Changes in the relations and productivity of production factors in Polish farms according to the market activity

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Abstract

Production factors are used jointly in the manufacturing process. They usually strengthen their productivity and therefore, albeit to a certain extent, they are complementary. The mutual relations between production factors defined the agriculture, the amount of output and productivity. The changes in production factors' relations resulted from the shifts noted in the group of farms. Therefore, this paper concentrates on the analysis of changes in resources of production factors and their mutual relationships, from the perspective of the entire Polish agriculture, and that of individual groups (types, categories) of agricultural holdings, according to their market activity (measured by the value of sold agricultural production).

The paper is based on the results of panel surveys conducted by the IAFE-NRI (mainly from the years 2000, 2005 and 2011). This surveys covered all agricultural holdings with more than 1 ha of agricultural land (UR), at the disposal of natural persons, located in the same 76 villages from different regions of the country. The villages had been selected purposely, so that the area of the surveyed holdings were proportional to the actual area structure of individual agricultural holdings in the country level. The surveyed entities constituted ca. 0.2% of the actual number of individual agricultural holdings. Research results showed the minor changes in the relations between agricultural production factors (input) and the level of their productivity. This favourable changes took place in the market oriented farms with high scale of agricultural output. As a result, in holdings where the scale of production ensured the level of income comparable with the other sectors of the economy (highly-commercial farms), the relations between production factors were similar to those observed in the EU agriculture.

Keywords: relations of production factors, productivity, market activity

Промени в отношенията и производителността на производствените фактори в полските ферми според пазарната активност

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Резюме

Производствените фактори се използват заедно в процеса на производство. Обикновено те засилват производителността и до известна степен са допълващи. Взаимовръзките между производствените фактори определят селското стопанство, обема на производството и производителността. Промените в отношенията между производствените фактори са резултат

от измененията, отбелязани при групите от ферми. Тази статия се концентрира върху анализа на промените в ресурсите на производствените фактори и техните взаимоотношения, от гледна точка на цялото полско селско стопанство и на индивидуалните групи (типове, категории) на земеделските стопанства, според тяхната пазарна дейност (измерена спрямо стойността на продадената земеделска продукция).

Статията се базира на панелни изследвания, проведени от IAFE-NRI (основно през годините 2000, 2005 и 2011). Тези проучвания се отнасят до всички ферми над 1 ха земеделска земя (UR), собственост на физически лица от 76 села от различни региони на страната. Селата са избрани целенасочено, така че площта на изследваните стопанства да бъде пропорционална на актуалната структура на площта на индивидуалните стопанства на национално ниво. Изследваните бройки представляват 0.2% от актуалния брой индивидуални ферми. Резултатите от изследването показват минимални промени във взаимоотношенията между селскостопанските производствени фактори (input) и нивото на тяхната производителност. Тези благоприятни промени намират място в пазарно-ориентираните ферми с голям размер на земеделско производство. В резултат на това във фермите с нива на доходи, сравними с останалите сектори на икономиката (ферми със силна търговска ориентация), отношенията между производствените фактори са подобни на тези, наблюдавани в селското стопанство на ЕС.

Ключови думи: отношения между производствените фактори, производителност, пазарна дейност

INTRODUCTION

The development processes are closely linked to the diminishing importance of agriculture in modern economies (Tomczak, 2004), which is reflected not only in the constant decrease of the significance of this sector in generating the Gross Domestic Product (GDP) in various countries, but also in food production[1] and employment, as well as a systematic reduction of the share of agricultural production assets, and the incurred investment outlays for the development thereof (Bear-Nawrocka and Poczta, 2016). This universal norm does not automatically mean the social and economic exclusion of agriculture (Woś, 1999). Systematically decreasing amounts of production resources in agriculture should normally be accompanied by structural changes, improving the efficiency of their use (Woś, 1999). This processes are essential for meeting the human basic needs. For that reason, the food security is a common objective all around the world.

The amount of possessed production factor resources (land, work, capital), along with their qualitative characteristics, and interdependencies (relations), determine the production potential of agriculture. In agricultural activity, it is the proportion of production factors, which is connected to the entire production process, the level of which is, to a significant extent, dependant on work efficiency (Kołodziejczak and Poczta, 2002). The relations shaped are additionally the main element co-defining the type and structure of agriculture, the productivity of production factors, agricultural production size, and even the scope of relations between agriculture and other agribusiness branches, e.g. processing industry, agricultural trade, etc. (Poczta, 2003).

