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TERRITORIAL INEQUALITIES IN VEGETABLE PLANT PAYMENTS IN HUNGARY

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The European Union's Common Agricultural Policy (CAP) provides EU countries with significant resources. Land-based payments are a major part of farmers' income. By linking subsidies, the amount of funds received per hectare by subsidy claimants can be increased. The majority of subsidies do not impose any production obligations but simply require compliance with landscape conservation and environmental protection measures. The high level of subsidies is exacerbated by the weak euro-forint exchange rate, which has degraded some parts of agriculture into an investment. Continued concentration of land holdings has led to a significant share of subsidies going to farms which further increase land concentration and thus negative rural trends. The support for vegetable plants belongs to the category of coupled support, even though there is no obligation to produce. In the analysis of support, it is of particular importance to look at individuals and non-individuals separately, as well as the size of holdings. In my analysis, I further disaggregate the currently used categories of holdings and analyse them separately by claimant.

Keywords: agriculture, CAP, vegetable, direct payments

Introduction

Hungary has been a member of the European Union since 1. 5. 2004. Agricultural support was set out in the Common Agricultural Policy measures, under which Hungary was eligible for €12.3 billion in the 2014–2020 period. Pillar I of the Common Agricultural Policy consists of Direct Payments, Single Area Payment Scheme, Greening, Support for Young Farmers, Coupled Support and the Small Farmers' Scheme. Pillar II includes rural development support, e.g. Agri-environment and Organic Farming. The European Agricultural Guarantee Fund covers Pillar I payments, export refunds and market intervention. The European Agricultural Fund for Rural Development finances Pillar II, the rural development programmes (Kengyel, 2020). The two pillars play very important role for Hungarian rural areas, especially for farmers (see Ritter, 2017). Applicants for land-based support must submit their applications to the Hungarian State Treasury (Magyar Államkincstár – MÁK) by May 15th of the calendar year of the farming year concerned. The predetermined annual support envelopes per sector are distributed per hectare and per head of livestock among the applicants for the year in question. Under the CAP, 241 measures were paid in the 2014–2020 programming period.

In case of measures financed by the European Agricultural Guarantee Fund, the European Union makes a monthly payment, usually two months later, in EUR, of the amount of payment declared for a given month. Pursuant to Article 28(1) of Decree 22/2016 (IV.5.) of the Ministry of Agriculture, partial or final payment of the support and the decision on the application for support are made between 1st December of the year in question and 30th June of the year following the year in question. The Treasury submits its application in the form of a monthly statement of expenditure which is reimbursed by the European Union after two months. Settlement is in EUR. In the case of measures financed by the European Agricultural Fund for Rural Development, the Treasury settles with the European Union on the basis of quarterly statements of expenditure, also in EUR. Payments are positively affected by the forint-euro exchange rate (Lipcsei, 2020).

The title is governed by Decree No 9/2015 (III. 13.) of the Ministry of Agriculture and Forestry of the Republic of Hungary on the rules for the use of direct subsidies linked to production. Contrary to the name of the Regulation, there is no production obligation for this title, entitlement can be established by sowing the crops covered by the Regulation, using a minimum quantity of seeds and keeping them in the field at least until flowering. During the initial CAP period in 2016, 18,680 ha of oil radish and 16,997 ha of oil pumpkin were claimed nationally, reducing the payment plans for the vegetable crop premium. From 2017, these were removed from the eligible crops and placed in a separate aid envelope.

Examination of publication lists of the Ministry of Agriculture, Forestry, Environment and Water Management identifies the joint application of the claim with claims for agri-environmental (AKG) management and organic farming (ÖKO), as it is suitable for combining/maximising the support (Lipcsei, 2020). A support amount of more than HUF 600,000 per hectare is available for the 2021 organic support, combined with greening and area-based support and coupled vegetable planting support. The combination of the maximum amount of area-based entitlements – maximising support, makes the entitlement a popular resource between horticultural and non-productive – passive – farming claimants.

