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# COMPARISON OF OPERATIONAL SUBSIDIES ON LESS FAVOURED AREAS IN EU COUNTRIES

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## Abstract

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This article is aimed at an analysis of operational subsidies on the Less Favoured Areas (LFA) in the European Union countries. With the help of cluster analysis, the EU countries were divided into groups and, using correlation and regression analyses, the relations between defined indicators were evaluate. The indicators of FADN EU related to the cultivated land area were completed with relative indicators. Some differences were proved in subsidy effectiveness between particular groups of the countries. The amount of operational subsidies only has a positive impact on subsidised costs in the mountain LFAs. Worse productive and climate conditions increase the dependence of the output on subsidies related to cost effectiveness. No dependence of the output share of subsidies and the subsidised costs was proven in all groups.

Keywords: agriculture, CAP, Operational subsidies – excluding on investments, outputs, inputs, LFA

## INTRODUCTION

Agriculture in the EU is one of the major sectors which employs almost 30 million people. The European model of agriculture ensures not only quality food but also permanent employment in rural areas. These areas suffer from depopulation and LFA (Less Favoured Areas) have become highly vulnerable areas. The LFA subsidies contribute significantly to sustainable agriculture and the permanent vitality of rural areas. The system of subsidies on farmers in LFAs was launched in 1975. The last reform of the Common Agricultural Policy (CAP) from 2013 sets the payments for farmers in mountain areas and other areas of natural or other specific limitations in order to compensate fully or partly their additional costs and lost profits caused by restricted farm production in those areas. Additional costs and lost profit calculations result from comparison with other productive areas which are not affected by any natural or other restrictions. The EU member states can specify the areas which are entitled to the payments in the following categories: mountain areas; other than mountain areas which face significant natural restrictions; and other areas which are affected by specific restrictions. Less favoured areas which are entitled to the payments are subsidised just in case the production costs are significantly higher because of problematic utilisation of the soil in these areas, e.g. high altitude areas with a short vegetation growth period caused by severe climatic conditions; sloping areas of lower altitude where no or very restricted mechanisation can be used but where farming is still important for the environment, for the improvement of rural areas and for the tourist potential of the area or the protection of coastal areas (EC, 2013).

The CAP receives approximately 40% of the total EU budget every year (EC, 2014). More than 70% of the money is used as a direct income subsidy (pillar I), approx. 20% can be used within the European Agricultural Fund for Rural Development (pillar II) and the rest of the money is used for payments to market price support. Compensatory subsidies within pillar II are provided in LFAs to prevent farmers from leaving the areas of natural restrictions. They represent about 4% of the CAP budget (EC, 2013). The European Commission endeavours to run environment-friendly agriculture in less favoured areas (LFA) as it helps keep nature‘s

diversity, increases the fertility of soil and protects soil from erosion. LFAs belong to areas endangered by emptiness and areas which suffer from specific natural restrictions. Nevertheless agricultural systems in less favoured areas are permanently forced to increase productivity and compete with intensive farming in more productive areas (de Graaff *et al*., 2011).

Novotná and Volek (2016) deal with the influence of subsidies on labor productivity. They explored a difference in labour productivity of farms categorised according to their size. The size of a farm has a significant influence on the labour productivity level calculated as a ratio of accounting added value and labour costs. The analysis revealed that an adjustment of the farm approach of the labour productivity, when the paid operation subsidies are added, changes this conclusion. The consequence of the subsidy policy is a convergence of the labour productivity of the size groups of farms.

Merckx and Pereira (2015) criticize the current CAP and argue, that subsidies emphasize the ubiquitous maintenance of farming and active management of the landscape, without identifying and targeting areas where rewilding marginal farmland may be beneficial for biodiversity and ecosystem services. These policies have two perverse effects. First, they promote the maintenance of agricultural practices in areas that could often be considered degraded from the point of view of several ecosystem services. Second, they distort land prices, artificially increasing the market value of marginal farmland. Furthermore, whilst subsidies may delay abandonment, they are unlikely in the long run to achieve their goal of halting and reversing this process; not only is farmland abandonment a process prone to self-enforcing socio-ecological regime shifts (Figueiredo and Pereira, 2011), incentive payments can never fully compensate the direct benefits that people received from the environment in traditional farming communities (Fischer *et al*., 2012). Ruben and Pender (2004) says that policies for poverty alleviation and sustainable development in LFAs should take the existing diversity among farmers and the heterogeneity in resources as a useful starting point. Attention should be focussed on the implications of this diversity for household decisions regarding land use, labour intensity, market exchange and social organisation.

Criteria for LFA classification are covered in studies of Dax (2005); Štolbová *et al*. (2007); Eliasson *et al*. (2010); Štolbová, Hlavsa, Lekešová (2010). Designation of LFA areas is applied at a rather broad level and does not necessarily guarantee that socio-economic and natural conditions at farm-level are considered. The key point is that there is a need to consider spatially differential impacts in further adjustments to policy reforms taking into account local circumstances. It becomes essential to increase funding for the Rural development programme to provide meaningful support, coordinating agricultural policy with rural and regional development policies (Gelan, Schwarz, 2008). The EU countries do not apply a uniform methodology to determine the amounts of the LFA payments. The payments and the differentiation of rates should be based on the effect of the adverse soil and climate conditions to contribute to the sustainable use of farmland in the LFA and, at the same time, to avoid overcompensation. The payments and list of crops to be subsidized fall within the competence of each country. Therefore, there are great differences between the EU countries in terms of the LFA payments (Štolbová, Hlavsa, 2008).

The analysis according to Jones *et al*. (2013) shows that in spite of an increased focus on livestock activities at the expense of mixed farming stocking rates decreased and the share of permanent pastures increased. Livestock payments in particular for cattle seem to have encouraged high expenditures on external inputs, whereas rural development payments seem to have encouraged more sustainable strategies such as the improvement of yields of mixed farming systems.

The analysis of enterprises in the LFA conditions shows that the significant part of companies still persist in the intensive forms of farming, whereof they achieve a relatively small economic effect. On the one hand, the intensive farms contribute to agricultural maintenance, but other hand they do not search the possibilities for innovation of the production structures (Grznár, Szabo, 2008; Gabriel *et al*., 2009) say that a combination of environmental variables associated with a lower agricultural potential predisposes farmers to convert to organic farming, which further promotes conversion of farmers in the neighbourhood. Organic farming as a 'wildlife friendly' method is more likely to occur in agriculturally less-favoured areas where economic incentives for conversion to organic farming do not need to be high and the loss of production due to conversion will be comparatively small. This suggests that an efficient conservation strategy, which takes the global demand for food into account, would promote organic farming as an agri-environment scheme in landscapes that are already rich in organic farms.

The evaluation of Czech agricultural entreprises shows that the highest losses after the subsidies are deducted from profits will appear in the mountain LFAs. The impact on economic indicators in the mountain LFAs seems to be significant. Enterprises which operate in mountain areas depend on the subsidies most of all. On the other hand they cope best with effects of unfavourable conditions (Lososová, Zdeněk, 2013).

## MATERIAL AND METHODOLOGY

The aim of this article is to analyse the policy of subsidies in the field of operational subsidies classified according to LFAs in EU countries in

2004–2012 which represents its comparison based on selected economic indicators and identifies adequate relations and dependencies between the indicators and operational subsidies based on economic reasons.

They were defined indicators based on subsidies, production and costs in order to evaluate their mutual dependencies structured by LFA. Among the analyzed indicators were included subsidies effectiveness, defined as the ratio of production and subsidies; subsidised costs are defined as the ratio of the costs and subsidies and cost effectiveness, defined as the ratio of production and costs.