Resources of agricultural production factors may contribute to improving the economic situation of agricultural holdings, or constitute a limitation of the possibilities of such a change (Kołodziejczak, 2014). Their adjustment to the attainable agricultural production, so as to achieve

[1] It translates into a decrease in the share of agricultural raw material in final food product.

a high effectiveness of the use thereof, is of key importance.

Poland's accession to the European Union (EU) and the related modernization of agriculture, contributed to a certain improvement of the relation between production factor resources and the economic effects thereof, (Poczta, 2012, Rolnictwo i obszary …, 2015) but this process was too slow (Baer-Nawrocka and Poczta, 2016). As a consequence the distance separating between Polish agriculture and that of other EU states is still considerable. The scale of these differences indicates an area of necessary adjustments, particularly in the situation of unbalance between resources of these factors and possibilities of the use thereof, which in the case of Polish agriculture especially relates to labour resources (Poczta and Kołodziejczak, 2004).

Changes in the resources and relationship of production factors in sector are the effects of transformations taking place in the individual farms. At the same time Polish farms are characterised by considerable differences in the size and structure of its production potential, and consequently the size of agricultural production. For the level of income from work in agriculture and for further development of this sector the size of commercial production of certain holdings, particularly market-oriented ones, is particularly of importance. For this reason, the paper focuses mainly on the analysis of changes in Polish agriculture production resources and mutual relations between the production factors in different groups (types, categories) of farms according to their market activity.

MATERIAL AND METHOD

The paper uses the results of panel surveys (every 4–6 years) conducted by the IAFE-NRI, mainly from 2000, 2005 and 2011. This surveys covered all agricultural holdings with more than 1 ha of agricultural land (UAA)[2], at the disposal of natural persons[3], i.e. individual agricultural holdings, being de facto family farms (Sikorska, 2014). Surveyed entities were located in the same 76 villages from different regions of the country and constituted ca. 0.2% of the actual number of individual agricultural holdings. The villages had been selected purposely, so that the area of the surveyed holdings were proportional to the actual area structure of individual agricultural holdings. Due to the fact that in Polish agriculture, the farm size is still strongly associated with other holding features (Zegar, 2009; Dudek, 2010; Karwat-Woźniak, 2011), and even the environmental sustainability level (Zegar, 2009), it may be assumed that the sample analysed has the quality of representativeness.

When considering the market activity of an agricultural holding, and thus defining its type, multiple criteria may be used, including the size criterion (value) of goods production, the value of which is determined arbitrarily in absolute volumes (Production Goals …, 2004, Economic Report …, 2006), or with the use of relative measures (Rychlik and Kosieradzki, 1981; Szemberg, 1991, Market activities…, 2013).

In the paper in order to determine the market activity of individual holdings, makes use of the criterion of agricultural goods production (value of agricultural production sold in the crop year). Assuming the main criterion for the division of production sales volume from individual agricultural holdings, which is simultaneously, one of the most important determinants of their economic size (Woś, 1998), to be the general economic development and market position (Adamowski, 1998), two basic segments of individual agricultural holdings have been distinguished, i.e. (1) exclusively (with

[2] According to the Polish law agricultural holding shall covered at least 1 ha of UAA.

[3] Despite the differences agricultural households (agriculture) family and individual, as well as household and entity are used interchangeably.

no sales) and (2) mainly semi-subsistence as well as (3) commercial. Among the latter the highly-commercial farms were distinguished.

When setting the limit values of goods production size, defining affiliation with one of the aforementioned subgroups, the guiding principle was the relation of the value of agricultural production of a given entity, to the average value of production sold per 1 holding locating its production on the market in the entire sample in a given year. This ratio was PLN 25.0 thousand in 2000, in 2005 – PLN 36.4 thousand, and in 2011 – PLN 51.0 thousand. It has been assumed that entities the value of production not reaching 20% of the average level for one period, should be included to the mainly semi-subsistence holdings, and therefore not market-oriented. On the other hand, entities producing at the level at least equal to the limit value, have been qualified the commercial subgroup, i.e. market-oriented. Furthermore, in the commercial holdings group, entities may be further distinguished, with the size of agricultural production allowing them to obtain an income from work in the used holding, per 1 fully employed person, at the level at least equal to average earnings in non-agricultural sectors. So determined production volume, was at least double the average sales value from a holding in a given time, and entities meeting this criterion were defined as highly-commercial farms. These holdings, due to the attained income and management efficiency, had competitive potential (Karwat-Woźniak, 2015).

