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CHANGES IN THE ECONOMIC SIZE AND PRODUCTION DIRECTION IN FARMS AS A RESULT OF INVESTMENTS IN FIXED ASSETS

Elżbieta Jadwiga Szymańska[1], PhD with habilitation, Associate Professor;
Mariusz Dziwulski[2], PhD

Institute of Economics and Finance, Warsaw University of Life Sciences – SGGW

ABSTRACT

The research aimed to identify the impact of the implemented projects on the change in the economic size and direction of farms. The research used studies of the literature on the subject and data from 4 803 farms that kept continuous accounting under the FADN system in 2005–2013. The analysed economy was grouped according to the value of investment outlays in funds, economic size, and production type. Research shows that the increase in the level of investment is conducive to increasing the economic strength of farms. However, these investments must be high enough to ensure the appropriate level of difficulty. For the lower average level of questions, smaller languages are less and very small. Moreover, investments favour and accelerate the processing of farms, which may also improve their economic effects. In the analysed group of mixed-type farms, they changed the destination for the cultivation of cereals and the place of milk.

Key words: investments, farms, economic size, type of farming, farm migrations
JEL codes: E22, Q12

INTRODUCTION

Equipping farms with production fixed assets affects their economic situation. The possession of modern machinery and technical devices enables the use of new technologies, which in turn contribute to an increase in work efficiency, quality improvement, or an increase in the production scale (Gołębiewska, 2010). Undertaking investment activities in farms proves that their owners have a market orientation, increase the size of production and modernize farms (Józwiak and Kagan, 2008; Zając, 2012). The rationale for increasing the resources of machinery and equipment is the existence of potentially profitable opportunities to increase the scale of production and reduce costs by choosing more capital-intensive production methods (Begg 1998). According to Czubak (2012), investments in farms enable the renewal of fixed assets, which translates into an improvement of production processes, animal welfare, farm development, and, consequently, an increase in farm income.

The investment activity undertaken by farmers is particularly important and necessary in the modernization and restructuring of farms. The scale of undertaken investments determines the survival, development, and competitiveness of a farm in the conditions of a market economy (Hüttel, Muβhoff and Odening, 2010). Investments in fixed assets indicate

[1] Corresponding author: Nowoursynowska 166, 02-787 Warsaw, Poland, elzbieta_szymanska@sggw.edu.pl, +48225934227
[2] Corresponding author: mariusz.dziwulski@gmail.com

that the farmer increases them or improves their quality, which is to contribute to increasing the farm's potential in the future. The improvement of technical means of work, as well as the introduction of modern machines and devices in agricultural production, lead to an increase in productivity in both plant and animal production.

The types of investments in farms are often determined by natural conditions and the preferred direction of production. It is related to the necessary equipment with appropriate machinery and equipment needed to conduct agricultural activity under certain conditions. Differences in equipping with production factors affect the economic strength and competitiveness of farms (Czudec, 2008). An important issue is therefore the appropriate adjustment of farm equipment to the type of production and the needs reported by farmers in this regard. Due to the importance of investments, it becomes important to determine their consequences on the development and direction of production. The research aimed to identify the impact of the implemented investments on the change in the economic size and production direction in farms.

THEORETICAL BACKGROUND

In a globalized economy that increasingly affects agriculture, to strengthen (or only to maintain) their agricultural market position and to meet the demand of buyers of agricultural primary products, the farms must take intensive investment activities that enhance the competitiveness of their products as regards both cost and quality aspects. Usually, this implies the use of an adequate process of investments in productive fixed assets, which generally are an essential way of conveying progress and innovation to the relevant manufacturing methods of agricultural primary products (Woś, 2004; Zwolak, 2010). Farm investment in agriculture is crucial to improve farm competitiveness, sustainability, and resilience (EC & EIB, 2016). The investment allows farmers to adapt to changes in economic conditions (e.g. price variations, policy reform, climate change) and to adjust to public regulations (e.g. environmental or animal welfare regulations).