This article uses calculations with the database of the survey The Farm Accountancy Data Network (FADN) in EU countries between 2004 and 2012. A standard output (SO) is a data collection which was used for grouping agricultural enterprises in the LFA. The standard output is an average cash value of agricultural output expressed in prices of farmers specified particularly for each commodity in the region given. It is calculated by the member states per one hectare or a head of livestock using basic economic data during the reference period of five consecutive years. The standard output of the agricultural enterprise is calculated as the total of all commodities produced multiplied by hectares or heads of livestock. The standard output coefficients are expressed in Euros and the economic size of the enterprise is measured as a total standard output of the enterprise in Euros. The coefficients are then calculated for more than 90 species of farm crops and livestock. The large number of data reflects the variety of agriculture within the European Union and sets the basis for required assessment necessary for complexity and reliability of the outputs.

To get precise data, the less favoured areas were divided into three categories based on the official classification of enterprises used in the FADN:

- in less-favoured mountain areas (most of the cultivated land in less-favoured mountain areas),
- in less-favoured not mountain areas (most of the cultivated land in less-favoured not mountain areas).
- Areas which do not have less-favoured area status (most of the cultivated land is not in less-favoured mountain areas).

As the system of subsidies paid depends directly on the land area, the indicators of total production, total costs and total operational subsidies were per hectare of farmland. As a result of that, the area size of particular agricultural enterprises of the member states was taken into account.

The data gained in that way were processed through cluster analysis, a multi-variable statistical method, which enables the division of large information sets into smaller and more homogenous groups. A similar way may be applied to the classification of the EU member states according to farm productivity (Giannakis and Bruggeman, 2015). The sequence of clustering can be categorised as follows: hierarchic, non-hierarchic and multi-stage. The Ward method was used in this study.

Ward's method joins two clusters A and B that minimize the increase in sum of squares of error within cluster, IAB (Rencher, 2002; Řezanková, Húsek, and Snášel, 2009),

$$I_{AB} = \frac{n_A n_B}{n_A + n_B} (\bar{\mathbf{y}}_A - \bar{\mathbf{y}}_B)^T (\bar{\mathbf{y}}_A - \bar{\mathbf{y}}_B),$$

where $n_A$, $n_B$ are the numbers of points in *A*, *B*; $\bar{\boldsymbol{y}}_A$, $\bar{\boldsymbol{y}}_B$ are centroids of *A*, and *B*, respectively. As distance function is used Eucliean distance between two vectors $\boldsymbol{x} = (x_1, x_2, \ldots, x_p)^T$ and $\boldsymbol{y} = (y_1, y_2, \ldots, y_p)^T$, defined as (Rencher, 2002)

$$d(\mathbf{x}, \mathbf{y}) = \sqrt{(\mathbf{x} - \mathbf{y})^T (\mathbf{x} - \mathbf{y})}.$$

The aim of the evaluation is the division of the EU states into groups which made the evaluation comprehensible. The commentary on the groups also contains basic descriptive statistical characteristics.

The next parts of the analysis, using methods of correlation and regression analyses, describe the relations between defined indicators. The indicators of FADN EU related to the land area of cultivated land were completed with relative indicators:

subsidies effectiveness $SE = \frac{TO}{OS}$;

subsidised costs $SC = \frac{OS}{TC}$;

cost effectiveness $CE = \frac{TO}{TC}$;

where *TO* is the total output; *OS* is the operational subsidies; *TC* is the total cost.

## RESULTS AND DISCUSSION

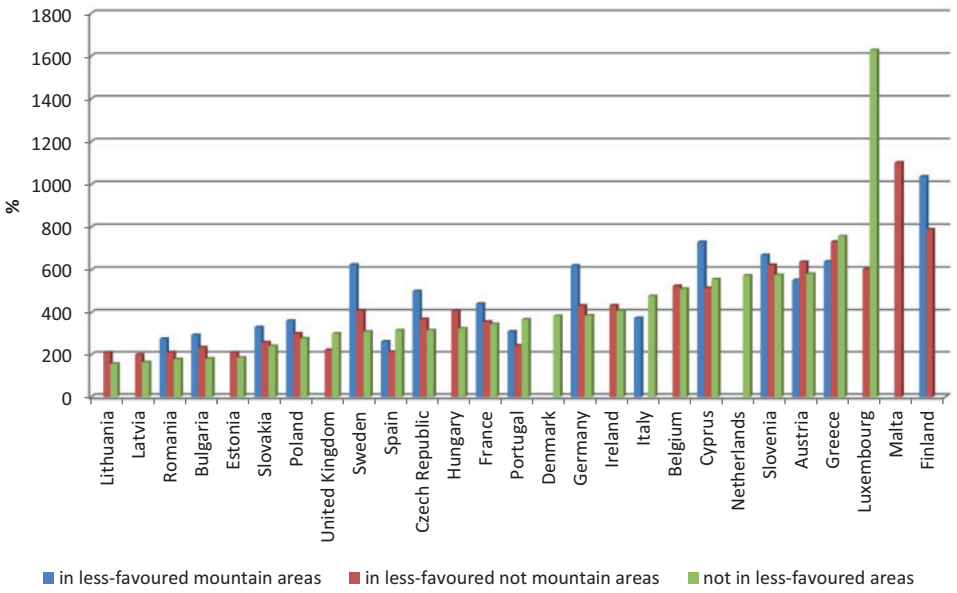
The division of the EU member states according to the LFA share of utilised farmland is shown in Tab I which contains the data of the European Commission. All utilised farmland in Malta is classified as LFA. The lowest LFA share of utilised farmland is indicated in Denmark, the Netherlands, Belgium and Hungary. The highest mountain LFA of the utilised farmland is indicated in Slovenia (69.5%), Greece (53.9%), Austria (50.4%) and Finland (50.4%). Belgium, Denmark, Estonia, Ireland, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands and the United Kingdom have no mountain LFAs.

Fig. 1 shows the comparison of operational subsidies on the LFA per hectare of utilised farmland in the EU countries. The highest operational subsidies on the mountain LFAs

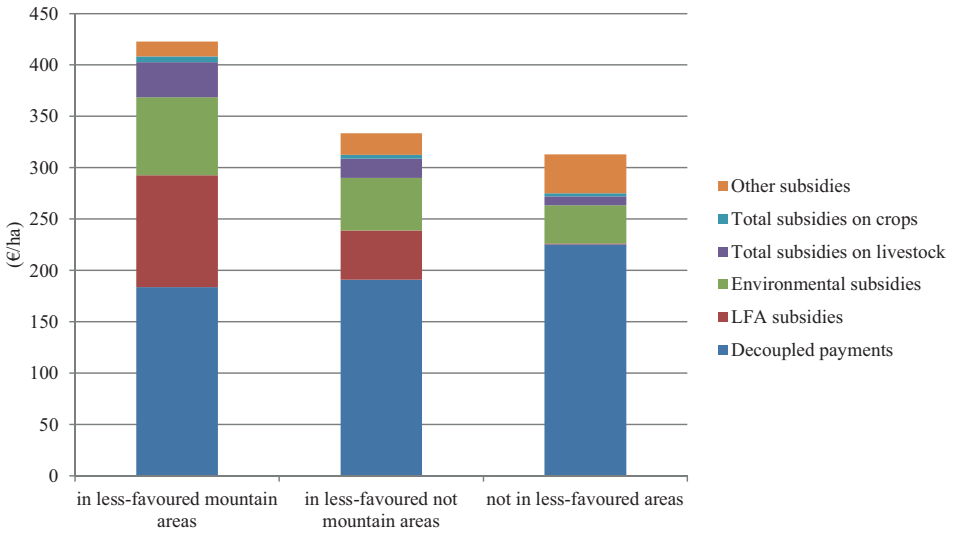
I: *The LFA share of Utilised Agricultural Area (UAA) in the EU countries*

| LFA/UAA | Countries |
|---|---|
| To 25% | Denmark (1.1), Netherlands (11.9), Belgium (18), Hungary (20.7), |
| 25–50% | Bulgaria (27.6), Romania (28.9), Estonia (40.9), France (44.5), Sweden (48.5) Czech Republic (49.2) |
| 50–75% | Italy (50.8), Germany (52), United Kingdom (52.8), EU-27 (54.4), Lithuania (57.1), Cyprus (60.2), Slovakia (61.3), Poland (62.5), Austria (64.1), Latvia (73.5), |
| More than 75% | Ireland (77.5), Greece (78.1), Spain (81.7), Portugal (92.4), Slovenia (92.4), Finland (95.1), Luxembourg (95.3), Malta (100) |

