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EFFICIENCY OF THE LITHUANIAN AGRICULTURAL SECTOR: RETURN ON FIXED ASSETS, OUTPUT, AND VALUE ADDED

Irena Kriščiukaitienė, Tomas Baležentis
Lithuanian Institute of Agrarian Economics

This study is focussed on the Lithuanian agricultural sector which currently operates under both competition and support of the European Union and its Member States. The aim of the research is to identify the underlying factors causing changes in gross value added generated in agriculture. The enumerated methods were employed for the research: statistical analysis, ratio analysis, index decomposition analysis. The research covers period of 1995–2009.

The efficiency of the Lithuanian agricultural sector as well as the whole economy was assessed by considering the two ratios, namely return on fixed assets (ROFA) and effectiveness ratio. The former one was computed by dividing total output from fixed assets, whereas the latter one was measured by dividing gross value added from total output. Agricultural fixed assets provided decreasing rates of return since 1996 until 2000. Afterwards ROFA in agricultural sector fluctuated around the value of 18 per cent and gained momentum in 2004 consequently reaching its peak in 2008 (22 per cent). Meanwhile, ROFA for the whole economy reached 41 per cent in 2008. The effectiveness in agricultural sector has been decreasing ever since 2003. As of 2009, effectiveness of agricultural sector was 35 per cent, whereas the same figure for the whole economy amounted to 52 per cent. Changes in fixed assets had similar impact on gross value added in agriculture and the whole economy, indexes of 1.9 and 2.2, respectively. ROFA and effectiveness, however, caused decrease of 36 and 12 per cent, in that order, in nominal gross value added. Meanwhile, these effects were positive for the whole economy. Given the results of our analysis, it can be concluded that fixed assets in Lithuanian agricultural sector could be used more efficiently.

Keywords: efficiency, output, value added, fixed assets, index decomposition analysis.
JEL codes: O130, Q100, Q130, C430.

Introduction

Efficiency as well as competitiveness can be assessed at the three levels, namely at those of state, sector, and enterprise (Navickas, 2010; Misiūnas, 2010). This study is hence focussed on the Lithuanian agricultural sector which currently operates under both competition and support of the European Union (EU) and its Member States.

Topicality of the research. Since becoming a Member State of the EU in 2004, Lithuania faces an increasing need to provide the competitive production to the Single Market. According to Eurostat (2010), the share of intermediate consumption in crop production (output) amounted to 37.2 per cent and 68.7 per cent in animal production for Lithuania, whereas the EU average values were 22.1 and 59.5 per cent, respectively (as of 2009). In addition, Z. Kazakevičius (2011) reported the declined efficiency of Lithuanian farming. Hence, Lithuanian agriculture is peculiar with relatively high level of intermediate consumption and thus less competitive production. Therefore it is important to investigate into the recent trends of main indicators describing productivity and competitiveness of the Lithuanian agricultural sector.

The problem of the research. Although efficiency and competitiveness of the Lithuanian agricultural and food sector has been analyzed in many studies at various levels (Kriščiukaitienė, 2007; Paunksnienė, 2009; Vinciūnienė, 2009; Tamošaitienė, 2010; Baležentis, 2011), relations between returns on fixed assets, output, and value added remain rather vague. This study, thus, attempts to reveal the main trends in aforementioned indicators identifying efficiency of the agricultural sector.

The object of the research is the Lithuanian agricultural sector.

The aim of the research is to quantify changes in gross value added generated in agriculture by considering the underlying factors. The following **tasks** are therefore set: 1) to describe the main trends of efficiency indicators of agricultural sector; 2) to estimate the impact of different factors on changes in gross value added; and 3) to compare efficiency of the Lithuanian agricultural sector with that of the whole economy.

The enumerated **methods** were employed for the research: statistical analysis, ratio analysis, index decomposition analysis. The research covers the period of 1995–2009.

1. Indicators for measurement of efficiency and productivity

This section shall briefly describe the main indicators identifying productivity of certain sector or economy as a whole. Further, the dynamics of these indicators will be presented.

