International Conference "Risk in Contemporary Economy" ISSN-L 2067-0532 ISSN online 2344-5386
XXIIth Edition, 2021, Galati, Romania,
"Dunarea de Jos" University of Galati, Romania – Faculty of Economics and Business Administration

DOI https://doi.org/10.35219/rce20670532125

Diversification or Specialisation of Agricultural Production

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With respect to the topic „diversification *versus* specialisation of production", in the economic theory are laid down the obvious advantages of specialisation in relation with the economic efficiency and viablility, and the diversification seems to be a viable choice for some practitioners. Hypothesis: 1. under non-favourable climate conditions, some crops achieve superior productions to the detriment of the most others; 2. the specialised structure of production will determine, during the average period, superior economic results that will counterbalance the non-favourable periods; 3. the production diversification determines constant levels of efficiency due to the low impact of each crop upon the overall economic impact; 4. the viability of production specialisation or diversification could be determined by the safety margin.

Keywords: diversification, specialisation, agricultural economy, economic performance

JEL Code: D240

1. Introduction

The applied research of agricultural economy focused during the last decades on the farm modernisation, and the agricultural policies targeted the specialisation, land merging and reduction of production costs in order to meet the food demand at a lower price. The economic benefits provided by the increase of agricultural productivity have been favourable also to other economic sectors, as a result of the decrease in the real price of products for consummers. Due to the lower demand of labor in agriculture, the other economic sectors occupied the workforce that was not needed in the agricultural sector [10].

A lond period of time were noticed dominant speeches about the development and modernisation of agriculture, these being focused mostly on the specialisation and intensification of the agricultural production. However, it was considered wheter this method is reliable in the case of a resilient and sustainable agriculture [8]. Other studies pursue both strategies and their potential to reduce the average unit costs for producing a consumption good.

The large farms, privately or cooperatively owned, can register a lower productivity, but higher profits per hectare. From the economic point of view, as far as the savings, investments and innovation are concerned, the large scale agriculture might be better. Even in terms of static productivity, if the small farms are more productive due to the fact that they use more input per hectare, the reduction of the farm sizes, without ensuring a higher level of input per hectare, might not bring the foreseen result. [1].

The farms with smaller sizes have much higher operation costs, and the increase of their ability to extend and diversify their production is fundamental in order to increase their competitiveness and to remain on long term viable in the new world agriculture. The transition occurred in the agriculture of the Central and Eastern European countries targeted a change of its organisation pattern. This intense process stimullated the debates regarding the economic efficiency of these structures, the farm sizes and the legal forms of establishment. Several opinions took into consideration the maintaining of intensive-production farms, with a collective organisation, the farms with smaller size being perceived as more inefficient [9].

The scale efficiencies are an important component for the production technologies. The agriculture transformation in the world was often accompanied by the increase in scale efficiencies and this could be a process applied in the developing countries. This type of approach is common on the entire European territory, an issue for the farmers being the risk to remain blocked in a continnous wave of investment and the increase of their indeptedness. Another group of farmers chose a different strategy that combines a market diversity based on a niche market [4].

The extreme specialisation and the exploitation of the scale efficencies could generate cost comparative advantages for the individual farmers, but also at regional scale. In the case of the fruits and vegetables farms, a strong specialisation creates a dependence on the large retailers' decisions. Only the strong centralised and large scale marketing agencies are able to counterbalance this power. The specialised farms from regions without such kind of institutions are especially at risk of entering into bankruptcy, because of the high level of their indeptedness, the continnous use of externally-financed innovation and the lack of marketing knowledge. If any of the conditions needed to obtain a cost comparative advantage is missing, the regions are extremely vulnerable too.

The increased specialisation weakens the economic resilience of the agricultural households [3].

The modernisation paradigm, based on specialisation and scale efficencies, could be modified when the farmers collaborate, by sharing knowledge, setting up alliances and defining alternative strategies of development and marketing based on diversification.

