

INVESTMENT OUTLAYS IN POLISH AGRICULTURE

Abstract

On the ground of the Central Statistical Office (GUS) data, values of investment outlays in the fields of buildings and structures, machinery and tools as well as transport equipment in agriculture have been evaluated for the period of 1995-2013. The method for converting values of the values of these outlays from current to constant prices of 1995 has been presented. In 2013 value of investments in Polish agriculture (in constant prices) was in a case of buildings and structures by 107.9%, machinery and tools – by 100.5%, and transport equipment – by 98.3% higher than in 1995. Total investments in the field of technical means (building and structures, machinery and transport equipment) increased during this period by 103.0%. Correlations between these inputs and the global production, gross value added, final and market production have been described.

Keywords: investments, agriculture, technical means, current prices, fixed prices.

Introduction

Investment outlays are the source of fixed assets replacement in agriculture. Investments at farms allow for their modernisation consisting in rational selection of sets of vital machinery, elimination of old facilities that are unnecessary upon introduction of new plant and livestock production technologies (Wójcicki and Rudeńska, 2015). They ensure achievement of the desired level of technical equipment, on which depends the value of obtained direct margin at farms, according to a research by Kocira (2008).

Investments in means of agriculture mechanisation are closely linked to the business cycle in agriculture and with the level of agricultural producer income (Wójcicki, 2014; Wójcicki and Rudeńska, 2013). Poland's accession to the

European Union (EU) contributed to better situation of Polish farmers as a result of Common Agricultural Policy (CAP) implementation and triggered the mechanisms of financial support for agriculture under the agri-environmental programmes, including stimulation of activity run under organic systems (Jucherski and Król, 2013). It also caused higher demand, e.g., for brand new agricultural tractors (Zalewski (ed.), 2013, 2015). This was followed by higher supply of means of agriculture mechanisation. Among 17 types and type-dimensions of means of mechanisation for which it was possible to calculate supply in 2004, in ten cases national demand in 2013 was higher than in 2004 (Pawlak, 2015).

Changes in the supply level of respective agricultural machines and in case of tractors – also their registration, measured in pieces, fail to give a full picture of the changes taking place, since in subsequent years both upward and downward trends are visible. Moreover, the direction of the trends is often changing. A synthetic and more comprehensive picture of changes can be achieved from an analysis of changes in the value of investment outlays. However, such analysis is hindered by a lack of a fully objective measure. The value of respective flows of investment outlays at fixed prices should be such a measure. The publications of the Central Statistical Office (*Główny Urząd Statystyczny, GUS*) give these values at current prices. A measure of this type does not consider progressing price changes, there is then the need to estimate the values of investment outlays in fixed prices in respective years of the period covered by the analysis.

This paper aims at drawing up an estimation method for investment outlays in agriculture in fixed prices and its application to research of changes in the value of such outlays in Poland in 1995-2013.

The scope of works covers three flows of the aforementioned outlays, according to their allocation to creation of resources of fixed assets in agriculture in the form of:

- buildings and structures,
- machines, tools and technical equipment,
- means of transport, including tractors.

Source material and research method

When implementing the aforementioned research objective the paper used GUS data (2002, 2005, 2008, 2011, 2015b) concerning the value of investment outlays in 1995-2013 at current prices. It was necessary to know the price change indices in their respective flows to establish the value of these outlays in fixed prices. For buildings and structures, data on changes in the prices of construction and assembly production were used (GUS 2006, 2009, 2015a). In order to determine the dynamics of prices of means of transport and other means of agriculture mechanisation the paper uses data from market report published by the Institute of Agricultural and Food Economics – National Research Institute (Zalewski (ed.), 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012,

2013, 2014, 2015), which give values of a comparable set of these means in prices from respective years calculated based on data from GUS research. Over the period covered by the analysis the set of objects covered by GUS research changed, therefore biennial periods were taken into consideration, comparing in these years the same objects. This basis was used to determine the price change indices of a representative set, which for means of transport was formed of tractors and trailers, and for machines tools and equipment – the remaining means of agriculture mechanisation, covered GUS research and meeting the comparability criterion. Based on indices in the system: “previous year = 100”, indices referring to the starting year (1995) were calculated using the following equation:

$$a_{kr95} = C_{kr-1} \cdot \frac{C_{kr}}{100} \quad (1)$$

where:

a_{kr95} – value of the price change index of the k -th category of fixed assets in r -th year with reference to the price of 1995 (%);

C_{kr-1} – value of the price change index of the k -th category of fixed assets referred to the situation in 1995, determined for the year preceding the year for which we determine the value of the index a_{kr95} (%);

C_{kr} – value of the price change index of the k -th category of fixed assets in r -th year with reference to the price of the previous year, calculated for the year for which we determine the value of the index a_{kr95} (%).