It is widely acknowledged that financial ratio analysis can constitute basis for robust assessment of business efficiency (Peterson Drake, 2010). Therefore, financial ratio analysis was applied when analyzing sub-sector efficiency (Meyers, 2004, 2006; Tamošaitienė, 2010; Guzewicz, 2006), namely for assessment of efficiency across different farming types, farm sizes etc. In this study the authors put forward the practice of evaluation of the sector efficiency by considering indicators indentifying operation efficiency – fixed assets, output, and value added – as well as the derived financial rations.

As defined in the European System of Accounts methodology (Council ..., 1996), *output* consists of the products created during the accounting period. The output indicator, hence, identifies the overall production level of sector or economy. *Intermediate consumption* consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. The goods and services may be either transformed or used up by the production process (Council ..., 1996). Thus, output less intermediate consumption constitute *gross value added*, which basically is remuneration for owners of factors of production. Finally, *fixed assets* are tangible or intangible assets produced as outputs from processes of production that are themselves used repeatedly, or continuously, in processes of production for more than one year.

The efficiency of economic sector or economy, therefore, can be assessed by considering the following ratios. The return on fixed assets (ROFA) ratio is computed by dividing total output from fixed assets (Mackevičius, 2008). The effectiveness of sector or economy is measured by dividing gross value added from total output. The following equation, hence, holds:

$$VA_t = FA_t \cdot \frac{Q_t}{FA_t} \cdot \frac{VA_t}{Q_t} = FA_t \cdot ROFA_t \cdot E_t, \quad (1)$$

where VA_t denotes value added, FA_t –fixed assets, Q_t – total output, $ROFA_t$ – return on fixed assets, and E_t – effectiveness during period t.

According to data of Statistics Lithuania (Rodiklių ..., 2011), gross stocks of fixed capital in the whole Lithuanian economy amounted to 232 059.8 million Lt in 1995 and grew up to 514161.1 million Lt in 2009, i. e. they grew by some 122 per cent with mean annual growth rate of 5.8 per cent. Meanwhile, gross stocks of fixed capital in agricultural sector (NACE 1.1 sectors A and B) went up by 90 per cent from 22917 million Lt to 43634.9 million Lt with annual growth rate of 4.7 per cent. Thus one can note that stocks of fixed assets increased at a slower pace in agricultural sector if compared to the economy as a whole.

During the investigated period of 1995–2009 the total output of Lithuanian economy increased by 204 per cent (mean annual growth of 8.2 per cent), namely from 52052 million Lt up to 157978 million Lt. The agricultural output, however, grew by 19 per cent (annual rate of 1.2 per cent) from 6584.9 million Lt up to 7842 million Lt. Since the total output is available in current prices only, all the remaining indicators are expressed in current prices as well. As it was described above, the ROFA ratio (Fig. 1) resembles the level of fixed assets productivity.