The diversification and the scale economies significantly contribute to more sustainable and resilient ways of development. The limits of the main pattern of agricultural development, based on scale economies and specialisation, become increasingly visible. The dismantling of the price supporting policies made the high specialised farms to clearly become more economically vulnerable and to face higher market risks than the more diverse farms that uses alternative manangement strategies. This fact makes us to argue that the decision-making factors and those with influence upon the contemporary agricultural knowledge and informatic systems should reconsider the advantages of the more diverse farms and alternative management strategies. [5].

An important aspect of the firm manangement based on scale efficiency is the company capacity to access markets for their entire range of products and to be competitive as far as both the quality and the price are concerned. The complementary effects of product diversification can generate the productivity increase with a minimum effect on scale efficiency. These effects act against the non-convexity of the production function, fact that explains the scale efficiency increase. Another positive effect consists in spreading the maximum and minimum values of the workforce demand, that are often difficult to manange within specialised farms [7].

The risk complex in the agricultural field is exclusively formed by systemic risks, some

being exclusively independent and some being mixte. In the case of „the harvest receipts" and of „the receipts at the level of agricultural holding", where the first value is calculated by multiplying the price by the harvest/ha, and the second one, adding the receipts from all types of harvest, both having charactersitics related to the independent risks as well as to the systemic ones. [6].

The cost theory offers three posible reasons to increase the scale efficiency: specialisation, size effects and indivisibilities. The specialisation involves a more fine aspect of the division of labour as far as the research project grows. The size effects address the case when a larger production unit produces more than a smaller unit. The indivisibilities are available only when the inputs are available in certain minimum sizes. The scale efficiency depends in a very large proportion on the intensive technological development of capital. The geografical concentration of specialised farms generates benefits of agglomeration and associated reductions of unit costs. This fact allowed for some regions to obtain a cost comparative advantage for certain agricultural products, because these overcome the competition from the less specialised regions [2].

The topic of production diversification *versurs* specialisation in general and of agricultural production in particular has a long history and, even if in the economic theory are estasblished the obvious advantages of specialisation in relation with the economic efficiency and viability, the diversification seems to be a viable choice for some practititioners. These farmers or entrepreneurs from other economic branches consider that carrying on several parallel activities or the achievement of a larger product range can lead to the increase in economic viability. Practically, for example, if the farmers will achieve a large number of crops in the period of general decline, when most of the crops register losses, the other crops will register high average productions that will counterbalance the before-mentioned losses.

In oder to sustain this topic or to supply analysis tools needed by the entrepreneurs in order to support their decision on diversification / specialisation, studies had been carried out with own teams that had as premises the folowing hypothesis:

1. under non-favourable microclimate conditions, some crops achieve superior production to the detriment of the most others;
2. the specialised production structure will determine superior economic results *per* average period, that will counterbalance the periods (years) when their productions registered low values;
3. the production diversification determines constant efficiency levels due to the low impact of each crop upon the overall economic result;
4. the viability of production specialisation or diversification could be determined by the safety margin.

The research with the results to be presented hereby was carried out at a plant farm in Botoşani county, with a total area of cca. 640 ha, oriented on a production structure dominated by the large crop: wheat, peas, maize, sunflower seed, rapeseed and barley.

In the first stage, according to the hypothesis taken into consideration, there is an inverse correlation between the average productions at different crops and, under these conditions, the production diversification is justified by the existence of some crops that register production increases during the non-favourable years for the other crops.

Table no. 1

Pearson coefficient for the correlation between the main crops

Crop	barley	beans	maize	peas	potatoes	rapeseed	rice	soybean	Sunflower seed	wheat	maximum	minimum
barley	-	0,4	0,6	0,3	0,5	0,3	0,2	0,3	0,7	**0,9**	**0,9**	0,2
beans	0,4	-	0,5	0,4	0,4	***0,1***	0,2	0,6	0,1	0,5	0,6	***0,1***
maize	0,6	0,5	-	0,5	0,6	0,5	0,5	0,8	0,8	**0,8**	**0,8**	0,5
peas	0,3	0,4	0,5	-	0,2	0,5	0,4	0,7	0,4	0,6	0,7	0,2
potatoes	0,5	0,4	0,6	0,2	-	0,2	0,3	0,5	0,5	0,6	0,6	0,2
rapeseed	0,3	***0,1***	0,5	0,5	0,2	-	0,4	0,6	0,5	0,6	0,6	***0,1***
rice	0,2	0,2	0,5	0,4	0,3	0,4	-	0,5	0,5	0,4	0,5	0,2
soybean	0,3	0,6	**0,8**	0,7	0,5	0,6	0,5	-	0,5	0,6	**0,8**	0,3
sunflower seed	0,7	0,1	0,8	0,4	0,5	0,5	0,5	0,5	-	0,7	0,8	***0,1***
wheat	**0,9**	0,5	**0,8**	0,6	0,6	0,6	0,4	0,6	0,7	-	**0,9**	**0,4**