The value of the price change index against the situation of 1995, thus calculated for the flows (categories) of investment outlays covered by the analysis, constitutes grounds for estimation of the value changes of these outlays at fixed prices.

The estimate can be done using the equation:

$$W_{ircs} = \frac{100 \cdot W_{ircb}}{a_{kr95}} \quad (2)$$

where:

W_{ircs} – value of investment outlays of i -th category of fixed assets in the r -th year, at fixed prices of 1995 (PLN million);

W_{ircb} – value of investment outlays of i -th category of fixed assets in the r -th year, at current prices (PLN million).

In case of machines, tools and equipment the number of researched objects in respective periods amounted to ca. 30. Whereas available data on prices of

means of transport concerned only from 2 to 4 objects, and, what is more, these were mainly tractors made in Poland, which starting from 2002 constituted below 50% of the national supply (Pawlak, 2012), and in 2013 – only 6.3% (Pawlak, 2015). As regards the means of transport, calculations with the use of the above procedure were made only for the period when the tractors made in Poland were predominant in the delivery structure (1995-2001). Next, values of investment outlays in this period in current and fixed prices were summed up, and this was used as grounds for determining the value of the index showing the relationship between the value of means of transport at fixed prices to the value of these means at current prices, average for 1995-2001. Multiplying the values of investment outlays on means of transport in current prices in subsequent years of the 2002-2013 period by the value of this index, the value of these outlays at fixed prices was estimated.

In case of investment outlays on machines, tools and equipment it was necessary to make a correction to calculation results as regards 2004. The estimated price growth – caused by covering these means with the value added tax (VAT) – resulted in demand growth in the first fourth months of the period and its drop in the following months of the year. Consequently, the distribution of sales of machines changed considerably during the year. The demand intensification was usually stronger in the second half of the year than in the first. In the first months of 2004, the amount of sold machines was around four times higher than in the similar period of 2003, while in the next months the sales were lower than in the previous year. However, in total the sales of respective types of means of agriculture mechanisation were in 2004 higher by 50-80% than in 2003 (Zalewski, 2005). Because of this, the average annual growth in the price of machines in 2004 was lower than that given in Table 2. Taking this into account, the value of investment outlays on machines, tools and equipment, calculated for 2004 and the next years was increased by 70%.

Correlations between the level of these outlays and the global output, gross value added and final and commercial production of the Polish agriculture along with determination of their descriptive linear functions and relevant determination coefficients were presented graphically.

Research results and their analysis

Investments in agriculture at current prices and price dynamics

As compared to the situation of 1995, the value of investment outlays in the Polish agriculture at current prices was higher by 261.1%, including:

- buildings and structures – by 375.5%,
- machines, tools and equipment – by 359.6%,
- means of transport – by 187.1%
- technical means in total – by 325.8% (Table 1).

Table 1

Value of investment outlays at current prices in PLN million

Years	Buildings and structures	Machines	Means of transport	Technical means in total	Total
1995	410.4	375.9	229.7	1016.0	1356.4
1996	501.7	787.4	507.1	1796.2	2142.9
1997	513.6	924.0	463.8	1901.4	2358.3
1998	602.2	733.0	284.4	1619.6	2022.9
1999	702.4	736.3	249.3	1688.0	2122.5
2000	699.9	679.1	257.6	1636.6	2078.7
2001	776.2	696.0	217.2	1689.4	2090.4
2002	875.0	691.4	247.9	1814.3	2183.9
2003	821.8	607.5	245.6	1674.9	2026.8
2004	844.5	680.6	280.8	1805.9	2155.4
2005	842.7	841.1	362.4	2046.2	2398.0
2006	1162.8	954.9	459.2	2576.9	2958.6
2007	1400.5	1150.2	564.8	3115.5	3554.9
2008	1449.3	1345.8	655.9	3451.0	3929.1
2009	1315.6	1355.4	566.2	3237.2	3710.3
2010	1281.6	1424.3	541.1	3247.0	3766.0
2011	1570.4	1579.9	588.7	3739.0	4283.9
2012	1597.0	1706.5	679.6	3983.1	4492.7
2013	1951.4	1727.8	647.0	4326.2	4897.4

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014).