According to Józwiak and Kagan (2008), the investment activities are evidence of the commercial, farm modernization, and expansion of production scale. Undertaken productive investments decide about development opportunities of farms. They show that a farmer increases assets or raises their quality, which contributes to increasing the farm capacity in the future. Improving technical work, as well as the introduction of new machinery and equipment for agricultural production leads to increased productivity in both crop production and livestock. On the other hand, lack of these actions may lead to processes that rely on reducing resource inputs, or reduce the number (or range) conducted activities (Kalinowski and Kiełbasa, 2010; Mikołajczyk, 2012). Investment in infrastructure has been cited as an important source of growth in agriculture (Jayne et al., 1994). Nelson (1964 and 1981) recognized that there are important interactions between capital formation, labour allocation, technical progress, and productivity.

The objectives of the investment measures implemented in agricultural holdings should be in line with the adopted directions of structural changes in agriculture. They involve, among others, the provision of adequate size and structure of food production, improvement of living and working conditions of the rural population, or environmental protection. The last of these issues matter to the growing importance of the concept of sustainable agriculture, strongly accentuating the model of agricultural production that is goal-oriented in terms of production and equally in the implementation of environmental and social objectives (Kowalski, 1997).

Farmers' investment decisions are influenced by investment prices (lower prices would encourage investment), as well as output prices (higher prices would encourage investment to produce more). There exist public policies directly targeting investment, e.g. subsidies for implementing specific investment projects or tax policies linked to investment. Those policies aim at decreasing investment costs. Other policies may influence farmers' investment decisions indirectly, through their impacts on market prices. It should however be noticed that in most developed countries and in particular the EU, direct intervention on output market prices has been progressively replaced by payments decoupled from production and prices.

In the agricultural economics literature dealing with farm investment, no consensus seems to emerge on the relative impacts of investment price and output price on farmers' investment decisions. Thijssen (1996), considering Dutch farms observed from 1970 to 1982, finds significant responses of investment to both investment and output prices and concludes that investment subsidies are good policy incentives to agricultural investment. On the other hand, the results obtained by Vassavada and Chambers (1986) in the case of U.S. agriculture show no response of quasi-fixed factors to their prices and a negative response to the price of output. Oude Lansink and Stefanou (1997) obtain the same puzzling effect of output price on investment in the case of Dutch cash crop farms between 1971 and 1992. Serra et al. (2009), using data for Kansas farms from 1997 and 2001, compare the sensitivity of investment to output price to its sensitivity to public payments, and find investment to be more sensitive to output price in periods of the favourable economic situation (i.e. increase in capital stocks) and more sensitive to government support in the case of the difficult economic situation.

Research in the French cultivation sector suggests that during periods of stable output prices, the level of expected output prices strongly affects farmers' behaviour, more than the level of the investment price. However, this is not the case anymore when prices become volatile. The production and investment choices are based on expected future profit. To make his/her decisions, the farmer observes input prices and investment cost in the current period and has to forecast the output price, as well as the future evolution of input prices and investment cost in the next periods (Femenia, Latruffe and Chavas, 2017).

Changes in the economic situation on agricultural markets have a significant impact on the strategic decisions of farms in terms of the amount of investment outlays. Favourable conditions in the environment of farms largely contribute to the fact that farmers undertake investment activities (Zając, 2012), while the agricultural products reduce the willingness to invest in agricultural activity (Musiał, 2009). Market conditions, on the one hand, contribute to the specialization of farms. On the other hand investment processes largely shape the economic situation of agriculture. Their scope and nature determine the directions of development of this sector.

MATERIALS AND METHODS

The research used studies of the subject literature as well as data from 4 803 farms that kept continuous accounting under the FADN system in 2005–2013. The selection of such a time range resulted from three premises:

a) in the analysed period, the most dynamic changes in the level of investments in the Polish agricultural sector took place, which allows for a reliable assessment of changes in the property of farms after Poland acceded to the EU,
b) the adopted scope covers the implementation of two support programs important for co-financing investments in agriculture, such as the Sectoral Operational Program 2004–2006 and RDP 2007––2013,
c) the condition of continuing accounting under the FADN system significantly reduces the size of the surveyed sample. To optimize the correctness of inference, it was limited to the 9-year research period.

The analysed farms were grouped according to the value of investment outlays in fixed assets in total in the analysed period, economic size, and production type.

Investment outlays include the value of purchased and manufactured fixed assets on the farm. According to this criterion, farms were divided into three quartile groups.

– Q1 – 25% of farms with the lowest level of investment outlays;
– Q2–Q3 – 50% with an average level of capital expenditure;
– Q4 – 25% of farms with the highest level of investment outlays.