The analysed presented in this chapter uses of the methods of statistical and comparative analysis, particularly descriptive statistics and structure and dynamics indicators.

The analysis concerns the years when Polish agriculture was within the Common Agricultural Policy (CAP) system, for which relevant data is available. In certain cases, analysed time span has been extended to the years prior to Poland's accession to European structures. This was due to the available empirical material used for the purpose of this study, and the fact that at the beginning of the 21st century, a change in the conditions defining economic activity resulted from the integration with the EU market has taken place (Józwiak, 2013).

Production resources in agricultural holdings according to their market activity

The research shows that in 2000–2011 overall decline in the total number of agricultural holdings covered by the IAFE-NRI survey was noted (by about 11%) and it was accompanied by the changes in the structure of the sample according to their market activity. This changes expressed primarily in the increase (from 11 to 28%) in the share of farms producing exclusively for own use, as well as in the decrease (from 65 to 50%) in the share of commercial households. At the same time, the processes of formation of market oriented farms was observed. This group of agricultural holdings was characterised by with a very strong and stable relationships with the market, as well as the economic and social efficiency level comparable to enterprises from non-agricultural sectors (Karwat-Wozniak, 2015).

Research shows that the changes in the number of different types of farms were accompanied by a relatively stronger shifts in the production resources at their disposal. In the analysed time span production assets' concentration by commercial farms intensified, especially in the group of highly-commercial farms (Table 1). In this context, the situation in holdings with exclusively subsistence production was slightly different. In these types of entities divestments were dominating, consisting of adjusting the sizes of owned production assets to production needs for the family. Consequently, the disparity increased in the level of equipment of holdings with production focused on the market, especially highly commercial, and entities producing solely or mainly for own needs.

The changes in the number of farm groups selected according to the market activity and the volume of possessed production resources

Table 1. Selected resources of agricultural production factors possessed by highly-commercial farms (100 = total sample)
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

Share (%) of production factors by highly-commercial farms	2000	2005	2011
- land	31.4	38.3	51.6
- machines and tractors	26.9	27.5	54.6
- livestock	40.8	54.9	67.8
- labour input	18.9	22.2	24.6

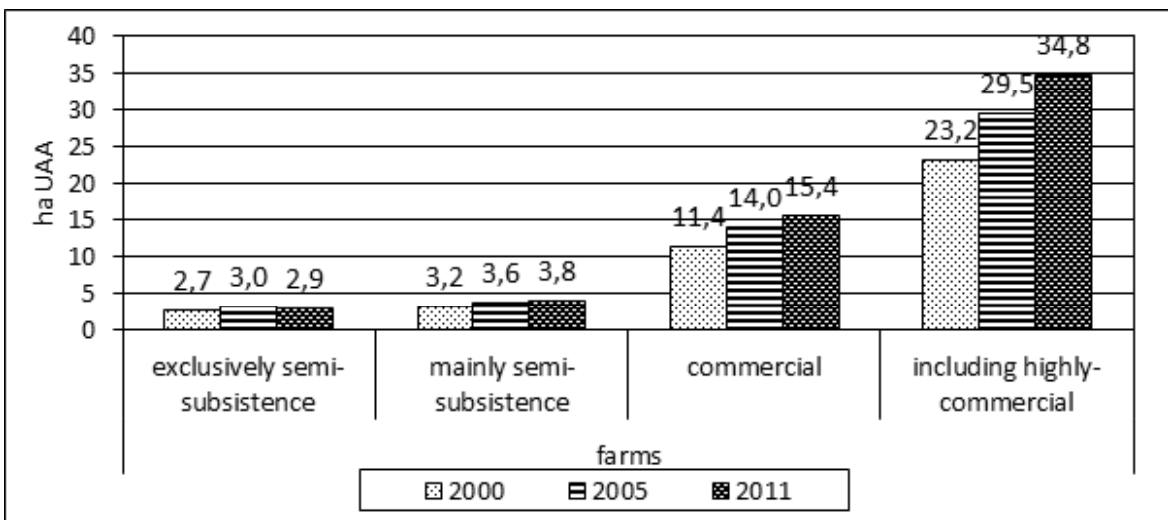

Fig. 1. Equipment with agricultural land in selected group of surveyed farms (in %)
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