Supporting small and medium-sized local businesses is a priority for national and international rural development efforts, and is emphasised especially from local economic point of view (Ritter, 2014). Several farm size studies have been carried out and several registers (National Chamber of Agriculture, Central Statistical Office, Hungarian State Treasury, National Food Chain Safety Office, etc.) register operators which do not always take into account the local residence and the person applying for support. The aim of this study is to explore the spatial disparities in land-based subsidies for local-non-local and private-non-private subsidy claimants that have not been investigated so far. I seek to establish a link between the different titles and landholding concentration, the prevalence of passive farming – the primary purpose of farming is not production but environmental protection or a minimum level of land-based subsidy eligibility – and the frequency of land-based subsidy linkages, which includes a full analysis of the current title. Through this research the aim is to support my practical experience that the concentration of land support is linked to land concentration and more specifically to passive farming. I intend to use the results of the study for further investigations, pointing out the shortcomings of the system and the real situation of land concentration with the frequency of coupling of subsidies (agri-environmental + coupled support combined).

The recent data will provide an opportunity to conduct broader studies, to understand the resource use of land-based subsidies and the land grabbing that is observed in Slovakia at the European level (Palšová, Bandlerová and Machničová, 2021).

Materials and methods

My research sought to find out the extent to which vegetable crop payments are paid between local (resident)/non-local and private/non-private land users, and what spatial differences can be found in these data. Calculated data on land use were produced using public publication lists based on the European Commission Implementing Regulation (EU) No 908/2014. The publication list (2016–2021) was used to determine the number of locally resident and local support claimants, which also allowed for the calculation of non-local support claimants. The non-local claimants were grouped among the 66 types of the Disclosure List (Ltd, Bt, Rt, Farmers' Association, Hunting Association, Church, Sports Association, Municipality, etc.). New categories of holdings (0–20, 20–100, 100–300, 300<) have been applied to the currently used – Hungary Agricultural Census 0–0.9; 1–4.9; 5–299.9; 300–1,199.9 hectares, masking the large reduction in small and medium farms below 100 hectares, which, like in Slovakia (Rumanovska, Lazikova and Takač, 2018), form a median of the most extensive farms, distorting the national data. Averaging the six years under study eliminated the non-uniform distribution/weighting of the disclosure data. Data were filtered and analysed by SPSS software, and the calculated values were summarised and plotted at LAU1 level using QGIS open source geospatial software. The number of beneficiaries and the amount of resources used allowed for the calculation of the Hoover, Herfindahl-Hirschman index, Unweighted Gini Coefficient and Dual Index for the analysis of spatial inequality. Pearson correlation, time series analysis and cross tabulation analysis were added.

The Hoover index is one of the most commonly used indicators of spatial inequality. The difference between the spatial distribution of two quantitative parameters can be illustrated using the formula below. Population data are most often compared with socio-economic indicators in research, and I have harmonised them by transposing the number of subsidy claimants into the analysis, synchronising them with the amounts in euro of the subsidy entitlements:

$$h = \frac{\sum_{i=1}^{n} \left| x_i - f_i \right|}{2} \tag{1}$$

where: x_i and f_i are the two distribution ratios (number of farmers, support payments). The method can be used to determine the percentage of land-based support (f_i) that should be reallocated between the territorial units to make the spatial distribution equal to the number of support claimants (x_i) (Káposzta and Tóth, 2013)

The *Gini* coefficient is the most common international indicator of income inequality and measures the relative size of concentration. It compares the income of each group with the income of other groups and measures income distribution. The coefficient value ranges from 0 to 100%, with a *Gini* coefficient of 0% indicating perfect income equality and 100% indicating full concentration, that is, total income inequality:

$$Gini = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left| x_i - x_j \right|}{2 \times n^2 \times x} \tag{2}$$

The Dual index is the ratio of the mean of the values above the mean of the overall distribution to the mean of the values below the mean of the overall distribution. Formula:

$$D = \frac{x_m}{x_a} \tag{3}$$

The two subsets can be defined on the basis of external and internal information. For internal information, we take the values of the data series as a basis. The boundaries of the two subsets are either drawn at the average of the original concept or are tied to some quantile value. In the case of external information, the subgroups are delimited on the basis of territorial or non-territorial (e.g., population of settlements) parameters (see Dusek and Kotosz, 2016). We can speak of territorial equality when the value of the indicator is 1, and for a value higher than 1, the index shows the gap between territorial units with a higher average value and those with a lower average value (Tóth and Káposzta, 2014).