In the division of farms into groups of economic size, the classification in relation to the Standard Output index (SO – Standard Output) from 2007 (Bocian and Cholewa, 2013) was used. The economic value determined on the basis of SO means the possible value of production that a farmer is able to achieve

with the possessed potential and running a business in a given region. The study identified six groups of farms: 1 – very small (2 000 ≤ 8 000 EUR), 2 – small (8 000 ≤ 25 000 EUR), 3 – medium small (25 000 ≤ ≤ 50 000 EUR), 4 – medium large (50 000 ≤ 100 000 EUR), 5 – large (100 000 ≤ 500 000 EUR), 6 – very large (≥ 500 000 EUR).

The type of farming, following the FADN methodology, was determined based on the share of individual agricultural activities in the creation of the total value of Standard Output on a farm (Florianczyk, Osuch and Płonka, 2016). The following types of farming were distinguished under this criterion: field crops, horticultural crops, permanent crops, dairy cows, herbivores, granivores, and mixed animals.

RESEARCH RESULTS AND DISCUSSION

The average economic size of the researched farms in 2005 was 45 thousand EUR SO (Table 1). The share of plant and animal production in the total production value was similar and accounted for 44% and 46% respectively. The structure of the herd was dominated by pigs with a share of 58%. The average farm in the sample generated income at the level of 46.5 thousand PLN and the share of subsidies to operating activities in the income was 34%.

The data show that with the increase in the value of investment outlays, the average economic size of a farm, the area of arable land, and the value of assets increased. Farms with higher investment levels were characterized by a lower share of payments in agricultural income. In the first group, it was 45% and in the third 32%. It resulted from a higher level of agricultural income on farms with higher investment inputs. In the first group, it amounted to 17.5 thousand PLN, and in the third – 93.3 thousand PLN per farm. Similarly, when calculated per full-time employee, the differences in average income between the analysed groups were large, from 11.4 thousand PLN up to 54.4 thousand PLN. At the same time, in entities investing more funds, the overall debt ratio of the farm was higher. In the first group, it was 5% and in the third – 18%.

In the studied group of farms, the investment activity of farmers was associated with an increase in the economic size of farms. In 2013, in the third group (Q4), as many as 31% of entities were classified into groups with greater economic strength than in 2005 (Table 2). In the second group (Q2–Q3), slightly more than 17% of the examined objects changed the economic size class to a higher one, and in the first group – only 7%. This was because investments in farms are usually associated with the expansion of the farm's production resources, mainly land and capital in the form of fixed assets. Therefore, the conducted research confirms the thesis that a higher level of economic size has a positive effect on the investment activity of farmers (Dziwulski, 2013).

Table 1. General characteristics of farms in the research sample in 2005

Description	UoM	Q1	Q2–Q3	Q4	Total
Number of farms	number	1 200	2 402	1 201	4 803
Economic size	EUR SO	20.9	37.4	85.0	45.2
Agricultural land area	ha	15.0	26.4	59.1	31.8
Total labour inputs (AWU)	AWU	1.7	2.0	2.6	2.1
Income from activity	thous. PLN	17.5	37.7	93.3	46.5
Share of subsidies in income	%	45	34	32	34
Income per full-time employee (own work – FWU)	thous. PLN / FWU	11.0	21.9	54.4	27.3
Asset value	thous. PLN	248.6	401.1	879.5	482.6
Overall debt ratio	%	5	9	18	13

Source: own study based on FADN data.

Table 2. Farm migrations within separate economic size groups in individual investment groups in 2005 and 2013

