Abstract. The main aim of the article is to evaluate the dynamics of reproduction processes taking place in Polish agriculture considering different production types in farms following the integration with the EU. It was observed that in the period of economic revival in Poland (2004-2007), farms were more active in modernising their production potentials. In the analysed period (2004-2010), farms covered by the FADN system were showing mostly narrowed reproduction, with the exception of 2004 when extended reproduction was recorded. It was observed that, in the case of farms specialising in milk production, the modernisation processes ensured extended reproduction throughout the entire analysed period. Also farms specialising in horticultural production and animal breeding in grazing system stood out positively. On the contrary, farms lacking specialisation showed assets decapitalisation. The phenomena resulted from limited ability of these farms to generate surpluses for financing development as well as the fact that they were less prone to invest. It should be noted, however, that these farms play an important role in creating welfare in rural areas understood in broader terms as well as in maintaining settlement network, stability and viability in rural areas.

Key words: reproduction, farm, investment, production profile.

JEL code: Q12

1. Introduction

The integration of the Polish economy with the EU Member States and the fact that the agricultural sector was covered by the CAP tools exerted a significant impact on the shaping of growth processes of farms and rural areas. The growth processes might be determined through reproduction of production assets, which in this article is defined as replacement of farms’ production assets worn and torn during production. This approach results from the need to limit the analytical scope due to the complexity of reproduction issues as well as direct connections of the capital to other factors. One could conclude that recently (i.e. from the 1990s onwards) studies on reproduction processes in agriculture in Poland have been significantly limited (if not neglected). The studies follow the classic theories of economics concerning the analysis of growth processes from the point of view of production factors, including especially the capital and relevant investments. The article attempts to present a wider approach including the macroeconomic context of the analysed processes characteristics. The presented issue is important also in terms of different directions of adaptation processes of Polish farms, which in fact is reflected in the development of rural areas.

The main aim of the article is to evaluate the dynamics of reproduction processes taking place in Polish agriculture considering different production types of farms following the integration with the EU. The analysis was based on the data from FADN (Farm Accountancy Data Network) which takes into consideration commercial farms, i.e. main beneficiaries of the Common Agricultural Policy generating at least 90% of the standard gross margin (SGM) in a particular region or country. The analysis covers the period of 2004-2010 due to the data availability. The article attempts to reply the following research questions: Are there differences between reproduction processes of farms with different production types in Poland? What is the context of general economic trends in shaping reproduction processes? What are the development perspectives for farms considering their production type? The first part of the study focused on issues related with the economy in general, making it possible to determine the conditions for reproduction in agriculture. At the next stage, reproduction processes were evaluated from the point of view of changes in investments and the reproduction ratio (relation of gross investments (excluding land purchases) to production assets depreciation).

2. Economic backdrop of agricultural situation following integration with the EU

After integration of Poland with the EU until 2008 the general economic situation was positive (Table 1). This translated itself into the GDP dynamics, reduced unemployment and increased investment rate. The economic downturn was recorded only in 2009, mainly as a result of phenomena concerning the global crisis, while the situation improved again in 2010. The effects of the crisis phenomena affected the Polish economy to...
a relatively limited extent. The fact that foreign trade in Poland is less important for the economy than in other EU countries served as a kind of buffer against global crisis phenomena. This also explains why the economy grew faster (in terms of changes in GDP) than in other countries, which can translate itself into increased demand for food products. This relates namely to positive changes in the real GDP, both prior to and during the economic crisis (Czyzewski A., Grzelak A., 2011). Regardless of the above-mentioned economic parameters, agricultural development depends on the value of budgetary support. It stands for an important source of funds in the Sector; thus, the integration with the EU and the fact that the agricultural sector was covered with the EU CAP tools was a crucial change in this area. Interestingly enough, still in 2002 the share of agriculture, rural development, and agricultural markets development accounted for 1.98% of budgetary expenditure, while in the years 1997-2003, i.e. before the Polish accession to the EU, it stood at 2.23% on average. From this perspective one can conclude that in comparison with those years, the share in the years 2007-2009 nearly tripled, which means that the importance of agriculture in budgetary policy increased and that operating conditions for this sector improved significantly. On the contrary, the reference base changed in 2010 due to the fact that Bank Gospodarstwa Krajowego took over the management of the European funds budget which was created in the same year. As a consequence, the share of expenditure on the agricultural sector was reduced from the accounting point of view. If the previous methodology was applied, the expenditure would be higher in real terms by 29% in comparison with the previous year (Czyzewski A., Matuszczak A., 2012). This might suggest that the operating conditions for agriculture in 2010 were favourable.