Investment outlays on technical means at current prices constituted from 74.9% to 88.7% of total investment outlays in the Polish agriculture. This share showed an upward trend.

In the analysis period price growth concerned:

- construction and assembly production – by 128.7%;
- machines, tools and equipment – by 289.7%.

The price dynamics of technical means was in general dropping. In case of machines, tools and equipment and means of transport, though, there was a sharp price growth in 2004. It was caused by increase in VAT rate from the level of zero, as of 1 May 2004, upon Poland's accession to the EU. Effects were visible already in 2005, because the level of average prices in 2004 was influenced by lower prices in the first months of the year. The average price in 2004 – forming the reference basis for calculation of the growth index in 2005 – was thus much lower than that noted in the period from May to December of the year.

Table 2

Years	<i>Price index for investment outlays</i>			
	Construction and assembly production		Machines, tools and equipment	
	Previous year = 100 (%)	1995 = 100 (%)	Previous year = 100 (%)	1995 = 100 (%)
1996	119.2	119.2	126.7	126.7
1997	114.2	136.1	119.5	151.4
1998	112.9	153.7	112.7	170.6
1999	108.6	166.9	110.6	188.7
2000	107.9	180.1	105.6	199.3
2001	103.8	186.9	109.5	218.2
2002	101.2	189.2	104.3	227.6
2003	98.9	187.1	102.9	234.3
2004	102.5	191.8	121.3	284.1
2005	103.1	197.7	115.9	329.2
2006	102.9	203.5	98.1	323.1
2007	107.8	219.3	100.7	325.4
2008	104.8	229.8	98.9	321.9
2009	100.2	230.3	101.5	326.6
2010	99.9	230.1	107.2	350.2
2011	101.0	232.4	104.4	365.6
2012	100.2	232.8	102.4	374.4
2013	98.2	228.7	104.1	389.7

Source: own study based on data from GUS (GUS, 2006, 2009, 2015a and Zalewski (ed.), 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015).

Investment outlays on technical means in agriculture in fixed prices

Compared to the situation of 1995, the value of investment outlays in the Polish agriculture at fixed prices was in 2013 higher for buildings and structure by 107.9%; for machines, tools and equipment by 100.5%; and for means of transport by 98.3%. The total value of investments in technical means of construction, mechanisation and transport in agriculture increased at the time by 103.0% (Table 3).

In the period covered by the analysis, the dynamics of respective flows of investment outlays was strongly differentiated. The growth trends as compared to the next years were the strongest in case of buildings and structures in 2006, 2011 and 2013, and in case of machines, tools and equipment in 1996, 2004,

2006-2008, and for means of transport in 1996, 2005-2008 and 2012. Upon Poland's accession to the European Union and upon launching the funds supporting production investments under the Common Agricultural Policy signs of animation were noted. However, in case of investments in means of mechanisation and transport in 2009, 2010 and 2013 there was a regress against the previous years. More intensive mechanisation investments in 2004 were linked to farmers seeking to execute purchases before price increase, because of covering the means of mechanisation of agriculture with value added tax, i.e. in the first four months of the year. The value of investments in agricultural machines, tools and equipment was in 2004 higher by 57.1% than a year before.

The level of investments in agriculture was also affected by the value of agricultural production obtained in respective years.

Table 3

Value of investment outlays at fixed prices in 1995 (PLN million)

Years	Buildings and structures	Machines, tools and equipment	Means of transport	Technical means in total
1995	410.4	375.9	229.7	1016.0
1996	420.9	621.5	507.1	1796.2
1997	377.4	610.3	463.8	1901.4
1998	391.8	429.7	284.4	1619.6
1999	420.9	390.2	249.3	1688.0
2000	388.6	340.7	257.6	1636.6
2001	415.3	319.0	217.2	1689.4
2002	462.5	303.8	174.5	1814.3
2003	439.2	259.3	172.9	1674.9
2004	440.3	407.3	197.6	1805.9
2005	426.3	434.4	255.1	2046.2
2006	571.4	502.4	323.2	2576.9
2007	638.6	601.0	397.5	3115.5
2008	630.7	710.8	461.6	3451.0
2009	571.3	705.5	398.5	3237.2
2010	557.0	691.4	380.8	3247.0
2011	675.7	734.6	414.3	3739.0
2012	686.0	774.9	478.3	3983.1
2013	853.3	753.8	455.4	4326.2

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014).

