

REMUNERATIONS AND LABOUR PRODUCTIVITY IN AGRICULTURE AGAINST A BACKGROUND OF OTHER ECONOMY SECTORS

Justyna Góral✉, Włodzimierz Rembisz

Institute of Agricultural and Food Economics – National Research Institute

ABSTRACT

The optimal allocation of resources in various sectors results in the sustainable development of the whole economy (the theory of optimum allocation of resources by Kantonowicz and Koopmans). According to Tinbergen's studies, the excessive labour force in one of them gives rise to all types of social and economic problems. The objective of theoretical considerations and empirical studies of this publication is to analyse the ratio of the remuneration for labour to its productivity in various economy sectors with particular attention paid to the agricultural sector. The authors also refer to the theory by Lewis and Schultz, who had analysed the problems of agriculture in developing countries, as well as to the Solow economic growth model with the Cobb–Douglas production function. In the light of the empirical data presented in the paper, we can conclude that in section A of Statistical Classification of Economic Activities this ratio is seriously disturbed and distorted. The remuneration is overvalued in relation to the labour productivity. Such a ratio is not a positive testimony to the reasonableness of management in the sense of agricultural producers' equilibria.

Key words: the ratio of the remuneration for labour to its productivity, sectoral aspect, agriculture

INTRODUCTION

For more than 200 years, economists have been analysing the reasons for which some economies develop faster than others (see: economics of development). Smith stressed that the annual product of each nation cannot rise in its value in a different way than just by increasing the number of productive employees or by an increase in their production force. The increase in the economic labour productivity results in a higher level of wealth and is contributed to by an improvement in capital to labour ratio, improved work organisation, increased competence of the staff, improved work discipline and motivation.

Jevons and Marshall believed that there is a close correlation among the factors of production, as their values are harmoniously matched with each other in

the economic process. This match provides an equilibrium while making the full use of the productive potential. Otherwise, we would deal with the Nurkse's vicious circle of poverty.

In his paper entitled *Economic Development with Unlimited Supplies of Labour* of 1954, Lewis presented a model of the bi-sectoral development, in which he assumed that some underdeveloped countries have a dual economy – both traditional agriculture characterised by the low productivity, low income and the modern industry. Agriculture developing in rural areas and the urban industry resulted in large development differences among the parts of the country. This fact intensified migration to cities, which resulted in self-sustaining development (thanks to industrialisation). Due to the very low marginal labour productivity (according to Lewis – close to zero), the loss of labour

✉ Justyna.Goral@ierigz.waw.pl

force in the countryside did not result in the proportionate loss in the food production [Lewis 1954]. This image shows approximately the realities of the Polish economy.

The amount of remunerations is a variable dependent on many exogenous factors, among which of key importance is the level of economic development. Differentiation in the level of GDP per employee results from the diversification of the resources of the factors of production, as well as from the total changes in the efficiency of using these resources (production technology, investment). The economic structures of underdeveloped regions have been dominated by the low-value added activities. Along with the economic development, the relative share of low-value added sectors (e.g. agriculture) should decrease. The flow of labour force from the low productivity sectors to others (proper allocation of labour force) is one of the important factors affecting the rate of the average labour productivity and of the economic growth [Kosmalski 2010].

The objective of this article is to analyse the ratio of the remuneration for labour to its productivity in various economy sectors. Here, we assume that this ratio of the remuneration to its source of financing informs about the reasonableness of the allocation of this factor. Here, the adequate proportions should be maintained. On a basis of figures, we showed the mutual correlations of these two variables in the analysed sections. The study used mostly the information from the Local Data Bank Central Statistics Office (CSO) and Eurostat. The paper repeatedly referred to, in the sense of the concept of reasoning, to Cobb–Douglas production function. A good analytical tool to consider the reasons for the labour productivity level they are the Neo-classical production functions and resulting labour productivity functions. A certain reference to the considerations carried out here was the previous paper by Rembisz [2016].

PRODUCTIVITY VERSUS REMUNERATIONS – THEORETICAL ASPECT

A key issue in assessing the reasonableness of management is the ratio of the remuneration for the factor of production to its productivity [Gadomski 2015]. This ratio evolved differently in various economy sectors,

which resulted from a series of endo- and exogenous reasons. From the Kuznets, Lewis, Schultz or Jorgenson models it follows that agriculture can be characterised by less favourable ratios than other sectors. The main point is that the labour productivity in agriculture is too low to finance the remuneration comparable to that in other sectors [Rembisz and Floriańczyk 2014, Rembisz 2016]. Hence, the maintenance of this state (including those proportions) without any structural changes would strengthen inequalities and would be an expression of irrational allocation. In microeconomic terms, this ratio is associated with the balance of the producer and is a basis for maximising its objective function. However, in macroeconomic and sectoral terms, this ratio is associated with the allocation and distribution. The productivity of factors finances their remuneration which is essential for the development and competitiveness of the whole economy.