In the years 2004-2010, an increase in the real aggregated gross disposable income was observed in the case of individual farms. This resulted from the implementation of the CAP mechanisms in Polish agriculture and the subsequent increase in support offered to this sector (Czyzewski A., Stepień S., 2009). It should be emphasised that there was no drastic income drop following 2007, while the years 2008-2009 outlined a decrease in the parity of disposable agricultural income. This resulted mainly from worse market conditions for agricultural production which was reflected in the opening of price scissors3. The parity went on to improve in 2010 as a consequence of positive economic trends in agriculture.

The years 2004-2010 showed an overall growth in the average disposable income per person in a household of farmers and disposable income of households of employees.

### 3. Differentiation of reproduction processes in agriculture considering different production types of farms

Considering the above-mentioned general economic tendencies which constitute the backdrop of further consideration, one should try to evaluate the reproduction

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**Table 1 Economic backdrop of agricultural situation in Poland in 2004-2010**

<table>
<thead>
<tr>
<th>Specification</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes of the GDP (%)</td>
<td>5.3</td>
<td>3.5</td>
<td>6.2</td>
<td>6.8</td>
<td>5.1</td>
<td>1.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Rate of unemployment (%)</td>
<td>19.1</td>
<td>17.6</td>
<td>13.9</td>
<td>11.2</td>
<td>9.5</td>
<td>11.9</td>
<td>12.3</td>
</tr>
<tr>
<td>Investments*</td>
<td>106.5</td>
<td>107.7</td>
<td>116.8</td>
<td>120.4</td>
<td>110.7</td>
<td>99.2</td>
<td>99.8</td>
</tr>
<tr>
<td>Share of expenses on agricultural sector in state budget (in %)</td>
<td>3.87</td>
<td>3.83</td>
<td>3.74</td>
<td>6.67</td>
<td>6.32</td>
<td>6.02</td>
<td>4.48**</td>
</tr>
<tr>
<td>Parity of income (a)</td>
<td>72.7</td>
<td>78.7</td>
<td>83.2</td>
<td>91.8</td>
<td>84.5</td>
<td>78.7</td>
<td>85.4</td>
</tr>
<tr>
<td>Index of price scissors in agriculture</td>
<td>102.2</td>
<td>96.0</td>
<td>102.0</td>
<td>107.2</td>
<td>90.1</td>
<td>96.0</td>
<td>107.0</td>
</tr>
</tbody>
</table>

* previous year=100;
** change of the reference basis due to the separation of the European funds budget from the state budget
(a) The parity was estimated as a relation of disposable income per person in a household of farmers and disposable income of households of employees.

Source: Czyzewski A., Grzelak A., 2011

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3 The significant increase in prices of agricultural products worldwide in 2006-2007 was accompanied (especially at the turn of 2008) by a food crisis (Urban R., 2010)

4 It should be emphasised that the situation is not homogenous. Larger farms (above 16 ESU) typically reached income overparity in comparison with families of employees. There are ca. 100k farms like these in Poland. Similarly, specialised farms, e.g., specialising in field crops, grain fed animal breeding, horticulture, or dairy cows, would typically reach overparity.
processes on farms. At the first stage, the evaluation focused on a comparative analysis of changes in selected economic and production categories of farms considering their production types in the years 2004-2010 (Table 2). Varying changes in the analysed parameters indicate that the nature of adaptations to market conditions conducted by farms changed following the integration with the EU. They consisted mainly in increasing agricultural land areas.