Source: http://ec.europa.eu/




1: *Operational subsidies on LFAs in 2012 (€/ha)*
Source: FADN, own results




2: *Structure of operational subsidies on LFAs in EU in 2012 (€/ha)*
Source: FADN, own results

were provided to Finland in 2012 (1 036 €/ha), the highest operational subsidies on less-favoured not mountain areas were provided to Malta (1 102 €/ha) and the highest operational subsidies on areas not in less-favoured area status were provided to Luxembourg (1 628 €/ha). In contrast, the lowest operational subsidies per hectare of the utilised farmland in the mountain LFAs are in Spain,

Romania and Bulgaria where they do not reach 300 €/ha. Latvia, Estonia, Lithuania, Romania and Spain have lower operational subsidies on the less-favoured non- mountain areas and Latvia, Estonia, Lithuania, Romania and Bulgaria have the lowest operational subsidies on the areas which do not have less-favoured area status.

However, the structure of operational subsidies plays an important role in the study. It is obvious from the particular payments for the LFA per hectare of farmland in 2012 that the highest payments are paid for decoupling in the non-LFAs, which is probably connected to their setting on the basis of direct payments related to production (up to 2003) and the payments decrease with worsening conditions of farming (according to LFAs, Fig. 2). The less-favoured areas obtain LFA subsidies and higher environmental payments so that the total operational subsidies per hectare are higher by 35% in the mountain LFAs and by 7% in the areas which are not in zones of less-favoured area status compared to those in the less-favoured not mountain areas.

The structure of operational subsidies in percentages in particular EU countries is shown in Tabs. II–IV for the years 2004 and 2012. Obviously particular crops and livestock are subsidised less and less during the years. The share of operational subsidies decreased from 22% in 2004 to 5.5% in 2012 in less-favoured mountain areas and shifted to decoupling where the share was 17.4% in 2004 (only used in the new member states, NMS) and 44% in 2012. The difference is more noticeable in less-favoured not mountain areas where the payments connected to production formed 58.6% of operational subsidies in 2004 and 8.4% in 2012. In contrast, decoupling made 9.6% in 2004 (again only new member states) and 54.6% of operational subsidies in 2012. The difference is the most significant in areas which are not in zones of less-favoured area status because there are the highest direct payments. In 2004 the payments connected to the production formed 67.7% and only 6% in 2012 while decoupling formed 12.4% of operational subsidies in 2004 and 68.7% in 2012.

Other types of operational subsidies seem relatively stable – the highest environmental subsidies are in less-favoured mountain areas with an unimportant change from 14.5% to 15.5%, the LFA subsidies decreased from 41.7% to 28.1%. The environmental subsidies increased from 11% to 14.5% in less-favoured not mountain areas and the LFA subsidies came down from 13.6% to 12.7%. In areas which are not in zones of less-favoured area status, the environmental subsidies increased from 10.2% in 2004 to 12.9% in 2012 and the LFA subsidies are insignificant here.

The following graph shows the share of average operational subsidies of the LFA costs in the EU countries. Most countries present a significant growth of this indicator towards worse production conditions, i.e. the highest share of subsidised costs is obvious in less-favoured mountain areas while the lowest share can be seen in areas which do not have less-favoured area status. The share of operational subsidies is higher in areas which do not have less-favoured area status than in less-favoured mountain areas in Portugal and Greece while in Italy, Slovenia

II: *Structure of subsidies in less-favoured mountain areas (% of operational subsidies)*

| | Total subsidies on crops | | Total subsidies on livestock | | Environmental subsidies | | LFA subsidies | | Decoupled payments | | Other subsidies | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2004** | **2012** | **2004** | **2012** | **2004** | **2012** | **2004** | **2012** | **2004** | **2012** | **2004** | **2012** |
| Bulgaria | | 0.4 | | 14.9 | | 13.5 | | 22.6 | | 32.8 | | 15.7 |
| Cyprus | 92.0 | 0.0 | 3.7 | 3.3 | 0.0 | 32.8 | 0.0 | 13.4 | 4.3 | 42.7 | 0.0 | 7.8 |
| Czech Republic | 6.5 | 0.2 | 12.5 | 3.1 | 12.0 | 25.9 | 35.3 | 21.6 | 25.5 | 42.5 | 8.2 | 6.7 |
| Germany | | 0.0 | | 2.0 | | 26.8 | | 17.9 | | 48.0 | | 5.2 |
| Greece | 56.8 | 3.1 | 28.8 | 2.6 | 0.1 | 2.0 | 12.8 | 12.8 | 0.0 | 72.8 | 1.5 | 6.8 |
| Spain | 52.0 | 15.5 | 39.5 | 16.9 | 1.1 | 5.1 | 4.5 | 6.5 | 0.0 | 52.5 | 3.0 | 3.4 |
| France | 11.2 | 3.1 | 41.4 | 17.1 | 14.0 | 9.6 | 26.3 | 25.2 | 0.0 | 41.7 | 7.1 | 3.3 |
| Italy | 65.9 | 2.7 | 20.5 | 1.2 | 6.4 | 13.1 | 5.6 | 10.1 | 0.0 | 68.2 | 1.6 | 4.7 |
| Austria | 8.5 | 2.1 | 24.8 | 6.4 | 39.1 | 34.1 | 23.1 | 23.4 | 0.0 | 25.8 | 4.6 | 8.2 |
| Poland | 49.6 | 0.5 | 0.0 | 7.6 | 0.0 | 14.7 | 4.1 | 14.6 | 35.2 | 48.3 | 11.1 | 14.4 |
| Portugal | 17.6 | 10.3 | 35.8 | 12.6 | 19.4 | 11.6 | 24.1 | 23.2 | 0.0 | 38.5 | 3.2 | 3.7 |
| Romania | | 0.1 | | 3.3 | | 26.3 | | 0.9 | | 42.7 | | 26.8 |
| Finland | 18.4 | 5.9 | 42.0 | 26.3 | 15.7 | 19.9 | 20.3 | 25.4 | 0.0 | 19.0 | 3.7 | 3.5 |
| Sweden | 16.4 | 0.1 | 38.4 | 17.9 | 23.9 | 28.1 | 18.5 | 21.8 | 0.0 | 31.4 | 2.9 | 0.7 |
| Slovakia | 1.8 | 0.0 | 5.5 | 3.0 | 0.0 | 12.5 | 55.2 | 31.7 | 34.8 | 51.7 | 2.7 | 1.2 |
| Slovenia | 7.5 | 0.0 | 28.3 | 8.0 | 29.0 | 18.5 | 28.3 | 24.5 | 0.0 | 36.5 | 6.9 | 12.5 |
| ***Average*** | ***4.7*** | ***0.0*** | ***16.9*** | ***5.5*** | ***14.5*** | ***15.5*** | ***41.7*** | ***28.1*** | ***17.4*** | ***44.1*** | ***4.8*** | ***6.9*** |