The Herfindahl-Hirschman Index (*HHI*) measures the concentration of income shares which is used to examine the distribution of individual income shares. The index takes its maximum value when all income is concentrated in one hand and its minimum value when it is evenly distributed in the population under study. The value set of the indicator expressed by the formula is the interval [1/*n*, 1]. The indicator shall be calculated as the sum of squares of the distributions of the phenomenon under investigation:

$$HHI = \sum \left(\frac{y_i}{\sum y_i} \right)^2 \tag{4}$$

The Herfindahl-Hirschman index can be used to express spatial concentration in two ways. On the one hand, it can be used to examine concentration or equality between several spatial units of homogeneous observation. It can be used for the analysis of additional land subsidies (AKG, ÖKO, coupled support). On the other hand, it can be used to characterise the distribution of observation units within a single area unit according to different attribute properties (Dusek and Kotosz, 2016). In spatial analysis, diversity and heterogeneity can be compared for individual area units using the indicators defined.

Pearson's correlation gives a reliable value on data series where the relationship between two variables can be described by a line. The coefficient is a value between +1 and -1. The closer the absolute value of the coefficient is to 1, the closer the relationship. The absolute value of the coefficient indicates a strong correlation in the interval 0.7–1; a medium correlation in the interval 0.3–0.7; and a weak correlation in the interval 0–0.3 (Nemes Nagy, 2005). If the sign of the correlation coefficient is positive then there is a straight line between the two variables, otherwise there is an inverse correlation. If there is no correlation ($r = 0$), the two variables are not necessarily independent but it is certain that there is no linear type of relationship between them (Győri and Egri, 2020). The method can be used to explore the relationship between farm size categories and land subsidies.

One method of time series analysis is the trend analysis or the trend function analysis. For an empirical data series, we look for the function that best fits the calculated data. The least squares method (LKN) is used for the fit. The goodness of fit is expressed by the R_2 indicator.

I used a cross-tabulation analysis to test my hypotheses about the relationship between farm size categories and types of claimant. In the analysis, I determined the observed and expected frequencies, row and column percentages, and adjusted standardized residuals for independence.

Table 1 Data of vegetable plant support

Local Farmer										
	number of farmers by category of farm size (hectare)				∑ farm	∑ support (Ft)	base index number			
	0–20	21–100	101–300	300<			0–20	21–100	101–300	300<
2021	3,758	72	6	0	3,836	1,151,955,505	104%	27%	55%	–
2020	4,094	50	3	0	4,147	1,126,061,724	114%	19%	27%	–
2019	3,567	64	2	0	3,633	1,023,497,583	99%	24%	18%	–
2018	4,079	77	2	0	4,158	1,058,333,173	113%	29%	18%	–
2017	5,721	191	4	0	5,916	1,455,770,427	159%	72%	36%	–
2016	3,601	264	11	0	3,876	1,400,988,814	100%	100%	100%	–
Local Farm										
	number of farms by category of farm size (hectare)				∑ farm	∑ support (Ft)	base index number			
	0–20	21–100	101–300	300<			0–20	21–100	101–300	300<
2021	239	67	10	1	317	481,467,498	101%	45%	29%	33%
2020	264	57	7	0	328	425,692,900	111%	39%	20%	0%
2019	241	51	7	0	299	373,211,110	102%	34%	20%	0%
2018	284	68	6	1	359	391,080,451	120%	46%	17%	33%
2017	472	179	24	1	676	891,065,733	199%	121%	69%	33%
2016	237	148	35	3	423	781,215,046	100%	100%	100%	100%

Source: Own edition based on MÁK data, 2022

I formulate my findings primarily on the basis of an analysis of these statistics. I have determined the under- and over-representation of farmers of different types and farm sizes on the basis of the value of the corrected-standardised residual mentioned earlier, in relation to a threshold of +/-1,96.