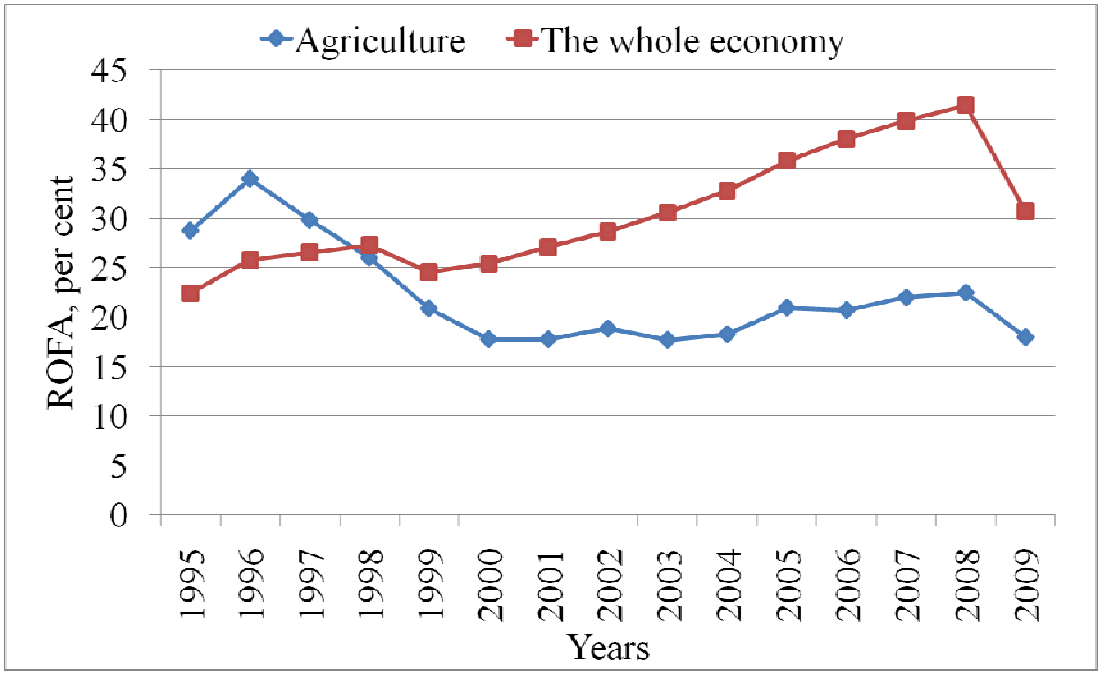

Fig. 1. Return on fixed assets in agriculture and the whole Lithuanian economy, 1995–2009

As shown in Fig. 1, agricultural fixed assets provided higher rates of return until 1998. However they have been decreasing since 1996 and did this until 2000. Afterwards ROFA in agricultural sector fluctuated around the value of 18 per cent and gained momentum in 2004 consequently reaching its peak in 2008 (22 per cent). Meanwhile, ROFA for the whole economy reached 41 per cent in 2008. Both of these indices, however, shrunk in year 2009 due to economic downturn. To conclude,

ROFA in agricultural sector has been lower if compared to that for the whole economy during 1998–2009 even though it had been increasing in 2004–2008 possibly due to Lithuania's accession into the EU. For acquired investments into agriculture might have enabled to expand more competitive production. Noteworthy, the stability of ROFA in agriculture exhibited throughout 2000–2004 might also be partially attributed to non–increasing amount of fixed assets.

The value added generated in the Lithuanian economy increased from 24063 million Lt to 82428 million Lt (at current prices), whereas in agriculture it grew from 2642 million Lt up to 2770 million Lt (concerning 1995–2009). Specifically, growth of 4.8 per cent and 243 per cent was observed for agriculture and total economy, respectively, though the corresponding deflated figures are 27 per cent and 88 per cent. Agricultural output prices, hence, were relatively less inflated (or even deflated) during the analysed period. Consequently, effectiveness ratio has always been lower in agriculture if compared to the whole economy (Fig. 2). More specifically, agricultural production prices were not increasing as robustly as those of imported machinery and raw materials and thus fuelled growth of intermediate consumption share in total output as well as decrease in effectiveness. As the following Fig. 2 depicts, the effectiveness in agricultural sector has been decreasing ever since 2003.

