farm taxation. Another characteristic feature of this typological class was the low amount of taxes per hectare of agricultural land (EUR 11.6, compared to the EU average of EUR 26), and the low level of taxation per AWU (slightly above EUR 316, compared to the EU average of EUR 604, approximately). Also, this group of farms demonstrated a small economic size of barely EUR 90 (compared to the EU average of nearly EUR 134). Other passive characteristics (i.e. share of taxes in subsidies, technical equipment of labor, intermediate consumption per hectare of agricultural land) were also at a low level, well below the Union average (Table 1, 2).

Table 2 Values of the *pseudo-test of differences of means^{a)}* for the features in typological classes of European Union countries grouped by farm taxation level

Specification	Typological class						
	1	2	3	4	5	6	7
Active features							
Taxes per hectare of agricultural land (EUR/ha)	-28.4	-8.7	15.0	xb)	x	-4.0	3.7
Taxes to total labor inputs (EUR/AWU)	-6.3	-4.9	128.3	x	x	-4.2	2.0
Taxes per EUR 1,000 of total assets (EUR)	-14.0	-3.6	0.6	x	x	5.5	2.9
Share of taxes in family farming incomes (%)	-18.0	-7.6	505.4	x	x	-3.3	1.1
Passive features							
Average area of agricultural land (ha)	-0.2	-0.7	-6.5	x	x	-2.4	-1.9

Specification	Typological class						
	1	2	3	4	5	6	7
Average economic size of farms (EUR)	-1.2	-2.1	0.7	×	×	-7.7	0.5
Labor profitability (EUR thousand/AWU)	-0.1	-0.5	97.2	×	×	-2.5	0.9
Share of total taxes in operating subsidies (%)	-16.3	-7.2	73.9	×	×	-0.1	2.5
Fixed assets per AWU (EUR thousand/AWU) (technical equipment of labor)	1.1	-2.4	1.1	×	×	-11.6	-1.3
Intermediate consumption per hectare of agricultural land (EUR/ha)	-2.0	-4.7	1.0	×	×	-6.7	0.7
Average total labor resources (AWU)	-4.4	-0.5	-0.4	×	×	-2.8	-3.2
Share of operating subsidies in family farming incomes (%)	-0.2	-0.2	-349.2	×	×	-1.7	-7.5

- a) the shades of grey represent high absolute values of the *pseudo-test of differences of means*: the characteristic features (dark and light grey indicate, respectively, a high and low intensity of feature k in class c);
- b) in the case of typological classes composed of a single object, the value of that test cannot be calculated.

Source: Own study based on FADN data (accessed on December 11, 2017).

The last of the clusters created (1) was composed of British, Lithuanian, Slovenian, Swedish and Irish farms with the lowest taxation levels of all classes under consideration. This is especially true for taxes per hectare of agricultural land and per EUR 1,000 of assets which were slightly over 15% above the Union average levels of around EUR 25 and EUR 2.5, respectively. The characteristic features of this group of farms were as follows: low share of taxes in EU operating subsidies (barely 1.2%, compared to the EU average of 6.4%); low levels of intermediate consumption per hectare of agricultural land; and poor labor resources (Table 1, 2).

4 Conclusion

Based on this study, the level of farm taxation was found to differ significantly across European Union countries. The use of the Ward's method enabled the identification of seven typological classes. Countries with high farm taxation levels accounted for around one third of the examined population. The highest taxation burden was observed in Dutch, Italian and Danish farms, whereas the lowest taxes were imposed on British, Lithuanian, Slovenian, Swedish and Irish farms.

Taxes paid by European Union farms are individual and depend on the solutions adopted in the country concerned. However, some patterns were revealed by the empirical study. Farms dealing with higher taxation levels were economically stronger and usually had a small area of agricultural land. They followed an intensive production strategy and demonstrated higher management efficiency, as reflected by several aspects, including the relatively small share of EU operating subsidies in family farming incomes. In turn, opposite relationships were discovered in farms subject to lower taxation levels. The interpretation of these results may be the reason for further research on this matter.

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