Thus it was determined the evolution of the average productions at the following crops: barley, beans, maize, peas, potatoes, rape, rice, soybean, sunflower and wheat based on the data obtained from FAOSTAT. The analysed period covered 58 years (1961-2018) and information for the productions in Romania (Annex: average productions for diversification / specialization) was sampled.

The analysis of the above-mentioned ten crops does not indicate any form of inverse correlation (negative Pearson coefficient), therefore no crop recorded an increase of the average productions, under the conditions when the average productions decrease for other crops.

For example, if there is a significant negative correlation between the beans and rapeseed crops, Pearson coefficient should register values between -0,70 şi -1,00.

Pearson coefficient for the average beans production in correlation with the average rapeseed production (fig. 1) registered a value of cca. 0,14. This indicates the lowest correlation level between the two variables, but not also an inverse relation between them. An inverse relation should be expressed by a correlation coefficient with negative value.

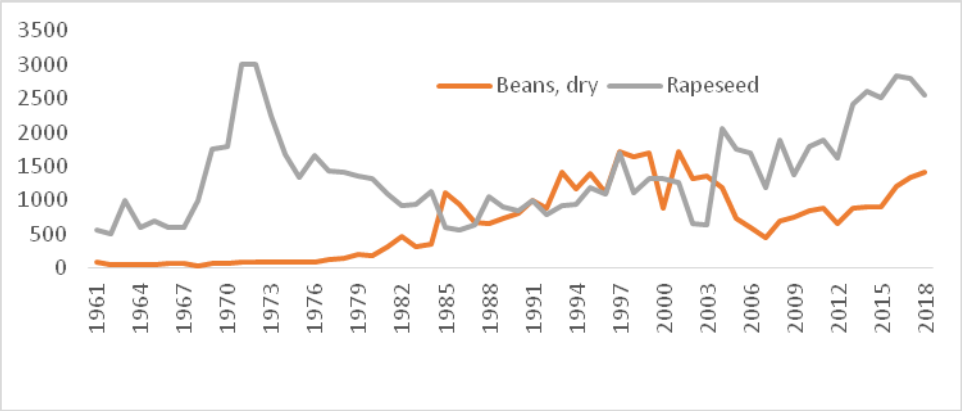

Figure no.1 Correlation between the beans and rapeseed average productions in Romania in the time frame 1961-2018 – as example
(FAOSTAT data)

Thus is ruled out the hypothesis that the production diversification is justified by the existence of some crops that register production increases during the non-favourable years for the other crops. The practititioners are likely to be confused by some exceptional events when, in some years, some crops bring enough productions as to enhance the unit cash flow.

However is usefull to be aware of some positive correlations between species as wheat and barley or maize and soybean, cases where Pearson coefficient for the average productions is 0,9 and respectively 0,8.