Value of agricultural production versus investments in technical means

In 1995-2013, there was a major growth in both respective categories of agricultural production and investments in the area of technical means. Figure 1 assumes respective values in current prices.

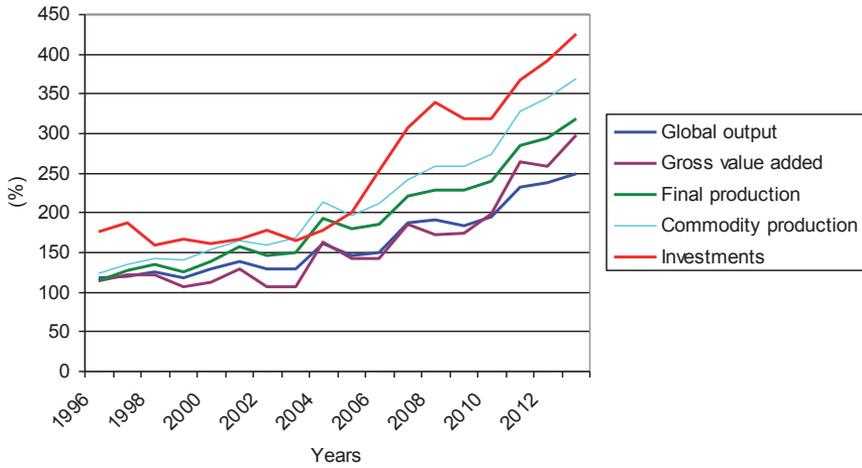


Fig. 1. Investment outlays on technical means of production versus the values of selected agricultural production categories in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

Correlation between investment outlays on technical means of production and the value of global output of agriculture is positive and strongly pronounced (Fig. 2).

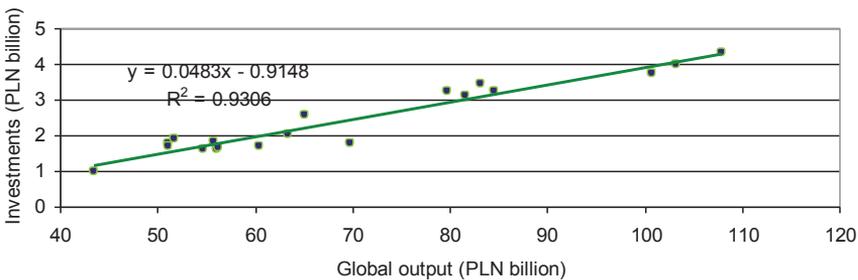


Fig. 2. Investment outlays on technical means of production versus the value of global output of agriculture in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

Also positive, but slightly weaker, is the correlation between the values of discussed investment outlays on the level of gross value added (Fig. 3).

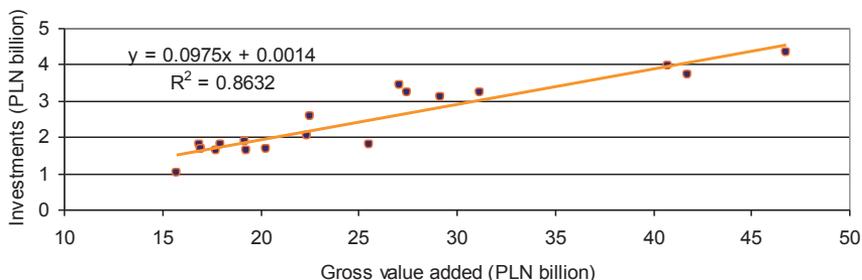


Fig. 3. Investment outlays on technical means of production versus gross value added of agriculture in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

Correlation of the value of investment outlays on technical means on final production value of agriculture is similar as the relation of the outlays to global output (Fig. 4).

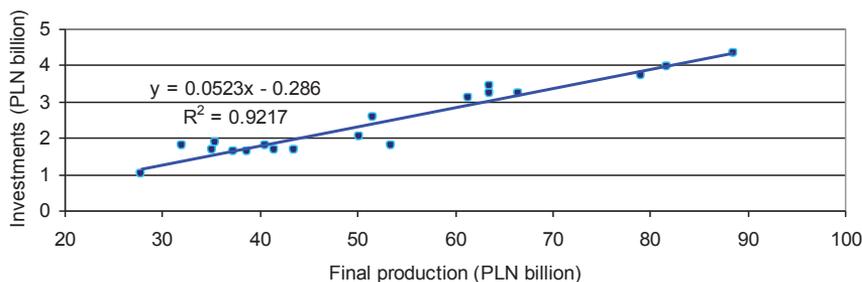


Fig. 4. Investment outlays on technical means of production versus the values of final agriculture production in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

The correlation between the value of investment outlays on technical means versus final production of agriculture is also strong (Fig. 5).