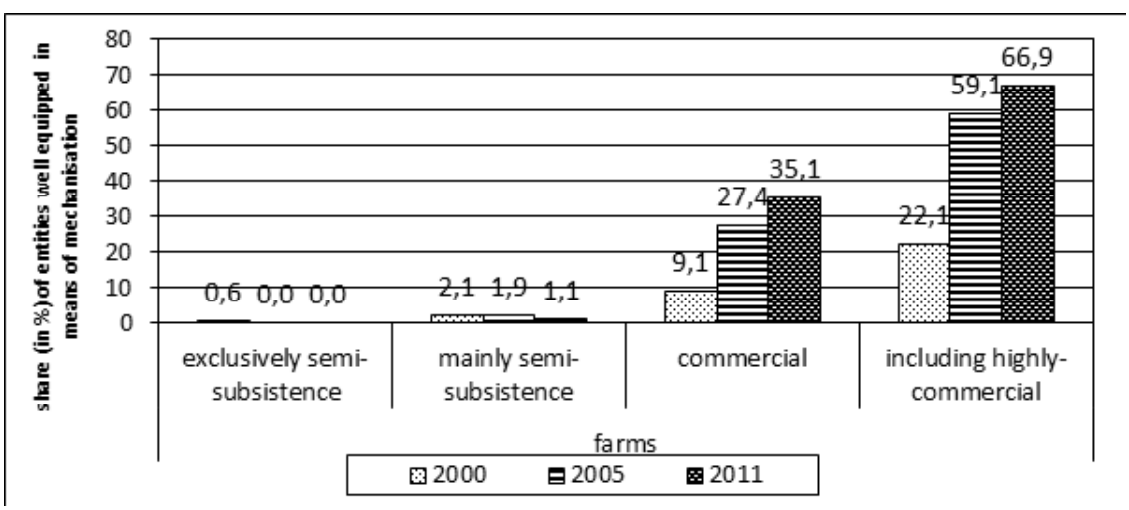

Fig. 2. Technical equipment in selected groups of surveyed individual agricultural holdings
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

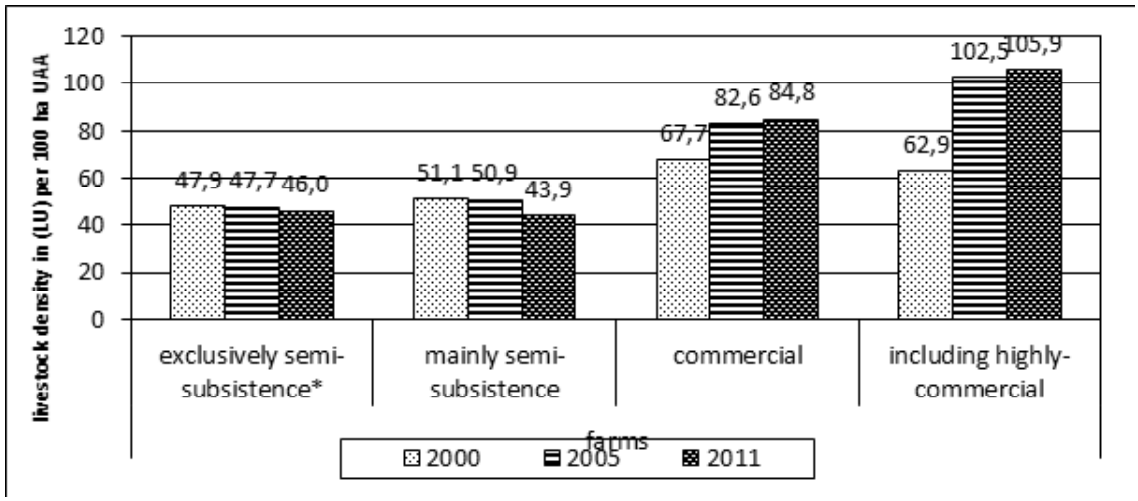

Fig. 3. Livestock density in the selected groups of surveyed individual agricultural holdings with animal production
*only holdings with agricultural production
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