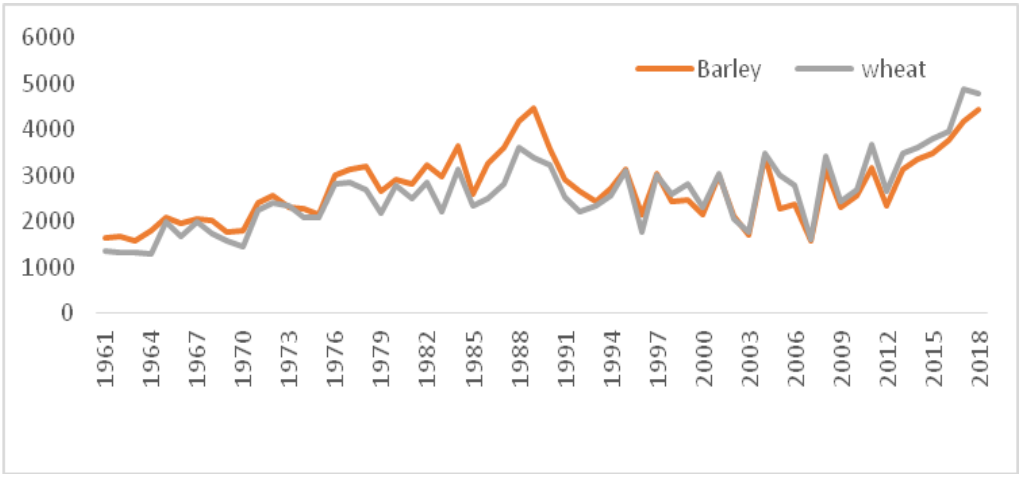

Figure no. 2 Correlation between the barley and wheat average productions in Romania in the time frame 1961-2018 – as example
(FAOSTAT data)

The obtained results point out the Pearson coefficient of 0,89 for the wheat average production in correlation with the barley average production (fig. 2). This value indicates common particularities of both crops (belonging to the same botanical family - Gramineae).

The research results in this stage show that there is no inverse correlation between the average productions at the analysed crops. Under these conditions, the production diversification is not justified by the existence of some successful crops under the conditions when the other crops register low productions.

In the second stage was determined the average income for the six analysed crops, in order to figure out the possibility to obtain some superior receipts at some crops, under the conditions when the most of the crops register decreases in average production.

The annual average income does not register significant different values except the barley crop, therefore all the others would be appropriate to build up the production structure in a diversified system.

The annual minimum income shows how much a farm income level can be reduced in non-favourable years. Thus, if the farm area has about 6 ha and it would be cultivated with 1 ha *per* each species, the total average income as the mean of the 5 years considered in analysis would be about 20.150 lei, while during non-favourable years, this income would drop up to 18.140 lei.

Table no. 2

Calculation of the average income *per* analysed crops

economic indicators	wheat	peas	maize	Sunflower seed	rapes eed	barley
average price (lei/kg)	0,70	1,40	0,60	1,30	1,60	0,60
average production (kg/ha)	4.360	2.214	5.740	2.780	2.815	4.060
minimum production (kg/ha)	4.100	2.700	3.800	2.100	2.700	3.600
maximum production (kg/ha)	4.800	2.960	7.900	3.200	2.960	4.600
variabilitaty of production (kg/ha)	700	260	4.100	1.100	260	1.000
variabilitaty of production (%)	16,1	11,7	71,4	39,6	9,2	24,6
annual average income (lei/ha)	**3.052**	**3.100**	**3.444**	**3.614**	**4.504**	**2.436**
annual minimum income (lei/ha)	**2.870**	**3.780**	**2.280**	**2.730**	**4.320**	**2.160**

However, the main objective of each entrepreneur is to maximize the gross profit and the activity return. For this purpose was calculated: the average gross profit, the minimum gross profit, the average return, the minimum return.

Table no. 3

Calculation of total income and of total expenses *per* analysed crops

economic indicators	wheat	peas	maize	sunflower seed	rapeseed	barley
total average expenses (lei/ha)	2.438	2.566	2.403	2.410	2.507	1.897
total minimum expenses (lei/ha)	2.380	2.883	2.078	2.174	2.466	1.811
annual average income (lei/ha)	3.052	3.100	3.444	3.614	4.504	2.436
annual minimum income (lei/ha)	2.870	3.780	2.280	2.730	4.320	2.160

The total average expenses registered a mean per crops of 2335,5 lei/ha from a minimum of 1.897 lei/ha for the barley crop, to a maximum of 2.566 lei/ha at the peas crop. The total minimum expenses were significantly lower at the barley crop.

The annual average income had a maximum value at the rape crop, while at the barley crop this had a minimum value.