Results and discussion

For the processing of the data of the Hungarian State Treasury using the SPSS program, I developed four categories of farms. In my opinion it is necessary to divide the holding categories into small, medium, large, and giant categories in order to study the concentration of holdings. The median was the value of 100 hectares used in EU statistics which is the divisor of the small-medium and large-giant holding categories. The amount of support per year in HUF was provided by personal payment data. Other values examined were the amount in euro of the resource used and the base ratio.

In 2016, a total of 3,876 individuals applied for vegetable plant subsidies amounting to HUF 1,400,988,814 (Table 1). Most of them applied in the 0–20 ha area category. The amount of the payments was 1,151,955,505 HUF, which is due to the reduction of the subsidy yield of the title. There is no concentration of support for individuals.

The number of non-individual applicants in the 0–20 hectare category has not changed significantly. However, the number of holdings in the other categories decreased from 148 to 67 in the 21–100 hectare category, from 35 to 10 in the 101–300 hectare category and from 3 to 1 in the 300+ hectare category. The total amount of support also decreased significantly from HUF 781,215,046 to HUF 481,467,498. The higher claim rate in 2017 is explained by the claiming of oil radish and oil pumpkin which were wrongly categorised as vegetable crops.

Result of base ratio

Compared to the basic year 2016, there is a significant change in the number of applicants in the farm categories above 20 hectares. The entitlement introduced in 2015 was paid in 2016, which is why I chose 2016 as the base year. Among private individuals (Figure 1), there was an increase in claims in the farm category above 20 hectares, with no claimants above 300 hectares. The number of farmers claiming 0–20 ha showed an increase in 2017. In the 21–100 ha category, the decrease was 72%–29%–24%-19%–27%. The change in the 101–300 hectare farm category occurred with a small number of claimants, falling from 11 to 6.

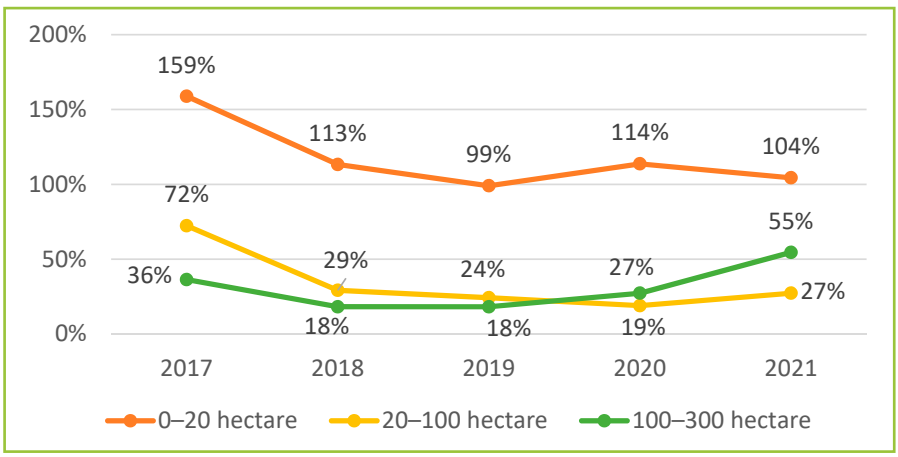

Figure 1 Change in farm size of supports applicants compared to base year 2016
Source: Own edition based on MÁK data, 2022