	Number of farms in relation to the economic size in selected investment groups																	
	Group	Q1					Q2–Q3						Q4					
	ES	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	5	6
Number of farms in 2013	1	**54**	133	3			**6**	31	2		2							
	2	20	**649**	96	6	1	17	**563**	200	13	1			**15**	9	3		
	3		48	**120**	18			193	**746**	125	3		3	39	**142**	34	2	
	4		6	8	**31**	1		16	140	**247**	18			11	157	**328**	38	
	5				4	**2**	2	2	6	38	**30**	1		4	20	139	**247**	2
	6																2	**6**
	Total	**74**	**836**	**227**	**59**	**4**	**25**	**805**	**1094**	**423**	**54**	**1**	**3**	**69**	**328**	**504**	**289**	**8**
% of farms in 2013 as compared to 2005	1	**73%**	16%	1%	0%	0%	**24%**	4%	0%	0%	4%	0%	**0%**	0%	0%	0%	0%	0%
	2	27%	**78%**	42%	10%	25%	68%	**70%**	18%	3%	2%	0%	0%	**22%**	3%	1%	0%	0%
	3	0%	6%	**53%**	31%	0%	0%	24%	**68%**	30%	6%	0%	100%	57%	**43%**	7%	1%	0%
	4	0%	1%	4%	**53%**	25%	0%	2%	13%	**58%**	33%	0%	0%	16%	48%	**65%**	13%	0%
	5	0%	0%	0%	7%	**50%**	8%	0%	1%	9%	**56%**	100%	0%	6%	6%	28%	**85%**	25%
	6	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%	0%	0%	0%	1%	**75%**

Explanation: 1 – very small, 2 – small, 3 – medium-small, 4 – medium large, 5 – large, 6 – very large.

Source: own study based on FADN data.

Most entities (21.5%) that decreased their economic size in the analysed period were in the group with the lowest level of investment (Q1). Among them, however, a significant percentage was occupied by large and very large farms (50%). Perhaps it was because these farms achieved maximum values due to the scale effects. However, the reason for low investment activity among large farms may be not only economic but also non-economic conditions, e.g. the lack of the possibility of maintaining business continuity resulting from the lack of a successor.

The data show that in 2005 the vast majority of farms (76%) in the first group (Q1) were very small and small farms (with an economic size below 25 thousand EUR). Among them, 92% in 2005–2013 remained in the group or moved to a group with a smaller economic size. At the same time, a significant part of very small and small farms, which in 2007–2013 were in the group with the highest level of investment (Q4), showed quite a clear potential for development. The data show that as many as 58% of entities, which in 2005 were classified as 'very small', 'small' and 'medium-small', increased the economic size group to a larger one. In 2005, small and very small farms constituted only 6% of investing entities.

The majority of this group were medium-sized farms (medium-small and medium-large) – nearly 70%. Therefore, this confirms the conclusions of the research by Zalewski, Bórawski, and Bełdycka-Bórawska (2017), who stated that the level of investment in small farms indicates that only some of them try to stay on the market by carrying out investments. The remaining ones, in conditions of strong competition, are forced to shut down their production. In this situation, it seems unjustified to support investments in small farms, of which only a few have a chance for development. Nevertheless, the issue of small farms is an important aspect from the point of view of shaping agricultural policy. The assessment of the development potential of farms should not only focus on the level of generated revenues but also take into account their environmental and social significance. These aspects have been largely taken into account in the EU agricultural policy for 2014–2020.

In the analysed group of farms, the dynamics of the change in the type of farming was even greater than in the case of the change in the economic size. It intensified along with the increase in the investment activity of farmers. The research shows that in 2005–2013 the number of farms with the 'mixed' type of farming decreased by 39%, of which by 49% in the group with the highest level of investment (Q4), by 41% in the group with an average level of investment (Q2–Q3) and 31% in the group with the highest level of investment expenditure (Q1). On this basis, it can be concluded that agricultural investments in fixed assets made after 2004 were conducive to the processes of specialization. At the same time, 22% of specialized farms from the first group (Q1) changed the farming type to mixed, while in the third group it was only 10% of entities. The relatively large scale of the growth of specialization in farms in this group may prove that this phenomenon is common, but the investments made in the analysed period were conducive to accelerating this process.

The mixed-type farms focused their production mainly on the cultivation of cereals and dairy cows. Almost 42% of farms from the studied group, which in 2005–2013 changed the type of farming from 'mixed' to 'cereal' and 31% to 'dairy cows'. When analysing the selected groups in terms of the level of investment outlays, differences in the directions of specialization were also observed. The farms that invested the most often decided to specialize in dairy cows, which is related to the greater capital consumption of such production. In farms with an average (Q2–Q3) and high (Q4) level of investment, the share of such farms amounted to 34% and 33%, respectively, and on farms investing the least (Q1) – less than 23%.