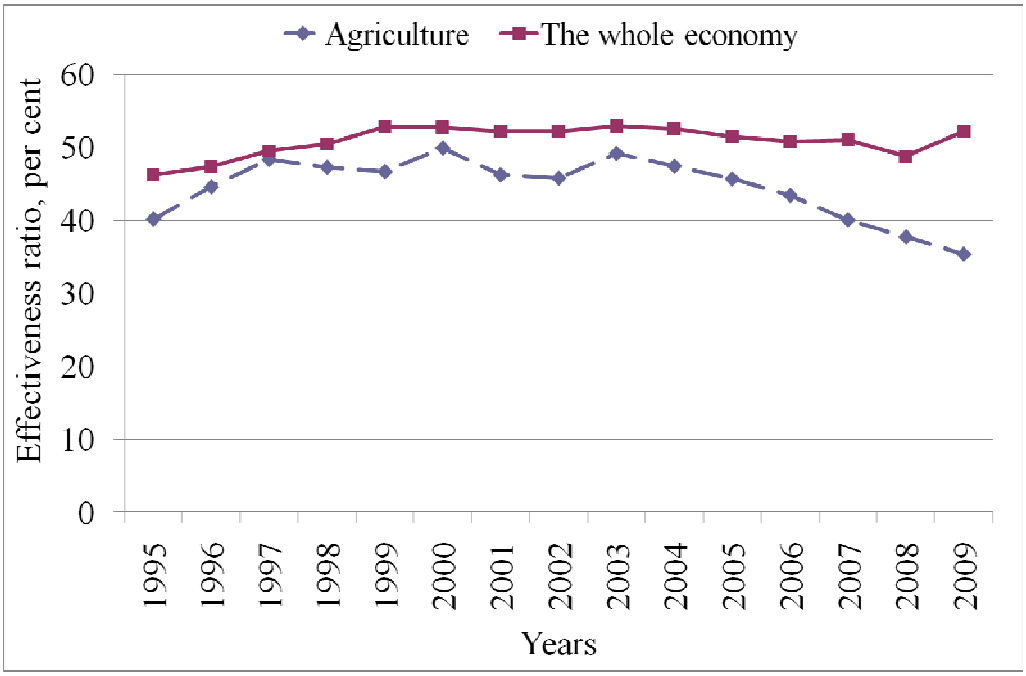

Fig. 2. Effectiveness ratio for Lithuanian economy and agriculture sector (per cent), 1995–2009

In the following Section 2 we will relate the enumerated developments with gross value added generated in agriculture and the whole economy.

2. Index decomposition of changes in gross value added

The Logarithmic Mean Divisia Index (Ang, 2005) will be applied for index analysis. By employing respective index decomposition analysis (IDA) models, we can decompose changes in gross value added (Eq. 1) either in additive or in multiplicative form. The additive IDA enables to decompose the difference $\Delta VA = VA_T - VA_0 = \Delta VA_{FA} + \Delta VA_{ROFA} + \Delta VA_E$ with sub-indexes T and 0 meaning current and base periods, respectively, and:

$$\Delta VA_{FA} = \frac{VA_T - VA_0}{\ln VA_T - \ln VA_0} \ln\left(\frac{FA_T}{FA_0}\right), \tag{2}$$

$$\Delta VA_{ROFA} = \frac{VA_T - VA_0}{\ln VA_T - \ln VA_0} \ln\left(\frac{ROFA_T}{ROFA_0}\right), \tag{3}$$

$$\Delta VA_{FA} = \frac{VA_T - VA_0}{\ln VA_T - \ln VA_0} \ln\left(\frac{E_T}{E_0}\right). \tag{4}$$

Similarly, the multiplicative IDA decomposes the ratio $D = VA_T / VA_0 = D_{FA} \cdot D_{ROFA} \cdot D_E$ where:

$$D_{FA} = FA_T / FA_0 , \tag{5}$$

$$D_{ROFA} = ROFA_T / ROFA_0 , \tag{6}$$

$$D_E = E_T / E_0 . \tag{7}$$

The changes in gross value added generated in agriculture were decomposed by employing Eqs. 2–4 (Fig. 3 and Fig. 4).