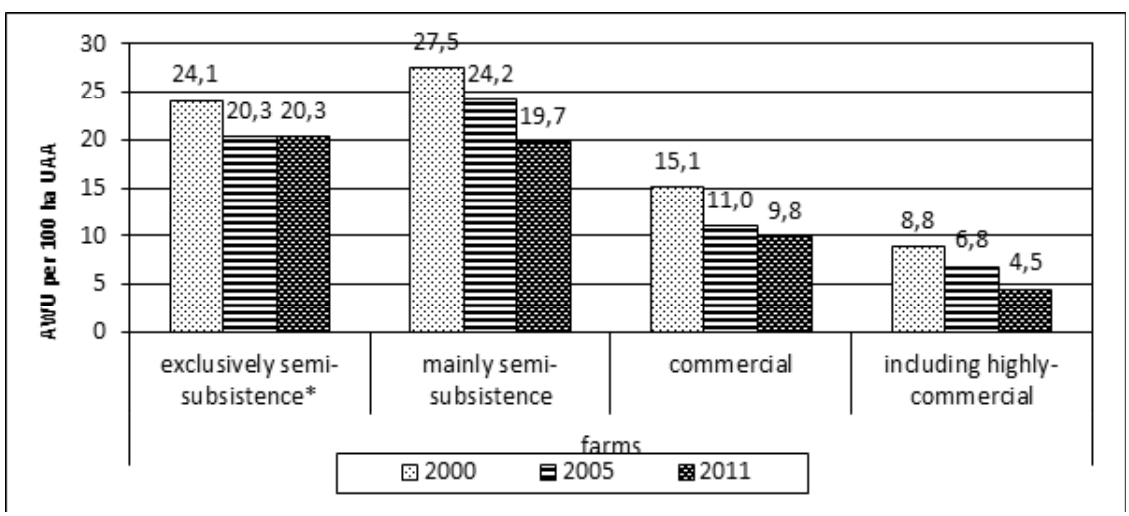

Fig. 4. Labour input in the surveyed individual agricultural holdings according to their market activity
*only holdings with agricultural production
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

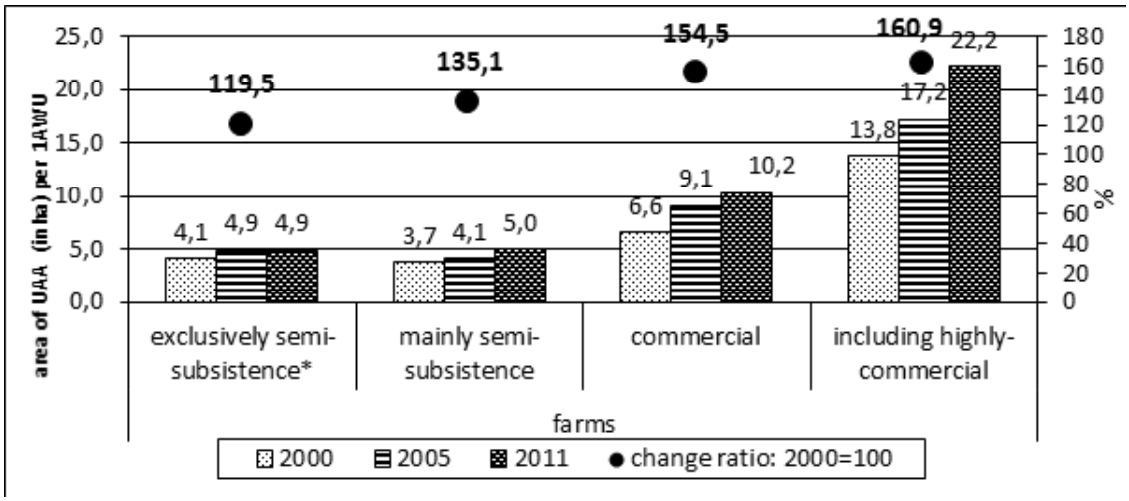

Fig. 5. The area of agricultural land per work unit in the selected categories of surveyed individual agricultural holdings
*only holdings with agricultural production
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