There was also a significant decrease in the number of farms of the 'granivorous animals' type. However, this phenomenon is structural and is associated with quite large changes in the pig market. According to the Statistic Poland, the pig population in 2005–2013 decreased by 41% to 10.99 million units. In terms of the dynamics of changes in the structure, however, a relationship inversely proportional to the value of investments was observed. Mainly farms that invested relatively less were leaving pigs in the analysed period. Among farms classified to the first group (Q1), as many as 47% of entities in 2005–2013 resigned from this production direction. The percentage of such farms in the last group (Q4) was 30% (Table 3).

One of the possibilities of mitigating the consequences of the described changes in the pig market is the improvement and modernization of pig farms through an intensive investment process. Modern farms with high production intensity can counteract strong competition from other producers from the European Union on the pig market, e.g. in Germany or Denmark.

The farms which in 2005, following the FADN typology, were classified as farming type 'granivorous animals' most often changed the farming type to mixed (51%) and a lesser extent to cereal crops (20%). The first of these types of farming was a transitional phase in the search for a more profitable production direction. In turn, the choice of cereal crops was determined by the earlier connection with the production of pigs and the knowledge and less labour-consumption of production technology.

Table 3. Farm migrations within the selected types of farming in individual investment groups in 2005 and 2013

	Number of farms by type of farming in selected investment groups																				
	Group	Q1							Q2–Q3							Q4						
	Type	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**4**	**5**	**6**	**7**	**8**
Number of farms in 2013	**1**	**101**			5		5	121	295			9		14	200	241			1		9	77
	2	2	**26**	1			1	12	5	32	1				12	2	35					3
	4			28				9	2		63				29	1		44				11
	5				108			56				450	6	1	172				252			69
	6				10	**9**		26				19	11		36	2			4	2		7
	7						**39**	21	2					119	54	1					116	40
	8	17	4	2	16	1	29	**551**	26	5	5	27	4	69	734	17	2		7	1	41	**216**
	Total	**120**	**30**	**31**	**139**	**10**	**74**	**796**	**330**	**37**	**69**	**505**	**21**	**203**	**1,237**	**264**	**37**	**44**	**264**	**3**	**166**	**423**
% of farms in 2013 as compared to 2005	**1**	**84%**	0%	0%	4%	0%	7%	15%	**89%**	0%	0%	2%	0%	7%	16%	**91%**	0%	0 %	0%	0%	5%	18%
	2	2%	**87%**	3%	0%	0%	1%	2%	2%	**86%**	1%	0%	0%	0%	1%	1%	**95%**	0 %	0%	0%	0%	1%
	4	0%	0%	**90%**	0%	0%	0%	1%	1%	0%	**91%**	0%	0%	0%	2%	0%	0%	**100%**	0%	0%	0%	3%
	5	0%	0%	0%	**78%**	0%	0%	7%	0%	0%	0%	**89%**	29%	0%	14%	0%	0%	0 %	**95%**	0%	0%	16%
	6	0%	0%	0%	7%	**90%**	0%	3%	0%	0%	0%	4%	**52%**	0%	3%	1%	0%	0 %	2%	**67%**	0%	2%
	7	0%	0%	0%	0%	0%	**53%**	3%	1%	0%	0%	0%	0%	**59%**	4%	0%	0%	0 %	0%	0%	**70%**	9%
	8	14%	13%	6%	12%	10%	39%	**69%**	8%	14%	7%	5%	19%	34%	**59%**	6%	5%	0 %	3%	33%	25%	**51%**

Explanation: 1 – field crops, 2 – horticultural crops, 4 – permanent crops, 5 – dairy cows, 6 – herbivores, 7 – granivores, 8 – mixed.

Source: own study based on FADN data.

CONCLUSIONS

The conducted analysis of changes in the number of farms in individual groups of economic size and the type of farming does not exhaust the subject of the research. On its basis, however, two conclusions can be drawn.

1. The lack of an adequate level of investment leads to a reduction in the economic size of farms. In the studied group, the lower average level of investment was attributed mainly to small and very small farms. However, there is a group of small development farms that have the potential to increase their economic size through investment development.
2. The increase in the level of investment outlays favours the specialization of farms. In the examined group, the number of farms with the agricultural type 'mixed' decreased in 2005–2013 by 39%, including by 49% in the group with the highest level of investment. The research shows that mixed farms focused their production mainly on the cultivation of cereals and milk production.

The conducted research may constitute the basis for broader considerations on the sensitivity of farms to changes in the economic situation on given agricultural markets and the development of farms in connection with the conducted investment activity.

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