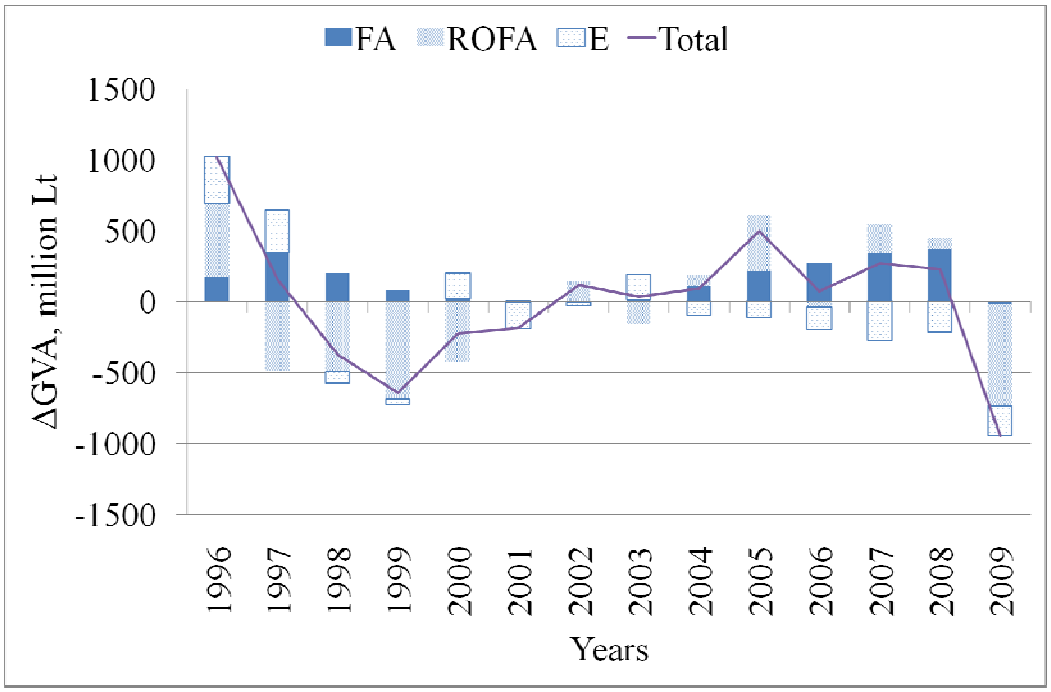

Fig. 3. The additive IDA for changes in gross value added (ΔGVA) generated in agriculture: fixed assets (FA), return on fixed assets (ROFA), and effectiveness (E) effects

Subsequently, Eqs. 5–7 were applied to perform the multiplicative IDA. As one can note, the most serious declines was experienced during crises of 1998–1999 and 2009. The shifts in gross value added were mainly driven by declined ROFA, what might be attributed to shrunk output. The falling effectiveness, in turn, deepened the decline of value added in 1998–1999 and since 2004. As for effect of fixed assets employed in agriculture, their positive effect on generation of value added had been falling since 1997 and began to recover in 2003. The latter phenomenon might be interrelated with EU support under the scheme of SAPARD and Rural Development Programme. Nevertheless, the economic crisis of 2009 caused decline in fixed assets formation.