Source: FADN, own results

III: *Structure of subsidies in less-favoured not mountain areas (% of operational subsidies)*

| | Total subsidies on crops | | Total subsidies on livestock | | Environmental subsidies | | LFA subsidies | | Decoupled payments | | Other subsidies | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 |
| Belgium | 8.7 | 0.0 | 69.2 | 25.1 | 2.9 | 10.5 | 6.8 | 8.1 | 0.0 | 42.5 | 12.4 | 13.7 |
| Bulgaria | | 0.9 | | 10.8 | | 5.7 | | 17.4 | | 48.9 | | 16.3 |
| Cyprus | 43.9 | 0.0 | 42.3 | 7.8 | 0.0 | 17.1 | 0.0 | 11.2 | 13.8 | 56.6 | 0.0 | 7.3 |
| Czech Republic | 19.7 | 0.2 | 9.3 | 3.2 | 6.6 | 16.8 | 16.9 | 11.6 | 35.3 | 57.4 | 12.3 | 10.7 |
| Germany | 44.9 | 0.4 | 19.7 | 0.1 | 15.5 | 12.5 | 11.2 | 8.2 | 0.0 | 70.7 | 8.7 | 8.0 |
| Greece | 73.0 | 7.9 | 16.4 | 1.0 | 0.1 | 1.4 | 8.9 | 7.3 | 0.0 | 74.0 | 1.4 | 8.5 |
| Spain | 65.1 | 2.8 | 25.7 | 7.2 | 0.9 | 6.8 | 3.5 | 4.7 | 0.0 | 76.6 | 4.7 | 2.0 |
| Estonia | 12.0 | 0.0 | 11.6 | 3.4 | 31.9 | 26.8 | 19.0 | 10.3 | 20.9 | 44.1 | 4.6 | 15.4 |
| France | 51.1 | 5.3 | 33.2 | 13.9 | 7.8 | 5.1 | 4.0 | 4.6 | 0.0 | 66.1 | 3.8 | 5.1 |
| Hungary | 31.0 | 0.1 | 9.8 | 9.3 | 0.1 | 22.8 | 0.5 | 9.0 | 35.7 | 50.5 | 23.0 | 8.3 |
| Ireland | 2.5 | 0.0 | 62.0 | 2.1 | 15.6 | 16.0 | 17.4 | 13.1 | 0.0 | 66.1 | 2.4 | 2.8 |
| Italy | 73.2 | | 15.3 | | 5.0 | | 1.9 | | 0.0 | | 4.6 | |
| Lithuania | 13.8 | 0.0 | 10.2 | 4.6 | 0.0 | 1.9 | 39.7 | 17.0 | 22.0 | 55.6 | 14.2 | 20.9 |
| Luxembourg | 18.1 | 0.0 | 30.3 | 0.1 | 20.0 | 19.7 | 26.2 | 20.6 | 0.0 | 44.7 | 5.4 | 14.9 |
| Latvia | 23.7 | 0.3 | 18.4 | 10.4 | 9.4 | 18.0 | 25.7 | 17.1 | 12.6 | 36.1 | 10.2 | 18.0 |
| Malta | 10.1 | 9.9 | 58.1 | 0.0 | 1.9 | 8.6 | 9.3 | 20.6 | 0.0 | 60.2 | 20.6 | 0.6 |
| Austria | 28.8 | 2.4 | 18.5 | 2.2 | 38.9 | 32.4 | 10.3 | 11.1 | 0.0 | 43.9 | 3.6 | 8.1 |
| Poland | 51.6 | 1.2 | 0.0 | 0.6 | 0.3 | 8.2 | 2.2 | 11.2 | 37.3 | 56.0 | 8.6 | 22.8 |
| Portugal | 34.8 | 8.1 | 41.2 | 28.1 | 11.4 | 9.9 | 10.0 | 14.8 | 0.0 | 34.9 | 2.6 | 4.2 |
| Romania | | 0.6 | | 6.2 | | 4.9 | | 4.9 | | 56.2 | | 27.2 |
| Finland | 29.4 | 6.1 | 22.1 | 10.6 | 24.5 | 25.1 | 22.3 | 27.8 | 0.0 | 28.6 | 1.7 | 1.8 |
| Sweden | 29.1 | 0.0 | 34.6 | 1.3 | 26.5 | 30.4 | 6.9 | 10.5 | 0.0 | 56.0 | 2.9 | 1.8 |
| Slovakia | 14.1 | 0.0 | 2.8 | 3.2 | 0.0 | 8.6 | 37.1 | 19.8 | 43.3 | 66.3 | 2.7 | 2.1 |
| Slovenia | 25.6 | 0.3 | 22.6 | 2.7 | 25.9 | 21.7 | 16.8 | 15.5 | 0.0 | 45.9 | 9.1 | 13.9 |
| United Kingdom | 4.2 | 0.0 | 67.1 | 1.7 | 9.2 | 17.9 | 15.1 | 7.9 | 0.0 | 71.3 | 4.5 | 1.2 |
| ***Average*** | ***30.8*** | ***1.9*** | ***27.9*** | ***6.5*** | ***11.1*** | ***14.5*** | ***13.6*** | ***12.7*** | ***9.6*** | ***54.6*** | ***7.1*** | ***9.8*** |

Source: FADN, own results

and Austria the share of operational subsidies in less-favoured not mountain areas is lower than in areas which do not have less-favoured area status (Tab. III).

The average operational subsidies per hectare of farmland during the period monitored for the less-favoured mountain areas form 501 €/ha. From 2004. The average growth rate was 0.5% a year and the median was 3.3% a year, which means that it increased from 364 €/ha in 2004 to 471 €/ha in 2012. The variability of subsidies in the less-favoured mountain areas is a little bit lower than the variability of production and shows a decreasing trend by 7.5% a year. The highest variation coefficient was 76 in 2004 and the lowest 41 in 2012. The span of subsidies has a decreasing trend by 6.4% a year, the minimum and maximum indicators approached during the monitored period.

The production per hectare of the farmland in less-favoured mountain areas averaged at 1 667 €/ha in 2004 and increased gradually with the growth rate of 2.4%. The median grew from 1 118 €/ha in 2004 to 1 643 €/ha in 2012. The highest production variability was recorded in 2009 (77) and did not grow much during the period. The highest span was recorded in 2009 and 2010 however it followed the same trend as the production variability and did not change much.

The costs per hectare in the less-favoured mountain areas averaged at 1 508 €/ha. The costs followed the similar average rate of growth as the output, the median grew by 2.9% a year on average. The variability of costs was lower compared to the output. The highest level was recorded in 2004. The span reached the peak in 2009 and since then seems quite stable.

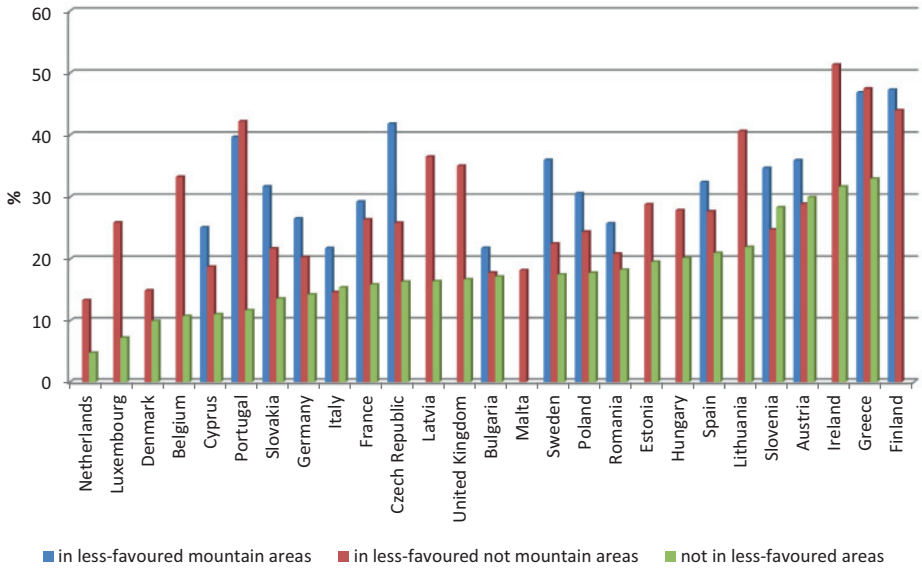
Using cluster analysis, the operational subsidies per hectare in the less-favoured mountain areas of the EU countries were divided into two main groups (Fig. 4).