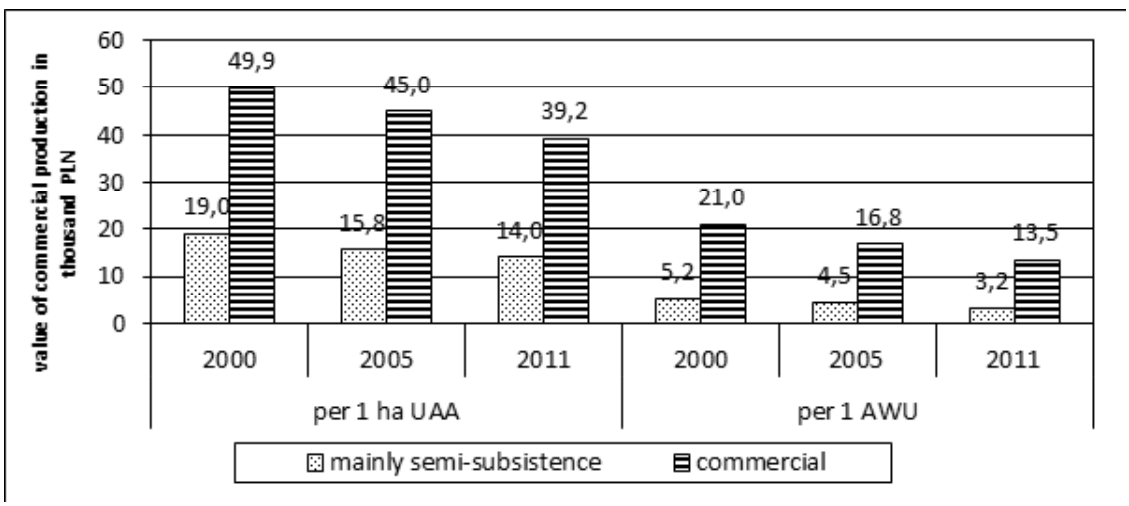

Fig. 6. Relations between land and labour productivity in selected groups of surveyed individual agricultural holdings (value of commercial production in highly-commercial farms = 100)
Source: Own elaboration based on IAFE-NRI surveys 2000, 2005 and 2011.

resulted in the shifts in the level of equipment of farms. These changes were common for the whole sample. They expressed mainly by an increase in the equipment of commercial farms with production resources (mainly highly-commercial), and in the reduction or stagnation in case of the remaining groups of households (Figure 1, 2, 3, 4). This process concerned all mentioned characteristics and analysed time span. However, the observed differences between surveyed groups became more visible after the accession to the EU. Increasing differences in the level of equipment with production factors of farms with different market activity was determined by various reasons.

Changes in the level of land possession were particularly strongly influenced by the situation on the agricultural land market, and mainly the increasing imbalance between demand and supply. In the situation of limited and decreasing general land resources and those in possession State Treasury, increasing demand for agricultural lands created by commercial entities, was accompanied by the phenomenon of attachment to one's patrimony. This phenomenon resulted in keeping the land by owners of holdings fulfilling mainly non-commercial functions. For this part of the population owned holdings secure the basic existence of the family in case of a loss of non-agricultural income sources. Conducting agricultural production intended for family subsistence with basic food became a relatively frequent model of functioning, especially for holdings with a relatively small or medium agricultural land area. Research indicates that the most common reaction was adjusting the holding to a sizes ensuring the satisfaction of own needs, and the surplus was most often rented out.

Consequently, the ca. 35% (50% – for highly commercial holding) growth in area size of commercial holdings was accompanied by practically no such changes in subsistence holdings. The result of these differences was a growth of differences in land possession between entities with high, medium and small market activity (Figure 1).

Inflow of EU funds for investments in holdings and the improvement of the economic situation in agriculture, was translated into a growth of income from agricultural activities. This situation speed up production investment activities[4], especially in the group of highly commercial holdings. Consequently, a relatively dynamic removal of the technical[5] underdevelopment was recorded.

For market oriented farms mentioned activities, was a necessity; in order to cope with the increasing competition, and maintain or improve their market position they had to modernize their techniques and technologies of agricultural production. Improvement in the level of technical labour equipment has been noted. For instance, in 2011, 67% of highly-commercial holdings have been well equipped with the means of mechanisation, when in the group producing mainly for own needs, the same ratio was 1%. In 2005 mentioned percentages amounted to 59% and 2%, and in 2000, 22% and 2% respectively (Figure 2).

[4]In 1996-2000, ca. 75% of holdings defined as highly commercial have invested in production assets, and every entity involved in such projects, has expended PLN 53.2 thousand for this purpose. Between 2005 and 2011, respective indicators were, accordingly, above 87% and PLN 236 thousand. In the group of subsistence holdings, between 2005 and 2011, agricultural investments were carried out by almost 18% of entities, expending for this purpose only EUR 8.9 thousand. For comparison, between 1996 and 2000, respective indicators were accordingly 20% and PLN 5.9 thousand.

