https://doi.org/10.17221/474/2020-AGRICECON

Income situation of agricultural households of EU countries

Irena Antošová, Naďa Hazuchová, Jana Stávková*

Department of Marketing and Trade, Faculty of Business and Economics, Mendel University in Brno, Brno, Czech Republic

**Corresponding author: irena.antosova@mendelu.cz*

Citation: Antošová I., Hazuchová N., Stávková J. (2021): Income situation of agricultural households of EU countries. Agric. Econ. – Czech, 67: 121–128.

Abstract: One of objectives of the Common Agricultural Policy is to ensure an appropriate living standard for agricultural households. The paper uses EU-Statistics on Income and Living Conditions (EU-SILC) data to assess the income situation and living conditions of agricultural households. The agricultural household income does not reach the average household income in any of the EU countries. Multidimensional cluster analysis is applied to classify EU countries according to the income situation of agricultural households. The cluster analysis revealed five segments and the fact that living conditions at a satisfactory level can be achieved irrespective of the economic status of the agricultural household, although it depends on an appropriate setting of agricultural policy. The index of living conditions is constructed and used for the comparison. Based on the analysis results, the variables included in the assessment of the living standard of agricultural households should be taken into account when fulfilling the objectives of the Common Agricultural Policy, especially the part that relates to improving the living conditions of agricultural households. The current EU-SILC database is appropriate for the evaluation of the household income situation. However, it does not reflect the specifics of agricultural households, so additional measurement is needed.

Keywords: agriculture; economic status; EU-Statistics on Income and Living Conditions; job sector; living conditions; poverty

Does working in the agriculture sector lead to a life of poverty, or is it an attractive sector? Finding the answer is the centre of interest of this paper. Evaluation of the income situation of the population is one of the socio-economic topics. Insufficient income creates a risk of the growth of poverty (Kujala et al. 2019).

Different economic and social systems in EU countries are decisive for achieving a certain income level in the country. The population's income situation is also influenced by the frequency of economic crises (Whelan and Maître 2010). The standard of living is often associated with the inhabitants' income situation and has a social and cultural dimension (Nolan and Whelan 2010). Household income is not the only factor for population satisfaction (Kabát and Stávková 2012).

Income inequality occurs in all healthy economies, but it can also be caused by political factors (Moller et al. 2009). Iyigun and Owen (2004) add that higher levels of income inequality appear in low-income countries. Yang et al. (2012) explain that citizens have equal opportunities and access to education or health care in areas with less income inequality. Households living in poverty cannot achieve access to required services (Halleröd and Larsson 2008). Andersen and Curtis (2012) summarise that income inequality is reflected in class identification's polarising effect in a given society. Frick and Krell (2010) report the first monitoring

Supported by the Grant Agency Research Infrastructure for Young Scientists (Grant No. CZ.02.1.01/0.0/0.0/16_017/0002334).

https://doi.org/10.17221/474/2020-AGRICECON

option of income inequality in the European Community Household Panel project in 1994. The creation of EU-Statistics on Income and Living Conditions (EU-SILC) survey followed in 2003 (Atkinson and Marlier 2010).

A sector in which the household is active is one of the factors determining the income level. The subject of our interest is the search for income disparities in agriculture and other sectors and causes of differences. Agriculture is very specific, and its products serve to meet basic human needs. Agriculture cannot be assessed solely by its share of national income. The monitoring of the income situation in agricultural households carries several pitfalls resulting from the specificity of agriculture. Davidova et al. (2012) indicate that subsidies in agriculture are significant for household incomes. Merely determining the percentage share of agriculture in GDP is not difficult, but is insufficient for determining the impact on the income of agriculture. EU-SILC provide information on the income situation of households, including household identification and sectorial affiliation. EU-SILC respects the structure of the International Standard Classification of Occupations (ISCO) (Hill 2015). The unified definition of an agricultural household is missing. A uniform EU methodology would contribute to improving the identification of the monitoring of household income. The Common Agricultural Policy (CAP) objective after 2020 is focused on the living conditions of the agricultural community (European Commission 2019). This is a fundamental change in the approach to the agricultural sector as well as an impulse for the development of this paper.