Group 1 (Cyprus, Greece, Finland, Austria, Sweden, Slovenia) uses more than doubled average subsidies per hectare (727 €/ha) than Group 2. Also the average output (1 583 €/ha) and costs (1 841 €/ha) are doubled.

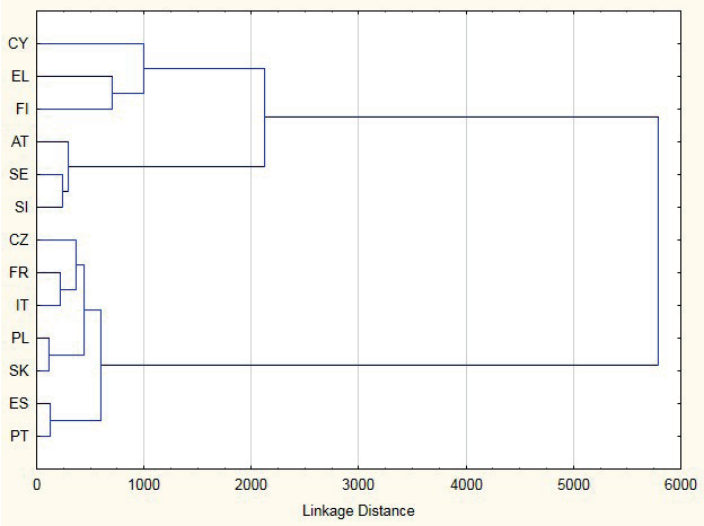
IV: *Structure of subsidies in areas which are not in areas of less-favoured status (% of operational subsidies)*

| | Total subsidies on crops | | Total subsidies on livestock | | Environmental subsidies | | LFA subsidies | | Decoupled payments | | Other subsidies | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 | 2004 | 2012 |
| Belgium | 34.4 | 0.6 | 45.0 | 11.7 | 5.3 | 6.7 | 0.0 | 0.0 | 0.0 | 70.0 | 15.3 | 10.9 |
| Bulgaria | | 4.4 | | 6.4 | | 4.5 | | 0.4 | | 70.7 | | 13.6 |
| Cyprus | 52.2 | 0.0 | 32.9 | 14.2 | 0.0 | 31.9 | 0.0 | 0.0 | 15.0 | 48.8 | 0.0 | 5.1 |
| Czech Republic | 30.4 | 0.2 | 5.0 | 1.6 | 4.3 | 6.9 | 3.0 | 0.7 | 40.6 | 67.2 | 16.8 | 23.5 |
| Denmark | 74.4 | 0.1 | 18.8 | 1.3 | 3.9 | 2.1 | 0.0 | 0.0 | 0.0 | 90.4 | 2.9 | 6.1 |
| Germany | 66.6 | 0.4 | 17.9 | 0.4 | 6.0 | 5.5 | 0.0 | 0.0 | 0.0 | 83.6 | 9.5 | 10.1 |
| Greece | 88.9 | 16.5 | 9.0 | 0.6 | 0.2 | 1.3 | 0.0 | 0.2 | 0.0 | 74.0 | 1.9 | 7.3 |
| Spain | 76.6 | 8.0 | 19.9 | 2.5 | 2.2 | 3.7 | 0.0 | 0.0 | 0.0 | 83.6 | 1.3 | 2.1 |
| Estonia | 22.3 | 0.0 | 14.6 | 1.8 | 30.8 | 28.6 | 0.2 | 0.3 | 29.6 | 50.5 | 2.5 | 18.9 |
| France | 75.2 | 3.4 | 18.4 | 4.7 | 3.2 | 2.3 | 0.0 | 0.0 | 0.0 | 84.9 | 3.2 | 4.6 |
| Hungary | 33.9 | 4.6 | 8.9 | 4.6 | 0.1 | 16.8 | 0.0 | 0.2 | 35.8 | 63.1 | 21.3 | 10.6 |
| Ireland | 26.2 | 0.0 | 62.2 | –0.5 | 8.5 | 10.5 | 0.0 | 0.0 | 0.0 | 88.3 | 3.1 | 1.6 |
| Italy | 80.7 | 2.5 | 11.2 | 1.6 | 5.2 | 7.6 | 0.0 | 0.2 | 0.0 | 84.4 | 3.0 | 3.8 |
| Lithuania | 41.1 | 0.1 | 12.6 | 3.4 | 0.0 | 1.7 | 0.0 | 0.2 | 39.2 | 74.2 | 7.0 | 20.5 |
| Luxembourg | 0.4 | 0.0 | 0.0 | 0.0 | 45.3 | 43.5 | 0.0 | 0.0 | 0.0 | 28.2 | 54.3 | 28.2 |
| Latvia | 43.2 | 0.0 | 21.9 | 21.9 | 3.3 | 8.3 | 0.0 | 0.0 | 18.9 | 42.3 | 12.7 | 27.5 |
| Netherlands | | 0.0 | | 0.7 | | 8.8 | | 0.1 | | 78.9 | | 11.6 |
| Austria | 44.4 | 2.9 | 8.0 | 0.6 | 44.3 | 36.7 | 0.0 | 0.0 | 0.0 | 52.3 | 3.3 | 7.5 |
| Poland | 58.1 | 2.1 | 0.1 | 1.2 | 0.0 | 5.8 | 0.0 | 0.0 | 34.6 | 63.1 | 7.1 | 27.8 |
| Portugal | 65.6 | 7.9 | 20.7 | 7.7 | 9.0 | 7.9 | 0.0 | 0.1 | 0.0 | 71.1 | 4.7 | 5.2 |
| Romania | | 0.7 | | 5.0 | | 1.0 | | 0.0 | | 64.5 | | 28.8 |
| Sweden | 63.2 | 0.0 | 16.9 | 2.7 | 15.1 | 18.5 | 0.0 | 0.0 | 0.0 | 77.5 | 4.8 | 1.2 |
| Slovakia | 23.3 | 0.0 | 0.6 | 2.9 | 0.0 | 9.5 | 0.0 | 1.0 | 59.2 | 70.5 | 17.0 | 16.2 |
| Slovenia | 31.2 | 0.0 | 25.3 | 0.4 | 30.8 | 34.9 | 0.9 | 0.1 | 0.0 | 53.1 | 11.7 | 11.4 |
| United Kingdom | 57.4 | 0.0 | 30.7 | 0.1 | 6.3 | 16.7 | 0.2 | 0.0 | 0.0 | 81.4 | 5.3 | 1.7 |
| ***Average*** | ***49.5*** | ***2.2*** | ***18.2*** | ***3.9*** | ***10.2*** | ***12.9*** | ***0.2*** | ***0.1*** | ***12.4*** | ***68.7*** | ***9.5*** | ***12.2*** |

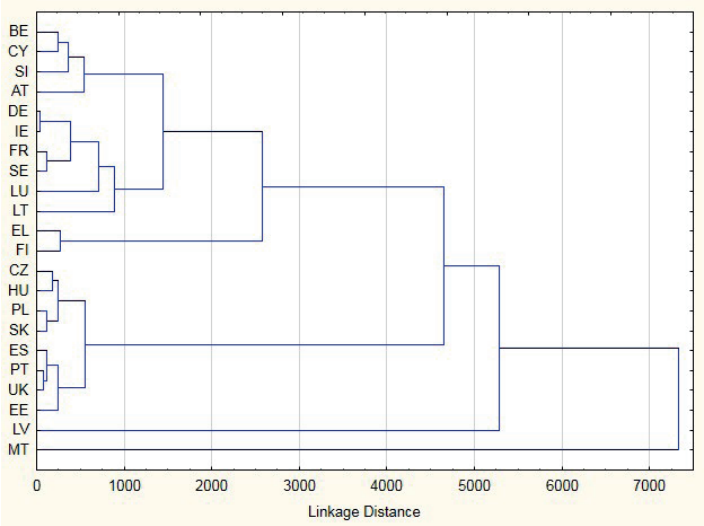
Source: FADN, own results




3: *Share of subsidised costs in LFAs (average 2004–2012)*
Source: FADN, own results




4: *Operational subsidies per hectare of farmland used in the less-favoured mountain areas in the EU countries*
Source: FADN, own results




5: *Operational subsidies per hectare of utilised farmland in the less-favoured not mountain areas in particular countries*
Source: FADN, own results

Group 2 (The Czech Republic, France, Italy, Poland, Slovakia, Spain, Portugal). In this group the average operational subsidies represent 316 €/ha, the output 679 €/ha and the costs 953 €/ha. In both groups the average costs in the less-favoured mountain areas exceed the output: the first group by 16% and the other by 40%.