As a relevant theoretical background we can refer to the Cobb–Douglas. The Cobb–Douglas production function in macroeconomic terms describes the mechanism of creating the national product. When transforming its form:

$$Y = F(K, L) = A K^\alpha L^{1-\alpha} \quad (1)$$

by making left and right division by the number of employees L , we obtain the labour productivity as the function of the capital to labour ratio for the given production flexibility:

$$y = A k^\alpha \quad (2)$$

where: $y = \frac{Y}{L}$ – labour productivity;

$k = \frac{K}{L}$ – capital to labour ratio.

From the equation (2) it results that the labour productivity depends on the capital to labour ratio and total productivities of the factors of production or general technical progress A . The labour productivity flexibility in relation to the total productivity of the factors of production is 1, while in relation to the capital to labour ratio is α .

The differences in the capital to labour ratio among the states result from investment processes or accumu-

lation of real capital [Tokarski 2003, 2010]. The international diversification of total productivities of the factors of production may be a result of various materialised and non-materialised technologies in real capital, various institutional and legal solutions, various labour markets (differentiation of skills and knowledge of employees). Here, it is worth referring to the extended Cobb–Douglas production function, proposed by Mankiw et al. [1992] in a form of: $Y = K^\alpha H^\beta (R L)^{1-\alpha-\beta}$, where H means the resource of human capital in the economy, R – resource of knowledge directly intensifying the labour productivity, $\beta \in (0; 1)$ and means the production flexibility Y in relation to H – human capital inputs. In this case, the total productivity of the factors of production depends not only on the number of employees, but also on their knowledge, and more broadly on the potential of the research and development sphere and innovation of the economy.

According to Woś [1967, 1979], for assessing the level of development and importance of the food economy we can use five indicators: employment, gross value of fixed assets, investment inputs, global production and gross value added. Therefore, the labour productivity can be expressed by the global production or gross value added per employee. We can put it as follows:

$$X_A = x_r + x_p + \sum_{i=1}^n x_i b_{ir} + \sum_{i=1}^n x_i b_{ip} \quad (3)$$

where: X_A – global production of the food economy;
 x_r – global production of agriculture;
 x_p – global production of the food industry;
 x_i – global production of i -th sections (branches) associated with agriculture and food industry, participating indirectly in food production ($i + 1, \dots, n, n \neq r, p$);
 b_{ir} – coefficient determining the flow of products and services of the i -th section (branch) to agriculture, expressed in percentage of the direct demand of the i -th section,
 b_{ip} – coefficient determining the flow of products and services of the i -th section to the food industry.

The value added is one of the most objectified categories of assessing the efficiency of enterprises, ap-

plied in assessing the labour productivity. Its essence is that it measures the productivity from the point of view of the values brought by human capital in relation to the material costs coming from the outside. It is an important criterion of the ability to generate value for the owners [Gołaś and Kozera 2008, Gołaś 2010].

Undoubtedly, the labour productivity in agriculture depends, as in other sectors, from its capital to labour ratio and from the area per employee [Puzio-Waławik 2006, Kołodziejczak and Wysocki 2013, Pawlak 2013, Włodarczyk 2013, Czyżewski and Kryszak 2016, Kusz 2017, Olipra 2017]. The need to maintain the appropriate ratios of the remuneration to the productivity is recognised in the literature. Therefore, it can be assumed that the land productivity and its area per full-time employee also determine the labour productivity. Starting from the correlations regarding the agricultural production level:

$$Y = L \cdot \frac{Z}{L} \cdot \frac{Y}{Z} \quad (4)$$

we obtain the labour productivity formula:

$$\frac{Y}{L} = \frac{Z}{L} \cdot \frac{Y}{Z} \quad (5)$$

Nevertheless, referring to the production intensification concept, we can propose the following correlations:

$$\frac{Y}{Z} = \frac{K+L}{Z} \cdot \frac{Y}{K+L} \quad (6)$$

where: $\frac{K+L}{Z}$ – the intensity of labour and capital inputs per 1 ha of UAA;
 $\frac{Y}{K+L}$ – efficiency of involvement of capital and labour.