A decrease was recorded in the farms’ average FTEs. On the contrary, a slight growth was noticed in both gross investments and fixed assets value. The biggest growth was noted in the case of agricultural income and agricultural land areas per 1 farm as well as agricultural output value and intermediate consumption. This might suggest that increasing agricultural land areas and a consequent increase in land-use intensity make up the main strategy applied as regards adaptations of farms following the integration with the EU. It also results from the concentration processes taking place in agricultural production (Siekierski J., Poplawski, L., 2006) and a development path followed by farms.

Improved income situation resulted from the fact that agriculture was covered with the EU CAP tools and from the consequent modernisation processes of the sector. The increase in the intermediate consumption might, on the contrary, result from the increased market activity of farms.

There is a strong differentiation in the values of the analysed parameters between farms considering their production types (Czternasty W., Smidzuk K., 2009). Farms specialising in crop production focused mainly on land and machinery purchases, while farms specialising in animal breeding concentrated on investments in buildings and relevant equipment (Sass R., 2012). One can notice a relative division into three groups. The first one includes farms specialising in field crops, permanent crops (orchards), and milk production. This group recorded significant increase in income, investments, production output value, intermediate consumption, and fixed assets. Also the modernisation processes were most advanced in this group. The next group, i.e. specialising in breeding animals in the grazing system and horticulture, was characterised by intensive investment activity in the first years of the EU membership which slowed down later on. In the farms with other production types, the dynamics of evaluated phenomena cannot be viewed so positively, although the income during the analysed period grew across the board.

Decreased investments in the case of farms specialising in breeding animals in the grazing system resulted from the fact that the modernisation process within this group had been very intense both prior to the integration with the EU and shortly afterwards. Interestingly, it was noticed that the increase in agricultural land area among farms specialising in animal breeding (mainly cattle and pigs) was not accompanied by adequate changes in the output. It might result from the fact that the number of animals in average farms covered by the FADN system stood, for example, in 2010 at 11 for cattle in farms specialising in grass fed animals and 33 for pigs for farms with grain fed animals. When comparing the figures with the fact that in the years 2004-2010 the number of animals in farms with herds was bigger than 20 (for cattle) and 50 (for pigs), one can notice deconcentration and gradual resignation from animal breeding in average farms included in the specialised groups. As a consequence, a part of these farms is likely to be classified as farms with mixed production. Some researchers (Michna W., 2012) refer to the fact that the animal output decreases as farms drop this type of activity as “animal output crisis”. Despite the fact that the farms with mixed production recorded increased income, its level was relatively low when compared with specialised farms and was mainly related to direct payments5.

The comparison of gross investments with depreciation (reproduction ratio) provides an interesting insight from the point of view of assessing the reproduction

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5 Share of direct payments in income in this group of farms in 2010 amounted to 73%, while the average for all farms stood at 62%
process (Table 3). Trends noticeable in this comparison show moderate volatility of the ratio (18%) in the analysed period in the group of farms covered by the FADN. This means that developmental conditions in Poland following the integration with the EU facilitated stable development of agriculture, which resulted from the fact that the sector was covered by the EU CAP tools and from a consequent increase in support, although a large number of farms is not capable of replacing their production potential anyway. The highest reproduction ratio (107%) was recorded in the first year following the integration with the EU. It was a consequence of intensive investment activity of farms shortly after the integration and a resulting significant investment needs following the period of unfavourable economic situation for agriculture in the years 1998-2003 as well as of a relatively low value of production assets due to high wear and tear levels. In the following years, the level of the ratio failed to ensure extended reproduction for an average farm included in the FADN system, although the situation varied depending on the production profile and resulting profitability as well as the farms’ size. It is noticeable that the reproduction ratio improved with increasing agricultural income and improving price relations for the sector which also led to the phenomenon of economic rent in agriculture (Czyzewski B., 2010). Therefore, the ratio improved in the years 2006-2007 and 2010.