The countries which did not record all data during the monitored period were not involved in the cluster analysis, i.e. concerning the less-favoured mountain areas, they are countries with an insignificant number of farms in FADN or they are not situated in the less-favoured mountain areas (Belgium, Denmark, Estonia, Hungary, Ireland, Lithuania, Luxembourg, Latvia, Malta, the Netherlands, the United Kingdom), or some data are missing (Germany) and Bulgaria and Romania which joined the European Union in 2007.

The average operational subsidies per hectare of the farmland used in the less-favoured non-mountain areas represents 447 €/ha from 2004, and the average rate of growth is 0.2% per year (Fig. 5). The median increased from 321 €/ha in 2004 to 389 €/ha in 2012. The variability of subsidies in the less-favoured not mountain areas is significantly lower than the variability of output and has decreased gradually. The highest variation coefficient was recorded in 2007 (111) and 2008 (112). The span of subsidies decreased during the period.

The average output in the less-favoured not mountain areas is 1 927 €/ha from 2004 and has grown gradually. The average rate of growth is 2%

per year. The median increased from 1 145 €/ha in 2004 to 1 401 €/ha in 2012. The output variability is significantly higher than in the less-favoured mountain areas and there is no trend recorded during the period. The span does not change either, with the highest levels in 2008 and 2012.

The average costs per hectare in the less-favoured not mountain areas are 1 809 €/ha and grew slowly during the years. The average growth rate is 3%, the median increased by 1% a year on average. The variability of costs was lower than that of the output with no noticeable trend. The span increased gradually.

The operational subsidies per hectare in the less-favoured not mountain areas differ in the various countries. In Fig. 5 they are divided into four groups:

**Group 1** (Greece, Finland) have the highest subsidies of 788 €/ha (except Malta), an average output of 1 473 €/ha and costs of 1 778 €/ha.

**Group 2** (Belgium, Cyprus, Slovenia, Austria, Germany, Ireland, France, Sweden, Luxembourg, Lithuania) with average operational subsidies of 435 €/ha, average output of 1 573 €/ha and costs of 1 642 €/ha.

**Group 3** (The Czech Republic, Hungary, Poland, Slovakia, Spain, Portugal, the United Kingdom, Estonia, Latvia) with the lowest subsidies of 237 €/ha on average, the lowest output of 763 €/ha and costs of 924 €/ha.

**Group 4** (Malta) with average subsidies of 1 976 €/ha in the less-favoured not mountain areas, average output of 12 799 €/ha and costs of 10 743 €/ha.

The data from Bulgaria and Romania are missing (as stated above) as well as from some other countries, including Denmark, the Netherlands and Italy because some of their data for several years were not presented.

The average operational subsidies per hectare of the utilised farmland in the less-favoured not mountain areas are 395 €/ha and grew by 3.1% a year from 2004 (Fig. 6). The median stays relatively stable and fluctuates around 350 €/ha. The variability of subsidies in areas which do not have „less-favoured area" status was lower than in the other LFA areas. The span increased steadily, i.e. the values of the minimum and maximum receded from each other during the monitored period.

The average output in the areas without less-favoured area status was significantly higher than in the LFA areas and reached 3 485 €/ha. From 2004, it grew permanently with an average growth rate of 3.9% and the median grew rapidly from 1852 €/ha in 2004 to 2429 €/ha in 2012.

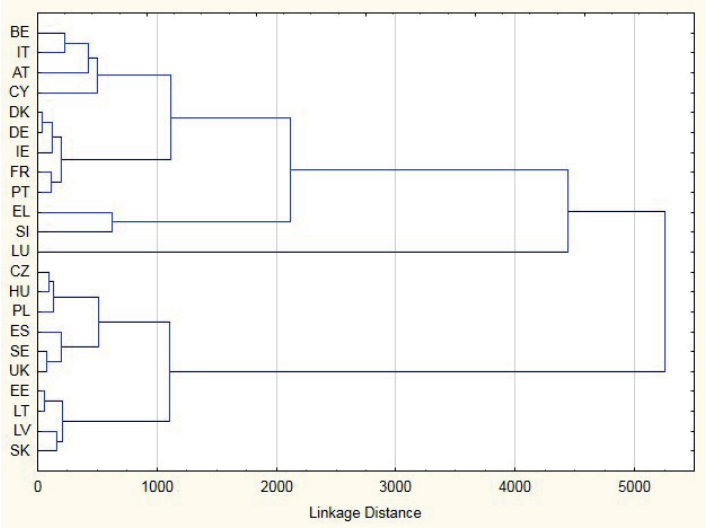
The variability of output compared to the LFA areas was high and kept stable during the period as well as the span which was noticeably higher than in the LFA areas.

The average costs per hectare of the farmland in the less-favoured not mountain areas (2 952 €/ha) were lower than the output, however they increased faster. The median grew by 3.4% a year on average. The variability of costs was lower than that of the output and kept a stable trend together with the span.

The operational subsidies per hectare in the not in less-favoured areas in the particular EU countries are divided into three groups as follows (Fig. 6):

**Group 1** (Luxembourg) has the highest subsidies of 1 279 €/ha with an average output of 23 867 €/ha and costs of 17 668 €/ha.

**Group 2** (Belgium, Italy, Austria, Cyprus, Denmark, Germany, Ireland, France, Portugal, Greece, Slovenia) with average operational subsidies of 428 €/ha, an average output of 3 093 €/ha and costs of 2 872 €/ha.

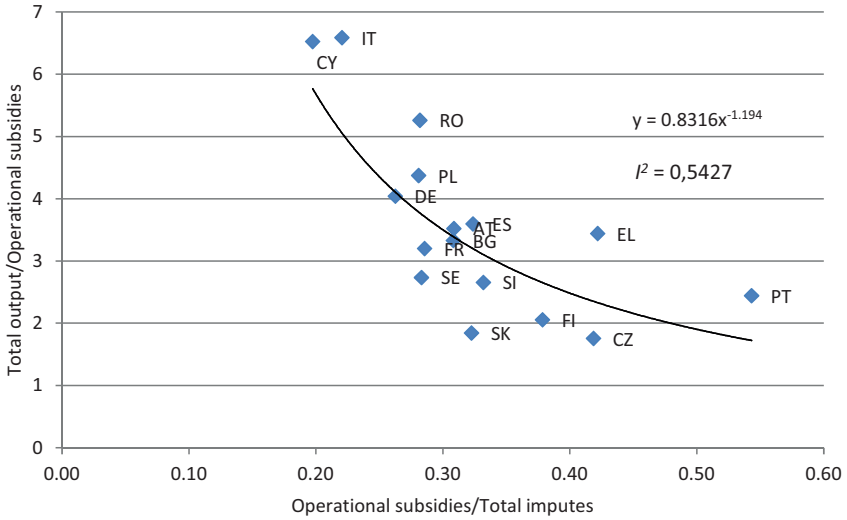



6: *The operational subsidies per hectare of utilised farmland in areas which are not less-favoured areas in the EU countries*
Source: FADN, own results