Researching the correlation between the value of agricultural production versus respective flows of investment outlays, global output of agriculture was taken as the reference basis for these outlays because it is correlated with them at the strongest level. Figure 6 gives evidence of strong impact of global output on building investments.

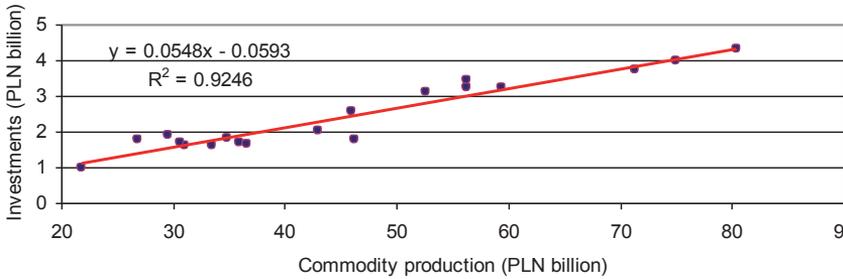


Fig. 5. Investment outlays on technical means of production versus the values of commercial production of agriculture in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

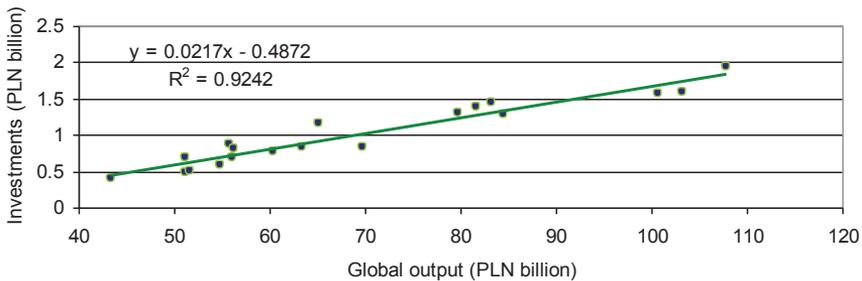


Fig. 6. Building investments versus the global output value of agriculture in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

Correlation for investments in machines, tools and equipment for agricultural production is less clear (Fig. 7) and the least visible is the correlation for means of transport (Fig. 8).

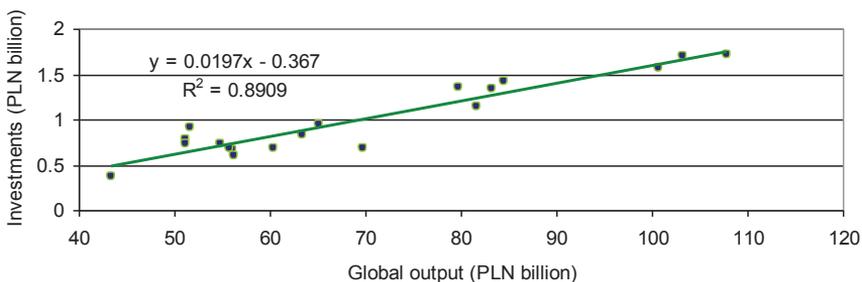


Fig. 7. Investment outlays on machines, tools and equipment versus the value of global output of agriculture in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

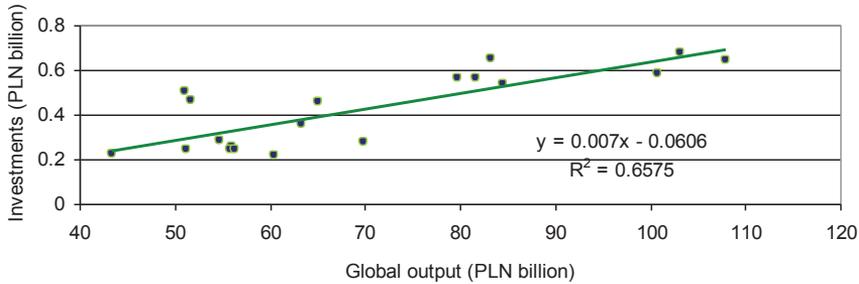


Fig. 8. Investment outlays on means of transport versus the value of global output of agriculture in Poland.