This paper aims to create discussions on the income situation and living conditions of households in the agricultural sector to contribute to better awareness and allow the creation of effective measures and financial instruments for regulating social and agricultural policy. This means providing agricultural policy makers with objective data that represent the agricultural sector in economically active households across the EU states, and data on the income situation in agricultural households. These households are classified according to the economic status of those active in agriculture and the size of the agricultural enterprise/farm from which their standard of living is derived.

MATERIAL AND METHODS

The EU-SILC data (Eurostat 2020), from which the agricultural sector can be excluded, is used as the data source. The household is defined as agricultural if at least one household member is economically active in the agricultural sector. The EU-SILC provides household income data, enables household identification and describes their living conditions. This paper uses data from 2016, exceptionally from 2015 (Ireland, Luxembourg, Italy and Malta), where newer data was not available when the paper was created. In total, data from 242 216 European households has been used. The conversion coefficient that EU-SILC (Eurostat 2020) data contain was included in all the calculations made in the article. This coefficient makes it possible to generalize the conclusions taken from a sample cohort of a survey of the entire population.

Household disposable income is a default indicator. Barbone et al. (2009) explain it as gross income minus all taxes and social insurance. According to EU-SILC methodology, disposable income is a gross income less taxes and social insurance contributions and inter-households paid. It is necessary to equivalise income according to the members of a household (Figari et al. 2011). Equivalised income can be obtained by the calculation of the equivalised household size, which equals to the sum of the coefficients of the individual consumption units: the head of the household counts as 1.0; children aged 0–13 count as 0.3 and other people count as 0.5:

$$EEC = 1 + 0.5\left(n_a - 1\right) + 0.3\,n_c \tag{1}$$

where: EEC – equivalised household size; n_a – number of adults; n_c – number of children in a household.

The equivalised disposable income can then be calculated from the Equation (2):

$$EDI = DI/EEC \tag{2}$$

where: EDI – equivalised disposable income; DI – disposable income; EEC – equivalised household size (Eurostat 2019).

The determination of poverty in agricultural households is based on the poverty line. The poverty threshold is calculated as 60% of the median equivalised disposable income according to the methodology for calculating poverty set by Eurostat (2019). If household equivalised income is below the threshold, a household is considered as living at risk of poverty (Eurostat 2019).

Cluster analysis is applied to determine segments of EU countries based on income characteristics. Objects within a cluster are as similar as possible,

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and an object within a cluster is the least possibly similar to objects from other clusters (Greene 2018). The *K*-means algorithm is used. For each cluster a centroid is calculated. Greene (2018) explicates that the *K*-means algorithm is an iterative procedure that minimises function.

$$f_{KP} = \sum_{h=1}^{k}\sum_{i=1}^{n} u_{ih} \left\| x_i - \overline{x}_h \right\|^2 \quad (3)$$

where: f_{KP} – function of the distance between centroids; $u_{ih} \in \{0,1\}$ – indicate whether the i^{th} object is (value 1) or is not (value 0) assigned to the h^{th} cluster; x_i – examided object; $\overline{x}_h$ – a vector of mean values of the h^{th} cluster.

The following must be fulfilled:

$$\sum_{h=1}^{k} u_{ih} = 1 \text{ for } i = 1,2,\ldots,n \text{ and}$$
$$\sum_{i=1}^{n} u_{ih} > 0 \text{ for } h = 1,2,\ldots,k \quad (4)$$

For comparison of living conditions in agricultural households, an index of living conditions is created by authors. The index contains six subjective standard of living indicators retrieved from the EU-SILC database (Eurostat 2020). The first indicator shows how households make ends meet, the second shows how much of a burden housing costs are, the third is if the household can meet unexpected expenses, the fourth indicator is if the household can afford one week of holiday away from home, and then if there is noise and crime in the neighbourhood of the home. The respondent expresses his/her household situation on a point scale; the answers are a weighted average of the household conversion rate in a given country. The index is the sum of individual indicators. The higher the value of the resulting index, the better the living conditions of agricultural households in the country will be.

Abbreviations of the EU countries are used as follows: Austria (AT), Belgium (BE), Bulgaria (BG), Cyprus (CY), Czech Republic (CZ), Germany (DE), Denmark (DK), Estonia (EE), Greece (EL), Spain (ES), Finland (FI), France (FR), Croatia (HR), Hungary (HU), Ireland (IE), Italy (IT), Lithuania (LT), Luxembourg (LU), Latvia (LV), Malta (MT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Sweden (SE), Slovenia (SI), Slovakia (SK), United Kingdom (UK).