[5]Due to the specificity of IAFE-NRI survey data, the fixed asset resources can be analysed partially, mainly through the prism of changes in equipment in means of work mechanization in a farm. There was no possibility to determine the value of indirect consumption and depreciation. However, it may be assumed that due to the position of highly commercial holdings in agricultural structures, the positive changes, which occurred with regards to capital expenditures in a sectoral perspective, concerned mainly this category of entities.

Changes were also documented in livestock sizes, and the nature thereof was affected by intensified contacts with the market (Figure 3). Exclusively or mainly semi-subsistence holdings were under the processes of withdrawing animal production and a reduction of the rearing scale. Consequently, stocking intensity has decreased, mainly in the latter of the abovementioned holding categories. In 2011, livestock density per 100 ha UAA in the set of mainly semi-subsistence holdings was 43.9 LU, and was smaller as compared to 2005 and 2000 by 14%.

A different phenomenon was visible in households producing mainly for the market, especially in the set of highly-commercial entities. Although husbandry was conducted a diminishing number of highly-commercial entities, but these tendencies were gradually decreasing[6]. Here, the trend was accompanied by an increase in the rearing scale in highly-commercial entities, which did not cease animal production. Consequently, between 2000 and 2011 stocking per 100 ha of UR in highly commercial holdings has increased from 62.9 to 105.9 LU[7] i.e. by 43.0 (by 68%)[8].

Land and livestock concentration, as well as the transformations in applied techniques and technologies, and the production structure, as well as diversification processes of professional activities, the rationalization employment relations, resulted in a drop of labour input. Between 2000 and 2011 in the surveyed individual holdings, their size has decreased by ca. 1/5. These changes have, with varying intensity, were noted in the individual groups of holdings resulted in diverse changes in labour resources and input at the disposal of individual categories of the examined holdings (Figure 4).

Throughout the analysed time span, a positive relation between input and market activity was maintained. However, the processes of employment rationalization have been relatively faster in holdings with a greater market activity. They were mainly caused by a growth in the distance in the capital-to-labour ratio and production specialization between holdings performing mainly functions of subsistence, and those focused on the market, especially highly-commercial holdings. Consequently, differences have decreased regarding resources (expenses) in labour between comparable holdings with varying market activity (Figure 4).

As a result of the abovementioned changes in resources of the land and labour factors, various transformations occurred in relations showing equipping of the active factor in the agricultural production process, namely, labour with land.

The analysis of the changes in the level of land equipment of the labour factor demonstrates the fact that every holding category conducting agricultural production, covered by the survey study, have displayed improvement in labour-land relation (Figure 5). Additionally, these tendencies have been particularly visible in the group of holdings producing mostly for the market, and

[6]Both in 2005 and 2011, the percentage of highly commercial holdings conducting animal production was identical at the level of 75%, whereas between 2000 and 2005, the percentage of highly commercial entities with husbandry has on average decreased annually by 0.8 p.p., and between 1996 and 2000, the pace of withdrawal from animal production was twice as fast.

[7]It should be added that the increasing concentration in highly commercial holdings with animal production, generally did not cause the exceedance of the environmental condition for sustainable agriculture for the adopted stocking level with a threshold value of 2 LU per 1 ha of UR.

[8]These changes occurred mostly between 2000 and 2005 and were the result of concentration increase in dairy cattle breeding. The intensification of concentration processes over this period, should be linked with increasing requirements imposed by recipients of raw materials of animal origin and the expansion of the production base by producers expecting a growth of competition at the time of EU accession. Due to a relatively extended period of building (e.g. a herd of cattle) and obtaining production effects, actions should be taken in advance.

especially in the group of highly-commercial entities. These tendencies, along with the abovementioned changes in capital asset possession, indicate an improving resource competitiveness of highly-commercial holdings.

Productivity of production factors in farms according to the market activity

The abovementioned changes in resources proportions and production factor expenditures in holdings with varying market activity were reflected in changes of their productivity in individual holding categories.

Due to the specificity of survey data, only a partial analysis is possible, of the differences in this aspect, via referring the value of agricultural commercial production to the agricultural land resources, and labour input[9].