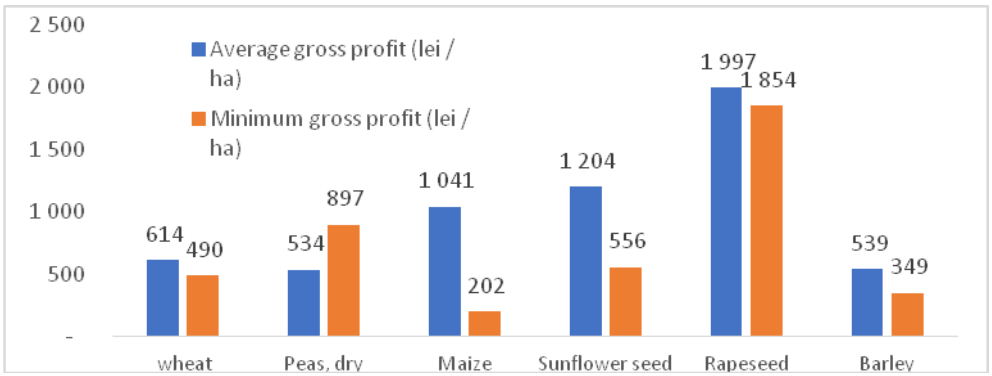

Figure no. 3 Calculation of average gross profit per analysed crops

The average gross profit by the rapeseed crop has superior values in comparison with the other crops (fig. 3). This brings during the whole analysed period a total value of 9.985 lei/ha as amount of the considered 5 years, and the less favourable year would supply a minimum profit of 1.897 lei/ha. At the other end, the barley crop brings during the whole analysed period a total value of 2.695 lei/ha as amount of the considered 5 years, and the less favourable year would supply a minimum profit of 1.746 lei/ha.

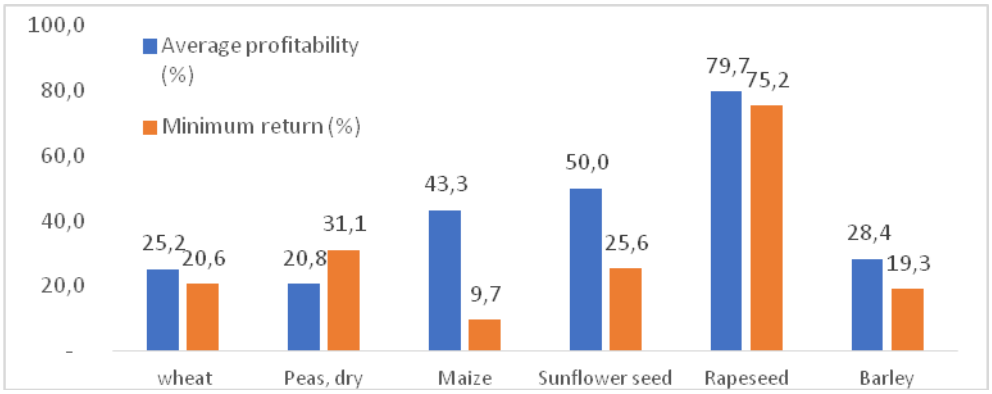

Figure no. 4 Calculation of the average rate of return *per* analysed crops

The efficiency of the use of resources is expressed hereby through the rate of return (fig. 4) that has an average value of 41,2% and can drop out to a value of 30,2% in the non-favourable years for agricultural production. Therefore, if the farm would own equal surfaces for each crop, it would obtain 41,2 lei gross profit per 100 lei total expenses, and during non-favourable years, 30,2 lei gross profit per 100 lei total expenses.

By the other hand, if this farm would produce only rapeseed, it would obtain 79,7 lei gross profit per 100 lei total expenses, and during non-favourable years, 75,2 lei gross profit per 100 lei total expenses. This would be an excesive specialisation form less probable to be achieved from technical reasons (crop rotation, incidence of diseases and organisms harmful to plants etc.), but also a production structure comprising the most profitable crops would register a return with an average value of 57,6% and could decrease up to a value of 36,8% during the non-favourable years for agricultural production.