The problem of the remuneration/productivity ratio refers to the producer's equilibrium theory, which should balance the remuneration level with the marginal productivity of each factor of production. The equilibrium is achieved when the remunerations of the factors of production are equal to their productivities. This determines the sphere of rational management in the sense of technical efficiency [Rembisz 2016]. In-

come of the agricultural producer is the remuneration of labour inputs. According to Rembisz [2013], there are two main sources of this remuneration: rise in the prices of agricultural products and increase in the labour factor productivity. The agricultural producer, by maximising its objective function, tries to balance the remuneration level with the marginal productivity of each factor of production. We can therefore formulate the correlation of the producer's conditional optimisation for two factors of production:

$$R = Y c_y \rightarrow \max \quad (7)$$

with: $K C_K + L C_L = m^k$, $\Pi = R - m^k$

where: R – revenue;

Y – production volumen;

c_y – price obtained;

K – capital inputs with agricultural land;

C_K – remuneration of the capital factor (rate of interest and rent);

L – labour inputs;

C_L – remuneration for labour (income);

Π – profit;

m^k – financial constraint (resources for remunerations of involved factors of production).

In turn, if we ignore the prices obtained as the data (constants), which is of our interest in this article, we have:

$$\frac{Y}{L} = \frac{\partial Y}{\partial L} = C_L \quad (8)$$

Nevertheless, taking into account the prices obtained, which is a source of financing of the remuneration, we have the following relationship:

$$\frac{R}{L} = C_L \quad (9)$$

Reduction in the current level of employment (which gradually occurs), increase in the area of farms (which also slowly occurs) and increase in capital inputs are the assumptions necessary for the future development of the agricultural sector. Only such changes will bring the improved productivity, and hence also the higher remunerations of farmers.

PRODUCTIVITY VERSUS REMUNERATIONS – EMPIRICAL ASPECT

This article assumes the *ceteris paribus* principle in order to extract only the impact of the analysed labour factor and to make the analysis general. The objective of this part of the paper is to synthesise the results of empirical studies in relation to the above-mentioned analytical and theoretical assumptions.

Figure 1 illustrates the diversification of the labour productivity in the individual sectors of the Polish economy in the years 2010–2015.

Statistical Classification of Economic Activities sections: section A – agriculture, forestry, fishing, fisheries; sections B, C, D, E – industry; section F – construction.

The data illustrated in Figure 1 and in the further Figures are an empirical verification of the analytical aspect. Agriculture, in terms of the labour productivity, significantly differs *in minus* from other sectors. What is more, this negative gap grows as the time goes by. At this point, we do not determine the reasons for this negative phenomenon. Of course, this finding is not surprising at all.

Figure 2 shows the average remuneration in sectoral terms. The illustration shows the highest and also the growing in time remunerations in agriculture. These results contradict the adopted assumptions not in the sense of their validity, but practice. The data indicates the independence of remunerations from the labour productivity. This rather indicates the irrational status. This is not a phenomenon motivating for the optimal allocation of labour resources, and thus for improving the competitiveness of the sector and strengthening the development of the whole economy. We do not keep on delving into the reasons of this state.

Data on the total average monthly remuneration applies to all entities of the national economy, i.e. also units employing up to 9 persons. Data on remunerations is provided in gross terms, i.e. including advances for PIT and, since 1999, mandatory social security contributions (pension, annuity and sickness) paid by the insured employee.

This phenomenon, negative for the economy, has been illustrated in Figure 3, where we can clearly see