IBM SPSS Statistics 27 is used in this study for processing EU-SILC data (Eurostat 2020).

RESULTS AND DISCUSSION

The largest number of households in the agriculture sector in relative terms to all economically active households in a country (Figure 1) are found in Romania and Ireland, accounting for 23% of all households. In Romania, farming accounts for 4.3% of the total GDP (European Parliament 2019) and 28.3% of the Romanian workforce (Theodora 2020). This is followed by Greece and Poland. Other countries range in units of percent.

Income situation of agricultural households. The diversification of farmer and household income sources requires that not only the income from their own agriculture but also the household's disposable income should be evaluated. The EU-SILC database concerning the respondent's sector activity respects International Standard Classification of Occupations (ISCO). So it is possible to earmark from the EU-SILC database the agricultural households using this indicator. The uniqueness of the EU-SILC (Eurostat 2020) is that the data are collected according to unique methodology in all EU states. Atkinson and Marlier (2010) add that this is a great opportunity for comparison within the EU. On the other hand, Hill (2015) adds that the EU-SILC does not consider the specificities of the agricultural sector – e.g. crop, political influences. Due to differences in economic performance in countries, the income situation is expressed relatively in order to allow an objective comparison between EU countries. The income situation is expressed as the ratio of the equivalised disposable income of agricultural households to the equivalised disposable income of all economically active households in a given country. The relative shares of monthly equivalised household income in percent are given in Table 1.

The closest to all sectors' average are agricultural households in Slovakia and Slovenia (reaching approximately 90% of the average). In most EU countries, agricultural households' income is between 70–80% of the average equivalised disposable income of all households in a country. Mishra et al. (2009) came to a similar finding of below-average incomes of agricultural households. The average share of an agricultural household's income in the average household income from all sectors across the EU is 76%. The income of agricultural households does not reach the average household income in any of the 28 EU countries,

https://doi.org/10.17221/474/2020-AGRICECON

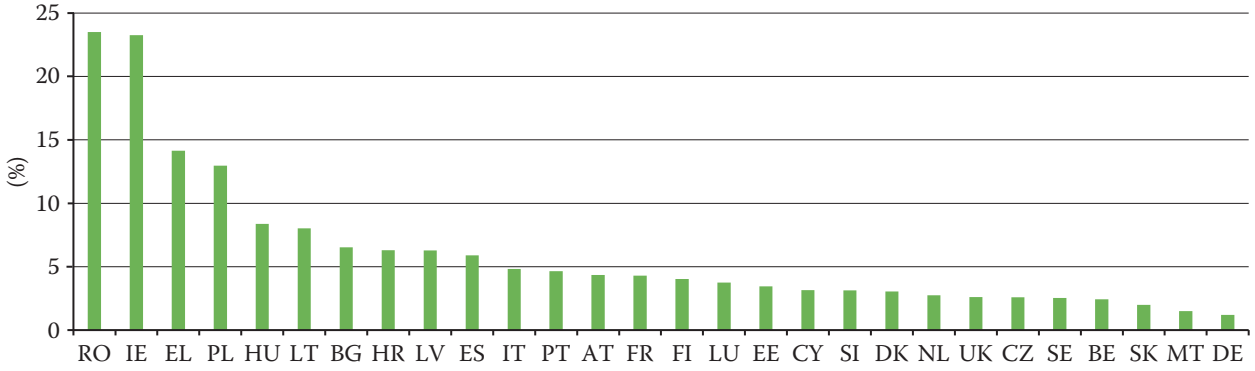

Figure 1. Share of the number of agricultural households in all economically active households in the country (%)

AT – Austria; BE – Belgium; BG – Bulgaria; CY – Cyprus; CZ – Czech Republic; DE – Germany; DK – Denmark; EE – Estonia; EL – Greece; ES – Spain; FI – Finland; FR – France; HR – Croatia; HU – Hungary; IE – Ireland; IT – Italy; LT – Lithuania; LU – Luxembourg; LV – Latvia; MT – Malta; NL – Netherlands; PL – Poland; PT – Portugal; RO – Romania; SE – Sweden; SI – Slovenia; SK – Slovakia; UK – United Kingdom

Source: Own calculations based on EU-SILC data (Eurostat 2020)

so the state's support is necessary. The results are coherent with Severini and Tantari (2015), who showed that CAP direct payments as a whole have been effective in pursuing a more equitable distribution of agricultural household income.