Therefore, when the natural and technological factors are taken into consideration, the specialisation of production structure determined by the level of gross profit and return can be appropriate in relation with a crop rotation formed by the (average) most profitable and

cost-efficient crops.

The third stage had as premises the hypothesis that the production diversification determines constant leveles of efficiency due to the low impact of each crop upon the overall economic result. Consequently, the sensitivity analysis was carried out on the gross profit and rate of return by reducing the production or price (therefore the total income) by 10, 20 and 30%.

The sesitivity analysis is the technique used to determine how the independent variable values will have impact upon a certain dependent variable within a given set of hypothesis.

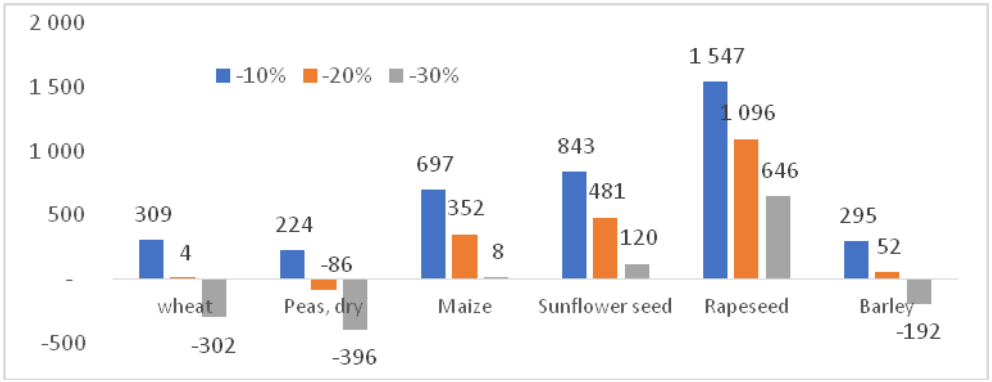

Figure no. 5 Sensitivity analysis carried out on on the average gross profit (lei)

The sesitivity analysis carried out on the average gross profit by reducing the production or price by 10, 20 and 30% (fig. 5) indicates the recording of losses at half of the crops under study. The impact of income reduction has a disproportionate effect to profit. For example, the total income reduction by 10% at the wheat crop determines a reduction of the average gross profit by 49,7,3%; in turn, at the most profitable crop, the impact of the same income reduction will determine a decrease of the gross profit by 22,6%.

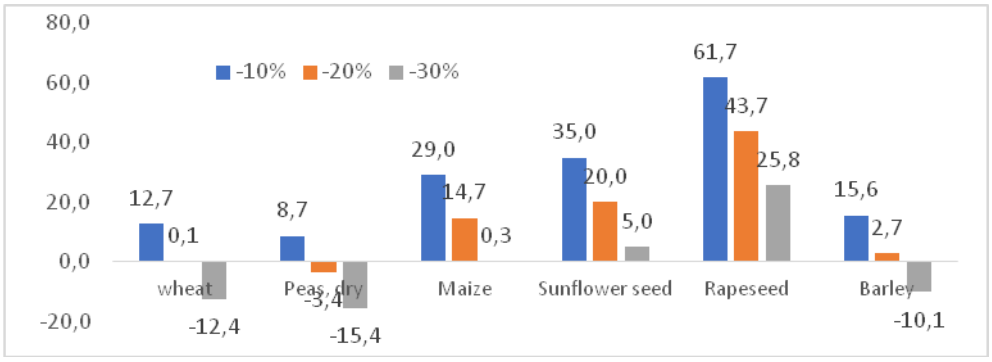

Figure no. 6 Sensitivity analysis carried out on the rate of return (%)

The sensitivity analysis carried out on the rate of return (fig. 6) by reducing the production or price (therefore, the total income) by 10, 20 and 30% will indicate, also, rates of losses and the disproportion is maintained at the same level as well as in the profit case. Thus, the total income reduction by 10% at the wheat crop determines a reduction of the rate of return by 49,7,3% at the rapeseed crop too, and the impact of the same income reduction will determine a decrease of the rate of return by 22,6%.

Thus was ruled out the hypothesis considering that the production diversification determines constant levels of efficiency due to the low impact of each crop upon the overall economic result. The diversification is not justified by this judgement, also.