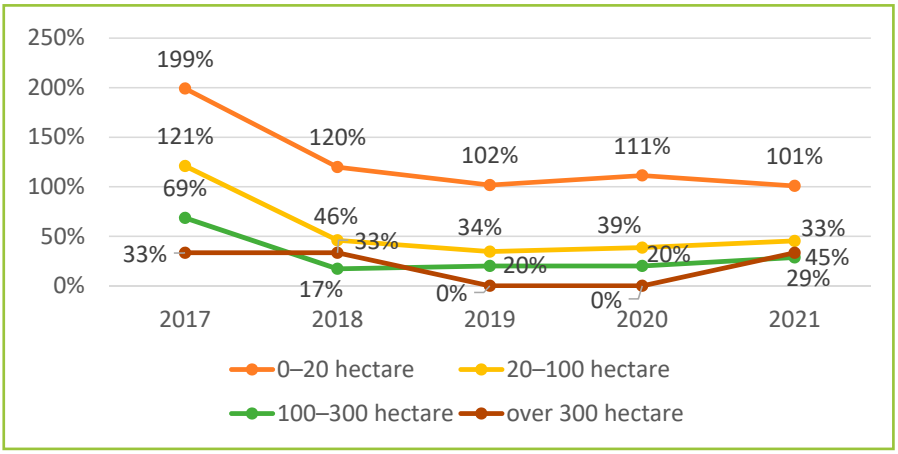

Figure 2 Change in farm size of company supports applicants compared to base year 2016
Source: Own edition based on MÁK data, 2022

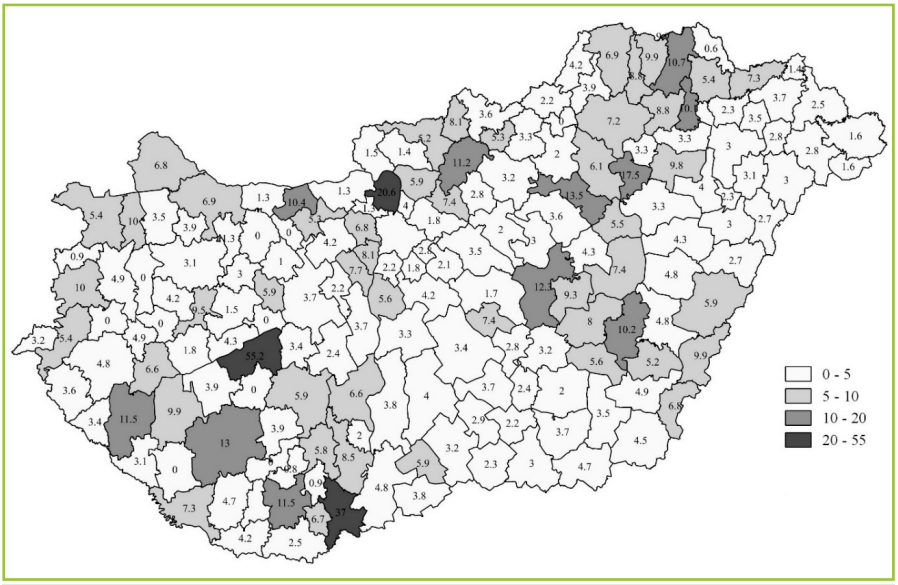

Figure 3 Vegetable plant area per local farmer, 2021 (hectare/person)
Source: Own edition based on MÁK data, 2022