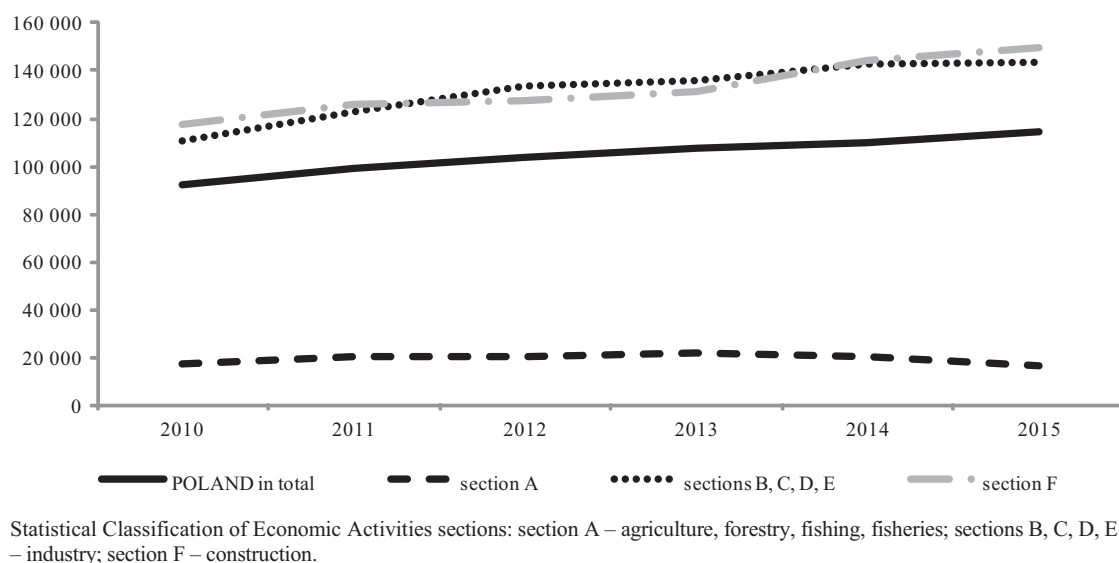
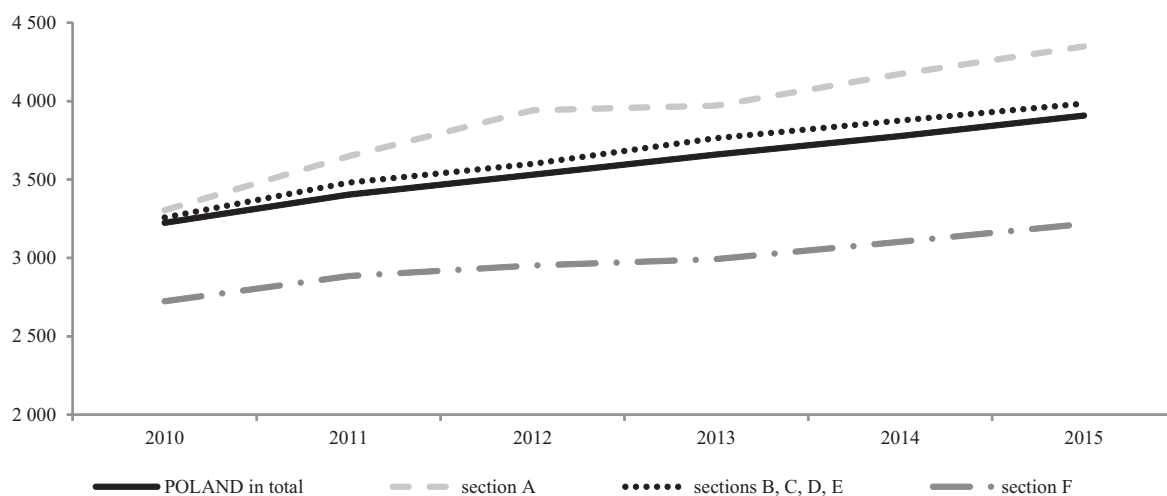


Fig. 1. Gross value added per employee (labour productivity) by groups of NACE 2007 sections

Source: Local Data Bank, CSO.



Data on the total average monthly remuneration applies to all entities of the national economy, i.e. also units employing up to 9 persons. Data on remunerations is provided in gross terms, i.e. including advances for PIT and, since 1999, mandatory social security contributions (pension, annuity and sickness) paid by the insured employee.

Fig. 2. Average monthly gross remunerations in PLN in the national economy by NACE 2007 sections

Source: Local Data Bank, CSO.

how much the remuneration and productivity ratio in agriculture differs from other sectors (Fig. 3). This difference is nearly fourfold times and still grows. Naturally, this is a derogation from the reasonable grounds as shown above. Analysing the data over time allowed

to capture the rate of those changes, as presented in Figures 4–6.

2016 saw the further deterioration (decrease) in the rate for section A [Strzelecki 2010, Kusideł and Modranka 2014].