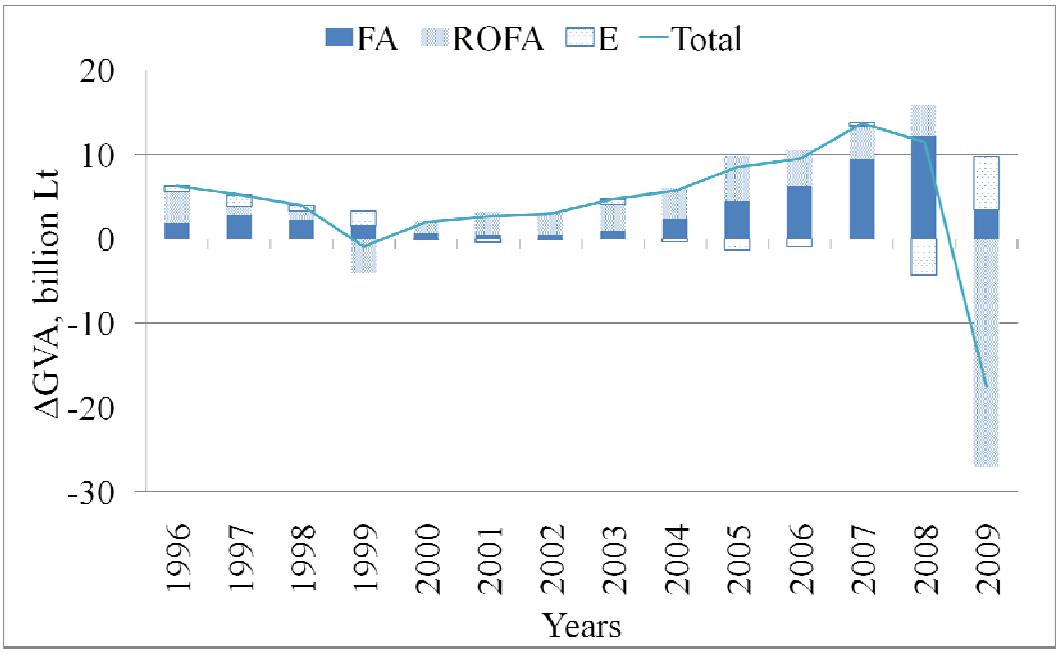

Fig. 4. The additive IDA for changes in gross value added (ΔGVA) generated in the whole economy: fixed assets (FA), return on fixed assets (ROFA) and effectiveness (E) effects

Comparison of Fig. 3 and Fig. 4 reveals that increasing effectiveness had a positive effect on gross value in the whole economy during the recent crisis of 2009, whereas the same effect was negative in agriculture. Hence, agricultural sector is peculiar with certain inertia leading to relative inefficiency.

The following Table summarizes results from additive and multiplicative IDA. As we can see, changes in fixed assets had similar impact on gross value added in agriculture and the whole economy, indexes of 1.9 and 2.2, respectively. ROFA and effectiveness, however, caused decrease of 36 and 12 per cent, in that order, in nominal gross value added. Meanwhile, these effects were positive for the whole economy.

Given the results of the analysis, it can be concluded that Lithuanian agricultural sector managed to accumulate fixed assets due to EU support through suchlike instruments as SAPARD, structural support, Rural Development Programme etc. These assets, nevertheless, were used relatively inefficiently. Hence, it is important to improve productivity of agricultural sector by introducing innovative technologies and thus providing more competitive production. For instance, improvements of crop

structure, crop rotation as well as rational use of agricultural machinery could increase the productivity.

Table. Results from additive and multiplicative IDA of changes in gross value added (GVA)

	Agricultural sector		The whole economy	
	Additive, million Lt	Multiplicative	Additive, million Lt	Multiplicative
GVA (1995)	2642.50	1.00	24063.18	1.00
FA	2123.71	1.90	48885.46	2.22
ROFA	–1 593.28	0.63	4963.74	1.37
E	–403.12	0.88	4515.81	1.13
GVA (2009)	2769.81	1.05	82428.18	3.43

The current situation when intermediate consumption relies on goods imported from EU states, whereas output export is oriented towards CES states creates unfavourable terms of trade. Furthermore, increased competitiveness would enable to opt for the Western markets and thus increase value added. These changes would lead to somehow increased effectiveness of agricultural sector. In addition, farmers should optimize their input and production structure with respect to CAP payments, prices, and agro–climatic constraints related to respective types of agricultural production. Appropriate decision support systems (Kurlavičius, 2009), hence, should be developed for the latter purpose. As for the EU and national governments, they should opt for streamlining support payments by focussing on transparency and amount thereof.

Conclusions

1. The efficiency of the Lithuanian agricultural sector as well as the whole economy was assessed by considering the two ratios, namely return on fixed assets (ROFA) and effectiveness ratio. The former one was computed by dividing total output from fixed assets, whereas the latter one was measured by dividing gross value added from total output.

2. Agricultural fixed assets provided higher rates of return until 1998. However they have been decreasing since 1996 and did this until 2000. Afterwards ROFA in agricultural sector fluctuated around the value of 18 per cent and gained momentum in 2004 consequently reaching its peak in 2008 (22 per cent). Meanwhile, ROFA for the whole economy reached 41 per cent in 2008. Both of these indices, however, shrunk in year 2009 due to economic downturn. To conclude, ROFA in agricultural sector has been lower if compared to that for the whole economy during 1998–2009 even though it had been increasing in 2004–2008 possibly due to Lithuania's accession into the EU. For acquired investments into agriculture might have enabled to expand more competitive production.

3. More specifically, agricultural production prices were not increasing as robustly as those of inputs (imported machinery and raw materials) and thus fuelled growth of intermediate consumption share in total output as well as decrease in effec-

tiveness. Indeed, the effectiveness in agricultural sector has been decreasing ever since 2003. As of 2009, effectiveness of agricultural sector was 35 per cent, whereas the same figure for the whole economy amounted to 52 per cent.