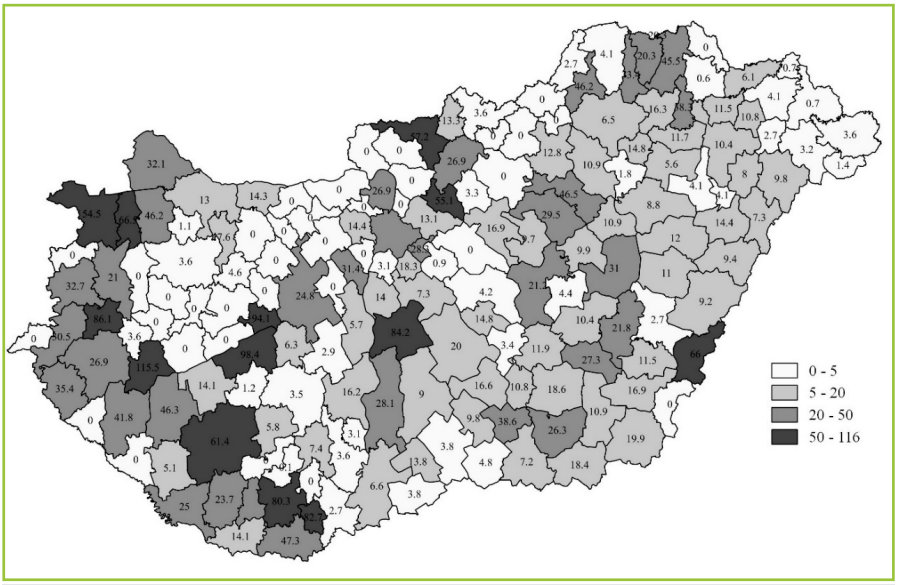

Figure 4 Vegetable plant area per local farm, 2021 (hectare/farm)
Source: Own edition based on MÁK data, 2022

The vegetable crop payment claims of farms (Figure 2) also did not change in the 0–20 hectare farm category. The 21–100 hectare category resulted in a 121%–46%–34%–39%–45% change. Between 101–300 hectares, a 69%–17%–20%–20%–29% decrease was observed. Claims over 300 hectares fell from the base year to 33% in 2021.

Based on the data from the Publication Lists of the Ministry of Public Works, I averaged the data for the last six years which I visualized using QGIS and a district (LAU1) level representation. The district level gives an easy overview of the values. Figure 3 illustrates the average area of vegetable crops used by a farmer for private claimants by averaging the data over six years. The data show that there are no claimants in ten districts. The average area in the Siófok district was 55.2 ha which is an outstanding figure among private farmers. The majority of the districts (114) fall into the 0–5 ha farm size category, with 45 districts between 0–10 ha, 11 districts between 10–20 ha, and 3 districts above 20 ha.

For non-individuals (Figure 4), the title is not relevant in 36 districts. 35 districts have an average area under 5 hectares for vegetable crop support, 57 districts have an average area between 5–20 hectares, 34 districts have an average area between 20–50 hectares and 13 districts have an average area over 50 hectares. The highest value is 115.5 hectares in the district of Keszthely. Budapest-based farms grow an average of 49.4 hectares of vegetable crops per year.

Analysis of territorial inequality indicators

To calculate the territorial inequalities (Table 2), I chose the Dual index, the unweighted Gini coefficient, the Hoover and the Herfindahl-Hirschman index. Each of these indicators is suitable for analysing inequalities by both amount in HUF and number of claimants. The four categories of holdings have been analysed both together and separately in order to illustrate the distribution of the resources of the aid scheme. The data used for the analysis were the number of applicants for district support and the amount of resources they used.

For individuals and non-individuals, the Hoover index was used to determine what percentage of the vegetable crop subsidy should be redistributed between the territorial units in order to achieve an even territorial distribution. Among private individuals, the size of the largest farm category is the 100–300 hectares which causes the largest area disparity. Among private individuals, there were no claimants over

Table 2 Microregional inequality indicators

Average data for vegetable plant production support 2016–2021			Hoover index (%)	Herfindahl- Hirschman- index (minimum value 56.82)	*Gini* coefficient (%)	Dual coefficient
Farmer / individual	0–20 hectare	∑ person	10.37	306.47	75	15.46
		∑ HUF		262.86	73	13.58
	20–100 hectare	∑ person	7.24	208.25	70	12.61
		∑ HUF		211.34	71	15.60
	100–300 hectare	∑ person	14.20	892.86	93	–
		∑ HUF		1,065.34	94	–
	300< ha	–	–	–	–	–
	∑ category	∑ person	17.81	297.87	75	14.63
		∑ HUF		218.09	70	11.43
Farm/ non-individual	0–20 hectare	∑ farm	16.48	165.88	65	9.07
		∑ HUF		207.88	69	11.32
	20–100 hectare	∑ farm	10.34	203.02	71	12.95
		∑ HUF		233.80	73	15.12
	100–300 hectare	∑ farm	12.43	407.78	87	–
		∑ HUF		522.82	89	–
	300< ha	∑ farm	1.03	2,777.78	98	–
		∑ HUF		2,809.50	98	–
	∑ category	∑ farm	31.18	155.44	62	7.50
		∑ HUF		225.58	71	12.89