Considering the production types there are clear differences in reproduction ratios between farms. Interestingly, farms specialising in dairy production recorded extended reproduction nearly in all analysed years. This suggests intensive investment activity of the members of the group and shows that modernisation processes were well advanced. The investments were mainly related to purchases of equipment to milk, cool and store milk, introduction of new technologies for preserving rapidly growing grass, and adapting buildings to higher phytosanitary standards. In total, milk production remained at the same level during the analysed period, while the cows average milk yield grew and the number of cows decreased (Rynek mleka…, 2010). Farms specialising in animal breeding in the grazing system as well as those specialising in horticulture recorded extended reproduction in the first sub-period (2004-2007) and narrowed reproduction in the following years (2008-2010). Those farms also used the modernisation possibilities of their output potential by taking part, among others, in measures like “młody rolnik” (young farmer), “inwestycje w gospodarstwie rolnym” (investments in farms; SPO 2004-2006), or “modernizacja gospodarstw rolnych” (“modernisation of farms”; PROW 2007-2013). In the first period, horticultural farms invested intensively in crops grown under covers or purchases of fruit harvesting combines and of cool stores. In total, about 37% of funds (from the PROW 2007-2013 funds – “modernisation of farms”) was provided to farms specialising in milk production, while 50% of funds from this measure related with constructing or modernising farm buildings was used for glasshouses.

In case of farms specialising in field crops reproduction of assets started improving gradually from 2005 and it reached the stage of simple reproduction in 2010. Those farms at first increased their land resources and later invested in production assets, i.e. purchases of combine harvesters, tractors, and sprinklers (Kagan A., 2011). The lowest level of the ratio was recorded in the case of farms with mixed production type. This might suggest assets decapitalisation in those farms.

Those farms normally operate on a small area, their production scale fails to generate sufficient funds to be used for investments and their repayment capacity is typically low (Augustynska-Grzymek I., Skarzynska A., 2011). These phenomena are a consequence (as well as later on a cause) of relatively low income in the case of smaller farms. This might also be related with higher preference of smaller farms towards consumption at the cost of pro-investment activities due to lower production scale and consequently an absolute lack of income. Their future should not be seen solely in the performance of production functions. It is difficult to evaluate the developments in the analysed ratio unanimously in the case of farms specialising in breeding grain fed animals. It can be noticed that assets reproduction undergoes changes which is related with the so-called hog cycle.

Table 3

Developments in the reproduction ratio (gross investments / depreciation) in Polish farms (included in the FADN system) in the years 2004-2010

<table>
<thead>
<tr>
<th>Years</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>91.3</td>
<td>117.1</td>
<td>92.0</td>
<td>113.0</td>
<td>107.2</td>
<td>101.9</td>
<td>88.5</td>
<td>105.2</td>
</tr>
<tr>
<td>2005</td>
<td>56.8</td>
<td>97.1</td>
<td>79.9</td>
<td>126.5</td>
<td>136.0</td>
<td>84.9</td>
<td>77.8</td>
<td>82.8</td>
</tr>
<tr>
<td>2006</td>
<td>58.0</td>
<td>102.1</td>
<td>89.0</td>
<td>176.8</td>
<td>141.0</td>
<td>102.0</td>
<td>78.8</td>
<td>84.8</td>
</tr>
<tr>
<td>2007</td>
<td>68.2</td>
<td>128.3</td>
<td>78.0</td>
<td>145.4</td>
<td>139.6</td>
<td>89.0</td>
<td>83.0</td>
<td>89.8</td>
</tr>
<tr>
<td>2008</td>
<td>85.4</td>
<td>78.0</td>
<td>74.0</td>
<td>120.1</td>
<td>88.4</td>
<td>73.2</td>
<td>65.5</td>
<td>69.4</td>
</tr>
<tr>
<td>2009</td>
<td>63.7</td>
<td>84.0</td>
<td>79.0</td>
<td>100.3</td>
<td>66.9</td>
<td>100.1</td>
<td>67.4</td>
<td>72.4</td>
</tr>
<tr>
<td>2010</td>
<td>101.1</td>
<td>81.0</td>
<td>83.0</td>
<td>109.0</td>
<td>73.6</td>
<td>89.6</td>
<td>72.1</td>
<td>77.5</td>
</tr>
</tbody>
</table>

1 - field crops; 2 - horticultural crops; 4 - permanent crops; 5 - dairy cows; 6 - grass fed animals; 7 - grain fed animals; 8 - mixed