The income differentiation in individual countries depends on numerous factors, while the size of the farm and the production orientation are decisive. Another factor is the economic status of people active in agriculture. In some countries, the share of employees and self-employed is almost balanced (Belgium or Portugal). In Ireland, employees are predominant, while in Romania self-employed citizens are predominant (Figure 2). It can be deduced that the countries with the lowest income of agricultural households (Table 1) have the largest share of self-employed citizens in the total number of agricultural households. The highest income for countries such as Ireland or Slovakia is linked to the agricultural employee's status. Examples include Romania, where the highest number of agricultural households can be found, income is the lowest of all, and the overwhelming number of citizens are self-employed. Self-employed people can also obtain resources by other means (i.e. for welfare transfers), whereas employees in corporations are dependent on their wages.

According to Dachin (2008), Romania faces structural problems, such as the fragmentation of agricultural land and the backward organisation in units. They keep the low level of productivity and it determines the low level

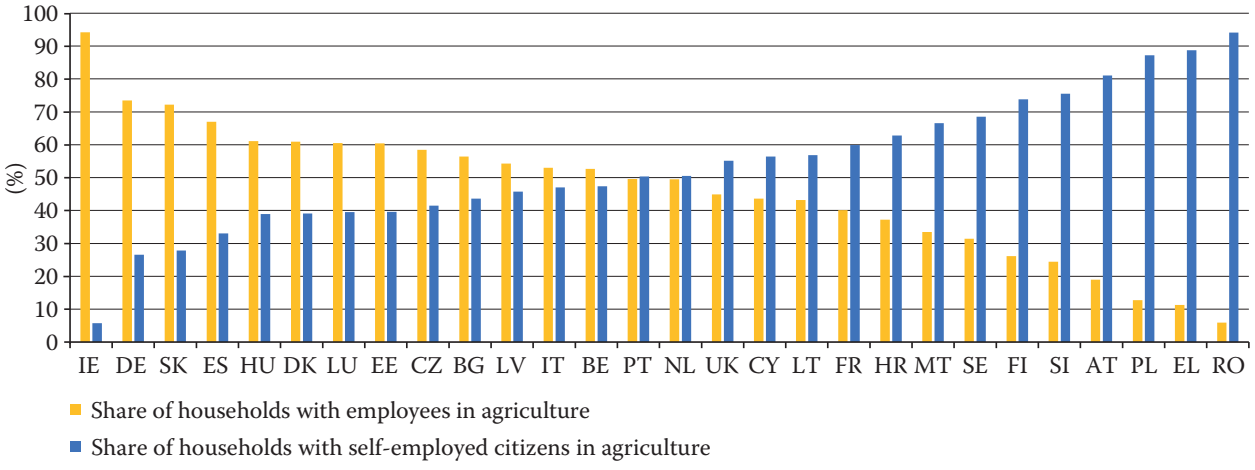

Figure 2. Share of households with employees and self-employed farmers (%)

For the explanation of abbreviations see Figure 1

Source: Own calculations based on EU-SILC data (Eurostat 2020)

https://doi.org/10.17221/474/2020-AGRICECON

Table 1. Share of an income of an agricultural household on an income of all households

Country	Share (%)	Country	Share (%)
SK	92	FI	79
SI	89	UK	76
LT	86	BE	75
CY	86	LU	72
HU	84	HR	71
IE	84	IT	70
NL	84	MT	69
DK	83	EL	69
CZ	82	ES	68
EE	82	PT	68
AT	82	LV	63
DE	81	PL	62
SE	80	BG	59
FR	79	RO	50

AT – Austria; BE – Belgium; BG – Bulgaria; CY – Cyprus; CZ – Czech Republic; DE – Germany; DK – Denmark; EE – Estonia; EL – Greece; ES – Spain; FI – Finland; FR – France; HR – Croatia; HU – Hungary; IE – Ireland; IT – Italy; LT – Lithuania; LU – Luxembourg; LV – Latvia; MT – Malta; NL – Netherlands; PL – Poland; PT – Portugal; RO – Romania; SE – Sweden; SI – Slovenia; SK – Slovakia; UK – United Kingdom

Source: Own calculations based on EU-SILC data (Eurostat 2020)

of agricultural income, which is also reflected in agricultural household income.