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

An analysis of correlations presented in Figures 6-8 showed that although the level of agricultural production is an important factor affecting the value of investments in technical means in agriculture, it is not the only one. Financial means allocated to support for these investments under CAP of the EU are also important. After Poland's accession to the EU, subsidies for modernisation investments under RDP 2007-2013 were the driving force of the Polish market of agricultural machines and tractors. The value of investments implemented in 2007-2013 under the programme of investments in machines and tractors was estimated by Muzalewski (2015) at PLN 14.6 billion, which constituted ca. 38% of the value of the market of agricultural equipment in Poland at the time. This should explain the less pronounced correlation, especially in case of investments linked to the means of transport (Fig. 8).

Investment outlays at fixed prices per area unit of arable land and permanent crops and per one farm

The growth in the investment outlays on technical means was accompanied by reduction in the farmed area and a drop in the number of farms in Poland. Growth dynamics of these outlays per area unit of arable land and permanent crops was thus higher than in case of the absolute value of respective investment flows in Polish agriculture and it amounted to:

- buildings and structures – 185.7%,
- machines, tools and equipment – 169.2%,
- means of transport – 162.5%,
- technical means in total – by 174.3% (Table 4).

Table 4

Value of investment outlays at fixed prices of 1995 per area unit of arable land and permanent crops (PLN per ha⁻¹)

Years	Buildings and structures	Machines, tools and equipment	Means of transport	Technical means in total	Including means of mechanisation
1995	28	26	16	70	42
1996	29	43	35	107	78
1997	26	43	32	101	75
1998	27	30	20	77	50
1999	29	27	17	73	44
2000	27	24	18	69	42
2001	30	23	16	69	39
2002	35	23	13	71	36
2003	34	20	13	67	33
2004	34	31	15	80	46
2005	34	35	20	89	55
2006	45	39	25	109	64
2007	49	47	31	127	78
2008	49	55	36	140	91
2009	44	55	31	130	86
2010	49	61	34	144	95
2011	59	64	36	159	100
2012	61	68	42	171	110
2013	80	70	42	192	112

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

Whereas a growth in investment outlays per one farm was as follows:

- buildings and structures – 209.1%,
- machines, tools and equipment – 198.9%,
- means of transport – 194.6%,
- technical means in total – by 201.8% (Table 5).

Table 5

Value of investment outlays at fixed prices of 1995 per one farm (PLN per farm¹)

Years	Buildings and structures	Machines, tools and equipment	Means of transport	Technical means in total	Including means of mechanisation
1995	198	181	111	490	292
1996	206	304	248	757	551
1997	187	303	230	720	533
1998	196	215	143	554	358
1999	217	201	129	547	330
2000	206	181	137	523	317
2001	220	169	115	504	284
2002	236	155	89	481	245
2003	237	140	93	470	233
2004	237	219	106	563	326
2005	239	243	143	625	386
2006	316	278	179	772	456
2007	353	332	220	905	552
2008	348	393	255	996	648
2009	323	399	225	947	624
2010	375	466	257	1097	722
2011	464	504	284	1253	789
2012	471	532	328	1331	860
2013	612	541	327	1479	867

Source: own study based on data from GUS (2002, 2005, 2008, 2011, 2014b).

Conclusions

Correlation between investment outlays on technical means of production and the value of global output of agriculture is positive and strongly pronounced. The highest value of determination coefficient of a linear function describing the correlation was noted for building investments, and the lowest – for means of transport, which include tractors.

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Abstrakt

Na podstawie danych GUS oszacowano wartości nakładów inwestycyjnych w zakresie budynków i budowli, maszyn, narzędzi i urządzeń oraz środków transportu w rolnictwie w latach 1995-2013. Przedstawiono metodę przeliczania wartości tych nakładów w cenach bieżących na wyrażone w cenach stałych 1995 r. W 2013 r. wartość nakładów inwestycyjnych w rolnictwie polskim w cenach stałych była w przypadku budynków i budowli o 107,9%, maszyn, narzędzi i urządzeń – o 100,5%, a środków transportu o 98,3% większa niż w 1995 r. Łączna wartość inwestycji na środki techniczne (budownictwa, mechanizacji i transportu) w rolnictwie zwiększyła się w tym czasie o 103,0%. Opisano współzależności między poziomem tych nakładów a produkcją globalną, wartością dodaną brutto oraz produkcją końcową i towarową polskiego rolnictwa.

Słowa kluczowe: inwestycje, rolnictwo, środki techniczne, ceny bieżące, ceny stałe.

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