Source: author’s study based on the data from the FADN system for the years 2004-2010

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6 W. Michna estimates that there are ca. 90% of farms like these in Poland (Michna W., 2011)
7 Studies show that extended reproduction occurs in farms with the size exceeding 16 ESU (Grzelak A., 2012)
This means that investment processes are activated in the case of increasing profitability on the market. It should be expected that in the case of farms with this production profile, the reproduction process will intensify in the years 2011-2012 owing to the fact that the farms are forced to adapt to new requirements concerning environmental protection and animal welfare until the end of 2012. It concerns limiting ammonia emission from animal breeding and extending farm houses for piglets and pigs. This might encourage small farms with small production scale to resign from this type of production further deepening polarisation processes.

4. Conclusions
The conducted study leads to the following conclusions.
1. During the period of the most favourable economic trends (2004-2007) in Poland farms were more eager to modernise their production potentials which was reflected in the improved reproduction ratio. It might initially suggest that macroeconomic conditions are important from the point of view of the reproduction processes. Especially the first year of membership was most important as the dynamics of those processes was clearly most intense. It was related with significant underinvestment resulting from a slowdown in agriculture in the years 1998-2003. The situation did improve significantly only in 2004 as a consequence of increased share of budgetary expenditure on agriculture, as the sector was included in the EU CAP tools, especially as regards direct payments (Czyzewski A., Pocza A., 2009). Another influential element consisted in the need for animal breeding farms to adapt to stricter phytosanitary standards. On the contrary, investments like these, while supporting more pro-ecological activities, do not result directly in increased income. If the same labour and land resources are maintained, positive income developments depend not only on investments but also on profitability of agricultural production in a particular year. Therefore, the development of agricultural farms in the economic sense expressed with increased income is, in many instances, the easiest to achieve by means of purchasing land.
2. During the analysed period (2004-2010) one could mainly notice on average narrowed reproduction in farms covered by the FADN system. Extended reproduction was recorded only in 2004. Despite the above, the scope of investment processes in agriculture during the period should be viewed positively. It led to improvements in terms of production techniques, efficiency and quality of agricultural production, environment protection and OHS. There are many differences in this respect considering farms’ production profile as well as their size. It was noticed that in the case of farms specialising in milk production, the modernisation processes resulted in extended reproduction during the analysed period which was accompanied by increased investments suggesting a positive growth potential.
3. Also farms specialising in horticulture and animal breeding in the grazing system stood out positively in the first period of the membership (2004-2007). In the following years, the level of investments no longer facilitated renewal of production assets. In the case of horticultural farms as well as permanent crops farms volatile profitability combined with high capital intensity of production hindered their development. It was noticed that the reproduction trends among the group of farms specialising in grass fed animals were related with the so-called hog cycle. On the contrary, one could notice a clear decapitalisation of assets in the case of farms lacking specialisation. The phenomena resulted from limited ability of these farms to generate a surplus which would be used for financing development due to limited production scale as well as low propensity to investments.
4. Based on the remarks, one should not conclude unanimously that future development of agriculture and rural areas will be limited only to farms with clear output specialisation, although they surely play an important role on the food market (Sapa A., 2009). Farms are operating under higher market risk and higher exposure to market trends. Owing to a different operating philosophy, farms with mixed production limit the risk, while they can also specialise in food production with increased quality standards, try to operate in the form of groups gathering other farmers, or perform functions related with the so-called countryside welfare (Brelik A., 2003), maintaining settlement network, stability and viability in rural areas. In contrast, maintaining narrowed reproduction in those units leads to accelerated polarisation processes in agriculture and may result in increased rate of unused production resources. It is less likely that capital and land resources should move automatically from those farms to farms with clear output specialisation. In many cases, the status of farm lands is changed into residential areas. Additionally, purchasing small plots from smaller farms is not really attractive due to relatively high cultivation unit costs. Therefore, the problem has also a social dimension and it concerns issues such as non-agricultural development of rural areas or quantification of public goods generated by agriculture.

Bibliography


This might suggest a decrease in the total UR area by ca. 5% in the years 2004-2010