Source: Own edition based on MÁK data, 2022

300 hectares. When farm sizes are considered together, 17.81% would need to be reallocated between territorial units which is due to the significant use of resources by farms over 100 hectares. The largest disparity between non-individuals is found for farms of 0–20 and over 100 ha. The result of the Hoover index calculated for farms over 300 hectares was 0 for 171 districts. When the four categories of holdings are analysed together, there is a concentration of territorial inequality (31.18%).

I calculated perfect equality (0%) and full concentration (100%) using the unweighted Gini coefficient. I calculated the Unweighted Gini coefficient for individuals and non-individuals by analysing separately the number of averaged claimants and the amount of support paid to them. The difference between the entitlement amounts of the districts was on average around 90% for claimants over 100 ha compared to 100%. For non-individuals over 300 ha, almost complete concentration (98%) was observed. Gini's analysis also describes the concentration of resources through the concentration of holdings which in this case is characteristic of large and giant holdings. The smallest disparity is observed for claimants with less than 100 ha.

I also calculated the concentration in the Hirschman-Herfindahl index. I determined the minimum value (56.82) which means that in case of equal resource allocation between districts *HHI* = 56.82. It can be concluded that for the farms, the amount of support is more concentrated than the number of claimants, while for the individuals, the number of claimants is more concentrated. Regardless of the type of claimant, a higher concentration is found above 100 ha. The largest amount of support appears as income for farms over 300 ha. The concentration is also striking when looking without farm size categories but in this case too, the higher proportion of resources used by non-individuals can be described. 31.18% for farms and 17.81% for farmers. The use of different farm size categories is also justified in this case.

I used the Dual coefficient to determine how many parts of the average of the above-average values are multiples of the below-average values. Among individuals, 137 districts had below average number of applicants and 50 districts

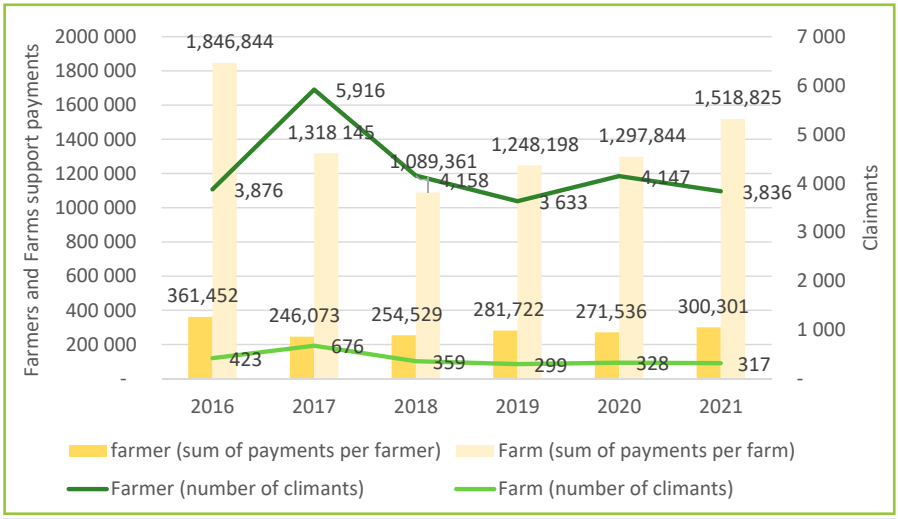

Figure 5 Aggregated claim data for vegetable plant support, 2016–2021
Source: Own edition based on MÁK data, 2022

had above average number of applicants. Among the dual indicators, the value calculated for the total farm size is noteworthy, with a greater spatial disparity in the number of farmers (14.63) than in the aid claimed (11.43). Similar values were calculated among non-individual vegetable crop subsidy claimants. Among non-individuals, 122 districts had below average number of support claimants and 122 districts had below average support. In this case, too, there was a greater spatial disparity in terms of the amount of support claimed (7.50) and the number of farmers (12.89).