V: *Correlation matrix of the indicators in less-favoured mountain areas*

| Variable | Operational subsidies | Total output /Operational subsidies | Operational subsidies /Total costs | Total output /Total costs |
|---|---|---|---|---|
| Operational subsidies | 1 | **–0.360** | **0.457** | –0.156 |
| Total output/Operational subsidies | **–0.360** | 1 | **–0.758** | **0.659** |
| Operational subsidies/Total costs | **0.457** | **–0.758** | 1 | **–0.230** |
| Total output/Total costs | –0.156 | **0.659** | **–0.230** | 1 |

Marked correlations are significant at $p < 0.05$, N = 135 (Casewise deletion of missing data)
Source: FADN, own results




7: *The relation of the share of subsidised costs and output to the subsidies in less-favoured mountain areas in 2012*
Source: FADN, own results

**Group 3** (The Czech Republic, Hungary, Poland, Spain, Sweden, the United Kingdom, Estonia, Lithuania, Latvia, Slovakia) with the lowest subsidies of 223 €/ha, an average output of (1 321 €/ha) and costs of 1 395 €/ha.

The data from Bulgaria and Romania are missing (as stated above) as well as for Malta, with its entire land area recorded as the LFA, Finland, with most of its land area in the LFA and the Netherlands because some of its data from several years were not presented.

Correlation analysis was used to show the relations between the monitored indicators (see Tabs. V to VII). Tab. V dealing with the less-favoured mountain areas demonstrates that the subsidy share of the costs ($r$ = 0.457) depends positively on operational subsidies, while the output share of subsidies depends on them negatively ($r$ = –0.360). Higher effectiveness of costs does not affect operational subsidies ($r$ = –0.156). The output share of subsidies strongly affects the cost effectiveness ($r$ = 0.659) and the output share of subsidies is negatively dependent on the shares of subsidised costs ($r$ = –0.758). The subsidy share of costs depends negatively on the cost effectiveness ($r$ = –0.230).

The relation of the shares of subsidised costs and the output to the subsidies is demonstrated through the non-linear power function (Figs. 7–9). Using of power functions provides the best result in the light of explained variance. In the less-favoured mountain areas the indicators show low to medium-strength dependence, characterised by the determination index $I^2$ = 0.54, while the dependence is significantly high in the less-favoured not mountain areas and the areas without less-favoured area status (Figs. 8 and 9).

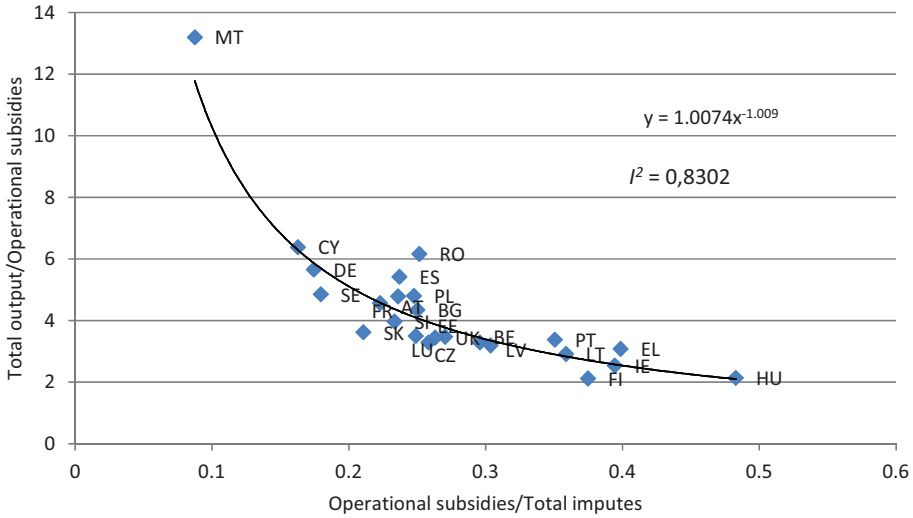
Subsidised costs were their highest in Portugal (0.54) and Greece (0.42) in 2012, where 1 EUR of accepted operational subsidies corresponded to an output of 2.4 EUR in Portugal and 3.4 EUR in Greece. A relatively high share of subsidised costs is mentioned for the Czech Republic, Finland and Slovakia, with a lower efficiency of subsidies. In this group, 1 EUR of accepted operational subsidies corresponded to an output of 1.75 EUR (in CZ), 1.84 EUR (in SK) and 2.05 EUR (in FI). Italy and Cyprus showed the highest cost effectiveness with 22% (in IT) and 20% (in CY) and a share of output of 6.6 (in IT) and 6.5 (in CY).

It is obvious that in the less-favoured not mountain areas (Tab. VI), there is no dependence of the output share of subsidies ($r$ = –0.026), the subsidy share of costs ($r$ = 0.054) and the output share of costs ($r$ = 0.139) on operational subsidies per hectare. The output share of subsidies affects the cost effectiveness ($r$ = 0.473), while the output share

VI: *Correlation matrix of the indicators in less-favoured not mountain areas*

| Variable | Operational subsidies | Total output /Operational subsidies | Operational subsidies /Total costs | Total output /Total costs |
|---|---|---|---|---|
| Operational subsidies | 1 | –0.026 | 0.054 | 0.139 |
| Total output/Operational subsidies | –0.026 | 1 | **–0.754** | **0.473** |
| Operational subsidies/Total costs | 0.054 | **–0.754** | 1 | –0.011 |
| Total output/Total costs | 0.139 | **0.473** | –0.011 | 1 |

Marked correlations are significant at p < 0.05, N = 225 (Casewise deletion of missing data)
Source: FADN, own results




8: *The relation of the share of subsidised costs and output to the subsidies in less-favoured not mountain areas in 2012*
Source: FADN, own results

VII: *Correlation matrix of the indicators in not in less-favoured areas*

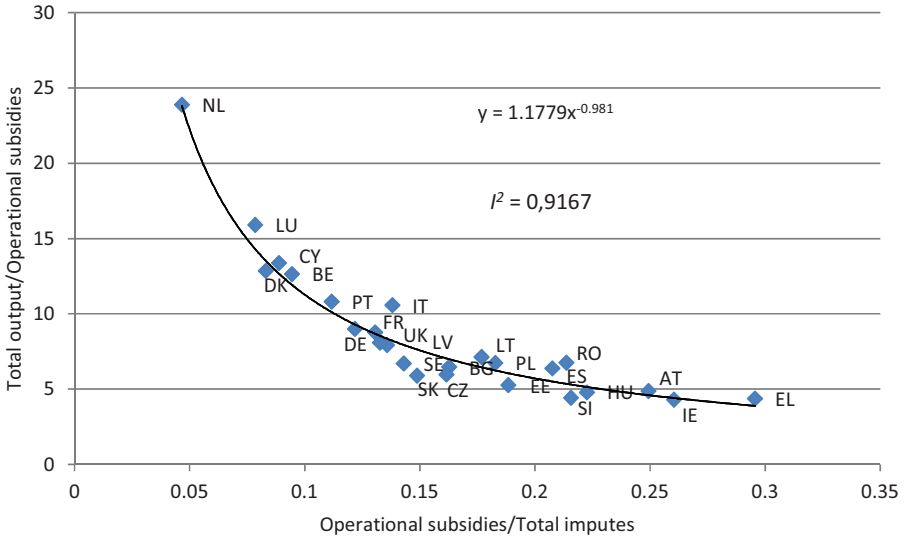
| Variable | Operational subsidies | Total output /Operational subsidies | Operational subsidies /Total costs | Total output /Total costs |
|---|---|---|---|---|
| Operational subsidies | 1 | **0.387** | 0.133 | **0.354** |
| Total output/Operational subsidies | **0.387** | 1 | **–0.711** | **0.269** |
| Operational subsidies/Total costs | 0.133 | **–0.711** | 1 | 0.138 |
| Total output/Total costs | **0.354** | **0.269** | 0.138 | 1 |

Marked correlations are significant at p < 0.05, N = 215 (Casewise deletion of missing data)
Source: FADN, own results

of subsidies is negatively dependent on the share of subsidised costs ($r$ = –0.754), as is also the case in the less-favoured mountain areas. The subsidy share of costs does not depend on the cost effectiveness ($r$ = –0.011).