The comparison of the commercial production level of the selected holding groups shows that differences in the productivity level of land resources and labour in holdings with varying market activity, but also with increasing disproportions were noted. The differences in the productivity of land and labour resources were increasing along with the reinforcement of disparity between production factors.

In 2000, the average sales value per 1 ha of UR in holdings producing for the market, but not defined as highly-commercial entities, constituted nearly 50% of the sales volume from an area unit in the highly commercial segment (Figure 6). Eleven years later, the respective difference was 39%. In the case of holdings directing only small parts of agricultural production to the market (semi-subsistence), this difference was greater still, as the average sales value from one hectare of agricultural land in this category amounted to 14% in 2011 (19% – in 2000) of the average value achieved by highly-commercial holdings.

Even greater disproportions between highly commercial holdings and entities with less market activity (remaining commercial, mainly subsistence, were revealed in the scope of the productivity of labour input. In 2000, the average value of commercial production per 1 AWU in the last mentioned holding category was only slightly more than 5% of the average value of an similar ratio obtained by highly commercial entities. In 2011, these disproportions had increased, and the value of sales of agricultural products in subsistence holdings per 1 AWU has only been slightly over 3%. In 2000 and 2011, the comparable ratio for holdings producing mostly for the markets, but not defined as highly commercial, was 21% and nearly 14% respectively.

CONCLUSIONS

Analysis of empirical data demonstrates that the relatively small changes in the resources of production factors in the whole agricultural sector and relationships between them (Bear-Nawrocka, Poczta, 2016) were accompanied by significant variation in the size of this resources in farms categorised according to the market activity (exclusively or mainly subsistence, commercial and highly-commercial). This process concerned a relatively stronger trend of concentrating land and production assets in highly-commercial farms. Consequently, between 2000 and 2011, this segment has strengthened its position within agribusiness structures. The share of land at the disposal of holdings from this category, has increased from 31% to 52%, that of technical means of production, from 27% to 55%, and that of livestock, from 41% to 68%. This, relatively intense processes of concentrating land resources and production assets in highly commercial holdings, were accompanied by a relatively small increase in labour inputs. The share of labour input in holdings among the total surveyed, has increased from 19% in 2000,

[9] The adopted measures determining land and work productivity do not always fully reflect its level. However, they allow to depict the tendencies and assess the scale of the phenomena.

to 25% in 2011.

The analysis of changes in the level of equipment the labour factor with the land, demonstrates that in each category of holdings with agricultural production, covered by the surveys, an improvement of the labour-land ratio was noted. In 2000–2011, the UAA area per 1 AWU has increased from 13.8 to 22.2 ha, and therefore was about the average level of this ratio in the EU-15. On the other hand, holdings producing solely and mainly for subsistence, the UAA area per 1 AWU in 2011 was accordingly 4.9 and 5.0 ha, and in 2000, 4.1 and 3.7 ha.

The comparison of the commercial production level of selected agricultural holding groups shows that differences in the productivity level of land and labour resources in farms with different market activity were noted. Moreover, the increasing disproportions thereof were visible. The differences in the productivity of land and labour resources were increasing along with the reinforcement of disparity between production factors. In 2000, the average sales value per 1 ha of UR in holdings producing for the market, but not deemed highly commercial entities, constituted nearly 50% of the sales volume from an area unit in the highly-commercial segment. Eleven years later, this difference was 39%. In the case of farms selling only small parts of agricultural production (semi-subsistence), this difference was greater still, as the average sales value from one hectare of agricultural land in this category of entities was 14% in 2011 (19% – in 2000) of the average value achieved by highly-commercial holdings.

Even greater disproportions between highly-commercial holdings and entities with less market activity (remaining commercial), mainly semi-subsistence, were revealed in the scope of the productivity of labour input. In 2000, the average value of commercial production per 1 AWU in the last mentioned holding category was only slightly more than 5% of the average value of an respective ratio obtained by highly commercial entities. In 2011, these disproportions had increased, and the value of sales of agricultural products in subsistence holdings per 1 AWU has only been slightly over 3%. In 2000 and 2011, the comparable ratio for holdings producing mostly for the markets, but not defined highly-commercial, was accordingly 21% and nearly 14%.

The conducted analyses demonstrate that further development of Polish agriculture is connected mainly with processes of production factor concentration, especially of land.

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