In the fourth research stage we analyse the choice of production specialisation or diversification strategy based on the use of the safety margin. This indicator is represented by the difference between the foreseen total production and the production at the breakeven point. This represents the safety of the economic unit. The greater this segment is in comparison with the total production segment, the more confident we will be that we will obtain profit. In other words, it is desirable for the breakeven point to be as close as possible to 0. To be even in the point 0 if it would be possible, but this fact would mean that we don't have standing charges.

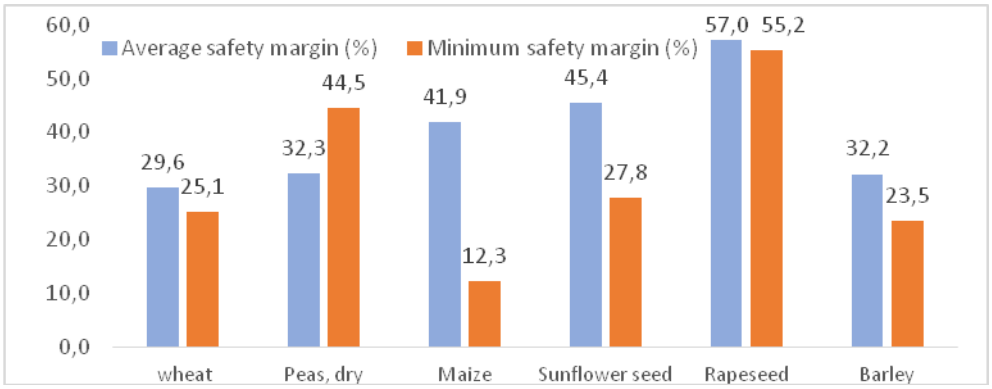

Figure no. 7 Safety margin (%)

The safety measurement according to the breakeven point is carried out by means of the safety margin. In fact, for us this is the most important indicator because it helps us to find out which is the farm capacity to counterbalance the before-mentioned risks. The safety margin (Ms) is determined as the difference between the foreseen total production (Qp) and the production at breakeven point (Qc) expressed in percentage in relation with the foreseen total production :

$$Ms = \frac{Qp - Qc}{Qp} x100$$

In order to determine the safety margin with this relation, it is necessary to know the breakeven point, that it not necessarily always needed; therefore, sometimes is more useful to take into account one of the following calculation relations:

$$Ms = \frac{Pb}{Vt - Chv} x100 \quad \text{sau} \quad Ms = \frac{Vt - Cht}{Vt - Chv} x100$$

The last relation needs only to know the following main indicators: total income (Vt),total expenses (Cht) and variable expenses (Chv).

In this context, the safety margin expresses the capacity of each crop to support the potential risk in order to register profit in non-favourable periods, too (fig. 7). For example, the reduction in wheat price by 10% and in production by 20% determine the income reduction by 30%, as well as the reduction in the variable expenses with the same value, when the standing charges remain unchanged. At a safety margine of 29,6% the average gross profit would be reduced to -8 lei/ha. If the safety margin would have been 30%, equal with the price and production variability, the income would have been equal with the expenses – profit 0.

We consider that a production structure formed by crops with superior safety margin would be less volatile in non-favourable circumstances. Therefore, the result of this stage leads us to the conclusion that the specialisation is an alternative with an economic viability superior to diversification.

5. Conclusions

The results of the studies regarding the viability of diversification *versus* specialisation shows that the production diversification is not justified by the existence of same successful crops in non-favourable periods; the production structure specialisation determined by the level of gross profit and return can be appropiate when is achieved a crop rotation consisting in the most profitable and cost-efficient crops; the production diversification does not determine constant efficiency levels due to the low impact of each culture upon the overall economic result; a production structure formed by crops with superior safety margin would be less volatile in the case of non-favourable circumstances.

Acknowledgement

This work is supported by the project POCU, in the framework of Human Capital Operational Programme 2014-2020, financed from the European Social Fund under the contract number 47331/26.06.2019 HRD OP /379/6/21 – SMIS Code: 124388.

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