The relation of the shares of subsidised costs and the output to the subsidies is demonstrated through the non-linear power function (Fig. 8) and characterised by the determination index for the less-favoured not mountain areas $I^2$ = 0.83. The subsidised costs reach their highest share in Hungary (0.48), with a relatively low efficiency of expended subsidies, where 1 EUR of accepted operational subsidies corresponds to an output of 2.1 EUR. A relatively high share of subsidised costs is mentioned for Greece, Ireland, Finland, Lithuania and Portugal, where 1 EUR of accepted operational subsidies corresponds to an output of 2–3 EUR. Malta shows the highest cost effectiveness where 9% of costs are subsidised and the share of output is 13 EUR. High effectiveness of subsidies is also reported in Cyprus, Germany and Sweden.

The areas which do not have less-favoured area status (Tab. VII) present a moderate dependence of operational subsidies per hectare on subsidies ($r$ = 0.387) and cost effectiveness ($r$ = 0.354). Subsidies do not depend on the share of subsidised costs ($r$ = 0.133). The output share of subsidies slightly affects the cost effectiveness ($r$ = 0.269) and negatively affects the share of subsidised costs ($r$ = –0.711), as is also the case in the LFA. The subsidy share of costs does not depend on cost effectiveness ($r$ = 0.138).




9: *The relation of the share of subsidised costs and output to subsidies to areas without less-favoured area status in 2012*
Source: FADN, own results

The relation of the share of subsidised costs and output to the subsidies is demonstrated through the non-linear power function (Fig. 9) and characterised by the determination index for areas which do not have less-favoured area status: $I^2 = 0.92$. The subsidised costs reach their highest share in the Nethelands, where 5% of costs are subsidised and 1 EUR of accepted operational subsidies corresponds to an output of 24 EUR. A high effectiveness of subsidies is mentioned for Luxembourg, Cyprus, Denmark and Belgium, where 8–10% of costs are subsidised and 1 EUR of accepted operational subsidies corresponds to the output of 13–16 EUR. Greece (0.3), Ireland (0.26), Austria (0.25), Hungary (0.22) and Slovenia (0.22) have the highest cost effectiveness with a relatively low effectiveness of subsidies, where 1 EUR of accepted operational subsidies corresponds to an output of 4.3 to 4.9 EUR.

## CONCLUSION

The Common Agricultural Policy has not only concentrated on the support of agricultural production but has also solved the problem of rural sustainability in a wider context in the last years. Rural sustainability and development have an imperative need of subsidies in the less-favoured areas (LFAs). This article is aimed at depicting the situation of subsidies, cost effectiveness and output of the less-favoured areas within the European Union countries.

Criteria for less-favoured areas were set within the Regulation (EC) 1698/2005. Based on these criteria, the entire land area of the utilised farmland in Malta is situated in an LFA and more than 90% of Portugal, Slovenia, Finland, and Luxembourg. Only 1% of the utilised farmland in Denmark is located in an LFA. Slovenia, Greece, Austria and Finland are countries with more than 50% of farmland consisting of less-favoured mountain areas. In cases where we compare the operational subsidies per hectare of utilised farmland in EU countries, Finland has been provided with the highest operational subsidies in the less-favoured mountain areas in 2012 ((1 036 €/ha), Malta was provided with the highest operational subsidies in the less-favoured areas (1 102 €/ha) and Luxembourg was provided with the highest operational subsidies in areas which are not less-favoured areas (1 628 €/ha). In contrast, the lowest operational subsidies per hectare of the utilised farmland in less-favoured mountain areas are in Spain, Romania and Bulgaria (300 €/ha).

Special attention is paid to the structure of operational subsidies. The relation of paid operational subsidies to the land area is obvious – decoupling is used (the independence of subsidies and output). The highest payments are achieved in decoupling of areas without less-favoured area status (the current share is 68% of total operational subsidies). This is probably connected with their being set on the basis of direct payments for output (before 2003) and payment decreases towards worse farming conditions (44% of total operational subsidies). The less-favoured areas obtain LFA subsidies and higher environmental payments, so the total operational subsidies per hectare are higher by 35% in the less-favoured mountain areas and by 7% in the less-favoured not mountain areas, than in areas which do not have less favoured area status.

The average operational subsidies per hectare of utilised farmland in the less-favoured mountain areas during the monitored period reached 501 €/ha and they increased steadily by 0.5% per year.

The average output per hectare of utilised farmland in the less-favoured mountain areas made 1 667 €/ha from 2004 and grew permanently with a growth rate of 2.4. The average costs per hectare in the less-favoured mountain areas were 1 508 €/ha and they changed similarly to the output. The variability of costs was lower than that of the output. The span did not change significantly in time. It peaked in 2009. The countries with the highest subsidies (1.5 of the EU average) are Cyprus, Greece, Finland, Austria, Sweden and Slovenia. Their operational subsidies are double compared to the average subsidies per hectare of countries in the other group (727 €/ha), as well as the average output (1 583 €/ha) and the costs (1 841 €/ha).

The average operational subsidies per hectare of utilised farmland in the less-favoured non- mountain areas during the monitored period reached 447 €/ha and they increased steadily by 0.2% a year. The variability of subsidies in the less-favoured not mountain areas is significantly lower than that of the output, and recorded a decreasing trend. The average costs per hectare in the less-favoured not mountain areas were 1 809 €/ha and they changed similarly to the output (1 927 €/ha). The variability of costs is lower than that of the variability of the output, with no significant trend. The variability of the output is evidently higher than that of the variability of the LFA and during the monitored period it showed no noticeable trend. A rather different situation is in Malta (with subsidies four times higher than the average of the group), as well as in and Greece and Finland (with double subsidies).

The average operational subsidies per hectare of utilised farmland in areas which do not have less-favoured area status during the monitored period reached 395 €/ha and they increased steadily by 3.1% a year. The variability of subsidies in the areas without less-favoured area status is lower than in the less-favoured not mountain areas. The span between the less-favoured mountain and less-favoured not mountain areas increased in time, i.e. the minima and maxima draw apart in the monitored period. The average costs were much higher than in the less-favoured areas (3 485 €/ha) and their variability was high compared to that of the LFA and stayed stable within the monitored period. The same situation can be observed about the span. The average costs per hectare (2 952 €/ha) were lower than that of the output but grew faster. The median increased by 3.4% a year. The variability of costs was lower than that of the output, and did not change noticeably in time, which was the same for the span as well. Luxembourg got more than triple the subsidies of other countries. Another group of countries (Belgium, Italy, Austria, Cyprus, Denmark, Germany, Ireland, France, Portugal, Greece and Slovenia) got a little higher subsidies than the EU average.

Correlation analysis proved that there are some differences in the effectiveness of subsidies between particular groups. Operational subsidies only positively affect subsidised costs in the less-favoured mountain areas. Moving towards worsening production conditions (i.e. towards the less-favoured mountain areas), the output share of subsidies depends more on cost effectiveness. No dependence of the output share of subsidies and the subsidised costs was proven in all groups. The share of subsidised costs does not depend on the cost effectiveness. The relation between the share of subsidised costs and output and the subsidies, explained through the non-linear power function, proved that dependence is lower in the less-favoured mountain areas, while dependence is high in the less-favoured non-mountain and areas which are not located in areas with less-favoured status.

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