Pearson correlation

As a first step, I compared the average annual number of claimants. I obtained a very strong positive correlation with $r = 0.94$. It can be concluded that the correlation between individual and non-individual claimants is very strong. In my opinion, the correlation can be described as a result of the close relationship between the farms and the private individuals that play a role in the concentration of holdings. In the further stage of the analysis I analysed the amounts of support per claimant. In this case I also obtained a very strong correlation ($r = 0.82$), which confirms the above idea.

With the correlation, I was looking for an answer to the question whether there is a relationship between individual and non-individual claimants and the subsidies per claimant, and if so, how close it is. Using the averaged data from the Publication Lists of the MÁK (Figure 5), I also estimated the number of claimants and the amount of subsidy per claimant. In 2016, there was an average of HUF 361,452 subsidy per 3,876 individual claimants, while in 2021, there was an average of HUF 300,301 subsidy per 3,836 claimants. The number of non-individual claimants decreased from 423 to 317, so that the average amount of support per claimant decreased from HUF 1,846,844 to HUF 1,518,825.

Trend analysis results

The trend function was recorded using an excel spreadsheet, and of the types of function tested (linear, exponential, logarithmic, power and polynomial), the polynomial was found to be the most appropriate. For private individuals, there was a decrease in support per claimant between 2016 and 2018, but an increase in the following years. This change is due to the impact of the Organic Farming scheme which started in 2018 and to delays in payments. The trends over the last five years are best described by a second-degree polynomial ($y = 11538 \times 2 - 74992x + 373410$; $R_2 = 0.6377$). For the next period, stagnation is predicted based on the trend function alone. In my opinion, a further increase is expected due to the priority support amounts of the 2022 Agri-environment + Organic farming tenders.

Cross tabulation analysis results

The analysis shows a significantly higher proportion of private farmers (97.1% of all private support claimants), but a significantly lower proportion of farm size categories above 20 ha (20–100 ha: 2.8%; 100–300 ha: 0.1%; over 300 ha: 0%). The reverse is true for non-individual claimants. Under-represented are farms with areas between 0 and 20 ha (73.3% of all non-individual support claimants) while a significantly higher proportion of farms with areas over 20 ha are represented in this type of group (21–100 ha: 23.7%; 100-300 ha: 3.7%; over 300 ha: 0.2%).

Conclusion

The vegetable plant subsidy is a typical horticultural entitlement. The transfer of eligible oil radishes and oil pumpkin to other payment envelopes in 2016 has created a less variable entitlement with a stable number of claimants. The number of claimants in the 0–20 hectare holdings has not changed significantly. Above 20 hectares, the number of payment claimants decreased year by year, both among individuals and farms. The 1 : 2 ratio between non-individuals and individuals is an objectionable result and warrants further investigation.

The regional inequality indicators show the predominance of large farms in terms of resource use. The highest inequality is found for farms over 100 hectares, and is multiplied for those over 300 hectares. Non individual claimants of large farm sizes induced the most significant inequality.

The results show that the justification for the entitlement can be established with a significant need for adjustment in future financial cycles. The support should be better promoted for the development of the horticultural sector for both private and non-individual beneficiaries. It has the potential for cumulation/coupling of land-based subsidies and could therefore facilitate concentration of holdings and uncontrolled use of resources. Vegetable crops are a labour-intensive sector which has a positive impact on rural employment and on the high-income agricultural sectors which is an important reason to maintain the title with some modifications. Based on Ritter (2018) it would be very important especially taking social issues of rural areas into account.

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