Lack of money and a low income situation leads to household poverty. For agricultural households, poverty focuses mainly on the lack of finance. Based on EU-SILC data results, job opportunities are not a problem; material deprivation is also not in the forefront. Poverty rates in EU countries ranked in descending order with the proportion of poor households active in agriculture are presented in Table 2. The share of poor agricultural households in all poor households for the EU is 25%. The poverty of agricultural households appears to be directly related to the poverty rate in the given country. An example of this is Romania, the country with the highest poverty rate and the largest number of poor agricultural households. Other countries such as Bulgaria or Portugal also have high poverty rates and a high proportion of agricultural households among the poor. Varga (2020) speaks about the poverty of agricultural households and suggests that the World Bank should be involved in reducing poverty in the agriculture sector.

To establish similarities in income situation between a large number of agricultural households, the cluster analysis is applied (Table 3). It takes into account the effect of various factors with an impact on the income situation of farmers. The cluster analysis gave rise to five segments of EU countries. The segment 5 contains only one country – Ireland, where agricultural households behave differently in their structure and conditions than all other countries. The cluster 3 comprises three countries (Romania, Greece and Poland), where all three countries have a low level of income, a high percentage of poor households and a high number of active households in agriculture in the form of self-employed persons. The segment 1 consists of economically developed countries characterised by a high number of agricultural households with employee status. This

Table 2. Poverty rate

Country	Poverty rate in the country (%)	Share of agricultural households within poor households (%)
RO	25.21	57.36
BG	22.89	38.96
LV	21.88	35.73
PT	18.95	34.76
PL	17.28	34.71
LU	15.30	34.09
LT	21.88	33.76
IT	19.93	33.28
ES	22.33	32.90
EL	21.24	31.99
HU	14.46	29.96
MT	16.44	29.68
HR	20.42	26.10
SE	16.22	25.45
UK	16.07	20.63
AT	14.08	19.56
FR	13.61	19.42
FI	11.66	18.06
DK	11.94	17.52
BE	15.48	16.85
DE	16.42	16.18
SI	13.89	15.80
NL	12.80	15.71
SK	12.77	13.93
EE	21.75	13.69
CY	16.13	13.66
CZ	9.68	13.66
IE	16.26	7.40

For the explanation of abbreviations see Table 1

Source: Own calculations based on EU-SILC data (Eurostat 2020)

https://doi.org/10.17221/474/2020-AGRICECON

Table 3. Country segments according to the income situation of agricultural households

Variables	Segments				
	1	2	3	4	5
The share of average equivalised income of the agricultural household in the average equivalised income of all economically active households (%)	84.07	70.96	60.37	79.34	83.58
Share of agricultural households in all economically active households (%)	3.34	5.00	16.87	3.66	23.26
Share of households with employees in agriculture in the total number of agricultural households (%)	62.29	53.49	9.97	31.92	94.23
The share of households with self-employed in agriculture in the total number of agricultural households (%)	37.71	46.51	90.03	68.08	5.77
Poverty rate in the country (%)	14.26	19.41	21.24	15.31	16.26
Share of agricultural households in poor households (%)	16.73	31.22	41.35	20.97	7.40

Segment 1 – CZ, DK, EE, HU, DE, NL, SK; segment 2 – BE, BG, IT, LV, LT, LU, PT, ES, UK; segment 3 – PL, RO, EL; segment 4 – FI, FR, HR, CY, MT, AT, SI, SE; segment 5 – IE; for the explanation of abbreviations see Table 1

Source: Own calculations based on EU-SILC data (Eurostat 2020)

is typical of large enterprises, where their employees closely approximate the average income of the majority of economically active households in the country. This includes countries such as Germany or Denmark, i.e. the former EU 15, where the enlarging of enterprises occurred gradually, although it also includes countries such as the Czech Republic, Slovakia and Hungary, where the size of enterprises was achieved by violent government decision. Segment 4 is similar to segment 1 regarding agricultural households' income, although many self-employed households characterise this segment. The segment 2 did not reach significant values of the monitored variables on the number of employees and the number of self-employed (atypical countries).

Living conditions of agricultural households. The index of living conditions (I_{LC}) was compiled to compare living conditions in EU countries. It combines items of material deprivation (crime, noise, a week of vacation away from home), how households make ends meet, housing and whether the household is able to manage unexpected expenses. The higher the index value, the better the living conditions (higher standard of living) reflected in agricultural households (Table 4).