4. Changes in fixed assets had similar impact on gross value added (indexes of 1.9 and 2.2 for agriculture and the whole economy, respectively). ROFA and effectiveness, however, caused decrease of 36 and 12 per cent, in that order, in nominal gross value added. Meanwhile, these effects were positive for the whole economy.

5. It can be concluded that fixed assets in the Lithuanian agricultural sector could be used more efficiently. Hence, it is important to improve productivity of agricultural sector by introducing innovative technologies and thus providing more competitive production. Furthermore, increased diversification of international trade partners would results in improved terms of trade. In addition, farmers should optimize their input and production structure with respect to CAP payments, prices, and agro–climatic constraints related to respective types of agricultural production. As for the EU and national governments, they should opt for streamlining support payments by focussing on transparency and amount thereof. These changes would lead to somehow increased effectiveness of agricultural sector.

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LIETUVOS ŽEMĖS ŪKIO SEKTORIAUS PRODUKTYVUMAS: ILGALAIKIO TURTO GRĄŽA, PRODUKCIJA IR PRIDĖTINĖ VERTĖ

Irena Kriščiukaitienė, Tomas Baležentis
Lietuvos agrarinės ekonomikos institutas

Santrauka

Šiame straipsnyje analizuojamos Lietuvos žemės ūkio sektoriaus, susiduriančio su ES parama ir valstybių narių konkurencija, produktyvumo problemos. Tyrimo tikslas – nustatyti ir kiekybiškai įvertinti bendrosios pridėtinės vertės, sukuriamos žemės ūkyje, pokyčius lemiančius veiksnius. Tyrime naudoti šie metodai: statistinė analizė, santykinių rodiklių analizė, indeksinio išskaidymo analizė. Tyrimo periodas – 1995–2009 m.

Lietuvos žemės ūkio sektoriaus ir viso ūkio produktyvumas buvo įvertintas atsižvelgiant į du santykinius rodiklius: ilgalaikio turto grąžą ir efektyvumą. Pirmasis rodiklis apskaičiuotas dalijant bendrosios produkcijos apimtį iš ilgalaikio turto apimties, antrasis – skaičiuojant bendrosios pridėtinės vertės ir bendrosios produkcijos apimties santykį. Ilgalaikis turtas žemės ūkio sektoriuje teikė mažėjančią grąžą 1996–2000 m., vėliau ji svyravo apie 18 proc. ribą ir pradėjo didėti nuo 2004 m., o 2008 m. pasiekė 22 proc. Tuo pačiu metu ilgalaikio turto grąža visame ūkyje siekė 41 proc. Žemės ūkio sektoriaus efektyvumas mažėjo nuo 2003 m. Taigi 2009 m. jis siekė 35 proc., o visame ūkyje – 52 proc. Minėti pokyčiai gali būti paaiškinti ilgalaikio turto apimties ir vertės augimu bei iš dalies mažėjusiomis žemės ūkio produkcijos kainomis. Ilgalaikio turto apimties pokyčiai darė panašią įtaką žemės ūkio sektoriuje ir visame ūkyje (atitinkami daliniai indeksai 1,9 ir 2,2). Ilgalaikio turto grąžos ir efektyvumo pokyčiai lėmė bendrosios pridėtinės vertės apimties sumažėjimą atitinkamai 36 proc. ir 12 proc. Tyrimo laikotarpiu pastarieji du efektai buvo teigiami visame ūkyje. Atsižvelgiant į tyrimo rezultatus, yra tikslinga didinti ilgalaikio turto grąžą racionaliau panaudojant žemės ūkio naudmenas ir techniką, didinant žemės ūkio produkcijos konkurencingumą Vakarų Europos rinkose.

Raktiniai žodžiai: produktyvumas, produkcija, pridėtinė vertė, ilgalaikis turtas, indeksinio išskaidymo analizė.

JEL kodai: O130, Q100, Q130, C430.