The pleasant living conditions are shown in the Nordic countries, while Romania, Bulgaria, Croatia and Greece are on the other end of the scale (Table 4). Within the segments formed in the cluster analysis, the best living conditions are in segments 1 and 4 (Table 5).

The agricultural policy for satisfactory living conditions is appropriately set up in segment 1, where there

Table 4. Index of living conditions (I_{LC})

Country	I_{LC}	Country	I_{LC}
SE	12.28	SK	10.14
DK	12.22	LT	9.52
FI	11.90	LV	9.39
NL	11.84	PL	9.37
AT	11.61	IE	9.25
DE	11.33	ES	9.07
BE	11.23	PT	8.97
LU	11.11	HU	8.87
FR	11.01	CY	8.74
UK	10.92	IT	8.62
EE	10.78	RO	8.33
CZ	10.59	BG	8.28
MT	10.28	HR	7.91
SI	10.17	EL	7.83

I_{LC} – index of living conditions; for the explanation of country abbreviations see Table 1

Source: Own calculations based on EU-SILC data (Eurostat 2020)

https://doi.org/10.17221/474/2020-AGRICECON

Table 5. Index of living conditions (I_{LC}) for country segments

	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
I_{LC}	10.82	9.68	8.51	10.49	9.25

Source: Own calculations based on EU-SILC data (Eurostat 2020)

is a high number of agricultural households with employees. In segment 4, there is a prevalence of self-employed employees. The worst living conditions are confirmed in segment 3 where agricultural policy is improperly set. In countries with better conditions set for life in agriculture (segments 1 and 4), households do not have a problem making ends meet or most do not have a problem facing unexpected expenses. In summary, living conditions of agricultural households depends on the country and their policy arrangements. Cazzuffi et al. (2020) support the idea of state assistance in improving living conditions of agricultural households in specific countries and add that rural development policies that focus on improving the welfare of rural households need to recognise the diversity of roles that farm and non-farm activities play for households with different characteristics.

CONCLUSION

According to results based on EU-SILC data, agricultural households' share in the total number of economically active households in the country ranges from 1% (Germany, Malta) to 23% (Romania, Ireland). In most countries, the income situation of agricultural households is 80–90% of the country's average income (76% averagely in the whole EU). In countries such as Romania or Bulgaria, average agricultural income is around 50% of all sectors' average income. None of the 28 EU countries reflects the agricultural household income higher than the average of all households. There is the problem of the definition of agricultural households, or their total income. A distinction should be made between those household members employed in or doing business in agriculture. If doing business then the question is what part of household income comes from agriculture and what part from another sector.

The cluster analysis was used to create segments of countries with households with similar income situation. Results of the cluster analysis show that achieving a satisfactory income situation and the resulting living conditions in agricultural households can be achieved both in countries with a high number of employees (segment 1) and in countries with a high number of self-employed in agriculture (segment 4), if agricultural conditions and support are appropriate in the country. The living standard index also confirmed the highest standard of living in segments 1 and 4, reflecting the unsatisfactory conditions for living in segment 3. This is problematic since it represents a significant number of agricultural households (more in Table 3).

Variables included in the assessment of the standard of living of agricultural households should be taken into account when fulfilling the CAP's objectives. The variables are mainly the share of the number of agricultural households in all economically active households, the share of the agricultural household's income to the average income, and the level of households at risk of poverty. The possibility of using variables that reflect the income situation and living standard of agricultural households is currently complicated by the absence of a unified definition of an agricultural household. Given the specificity of the agriculture, the current EU-SILC methodology is insufficient. The financial support provided to agricultural households should be linked to compliance with defined obligations to ensure that the CAP's new challenges linked to environmental protection, the fight against climate change. The obligations defined in this context for farmers cannot be implemented without effective financial assistance to achieve their better living standard. Financial support is crucial for creating favourable conditions for agricultural activity and ensuring economic subjects' income stability in agriculture. Severini and Tantari (2015) view the CAP issues similarly and mention that EU policymakers should be aware of the distributional consequences of their decision in order to decide the extent of the reduction of income inequalities. The previously discussed model scenarios of the set CAP conditions in the economy in terms of assessing farmers' incomes were not a priority concern. Some discretion in setting rules may be granted at a national level due to the different natural and climatic conditions of individual EU states.

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Received: November 27, 2020
Accepted: February 11, 2021