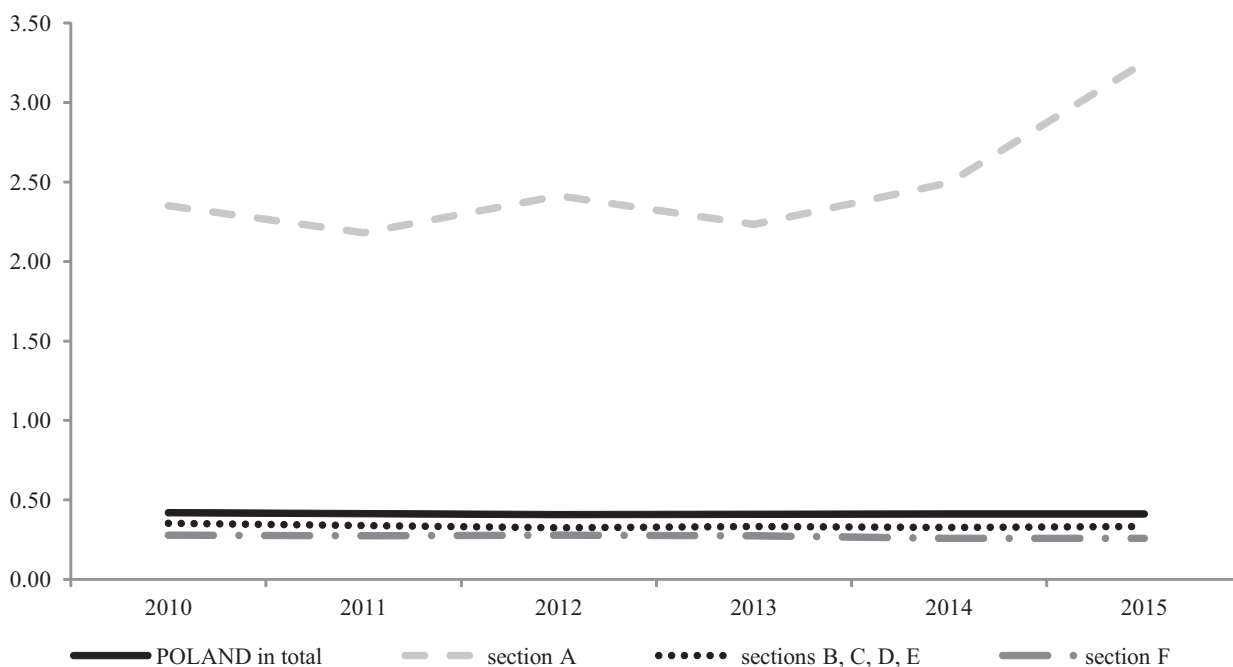
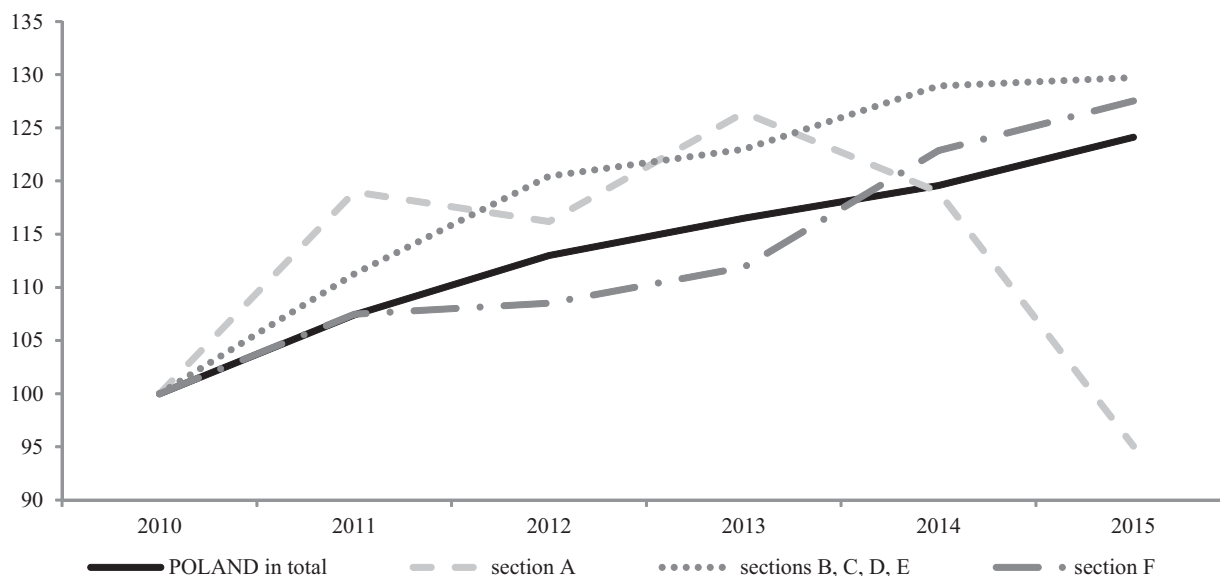


Fig. 3. Comparing the remuneration/labour productivity ratio in various economy sectors

Source: Local Data Bank, CSO.



2016 saw the further deterioration (decrease) in the rate for section A [Strzelecki 2010, Kusideł and Modranka 2014].

Fig. 4. Comparing the rate of the labour productivity in the sectors of economy

Source: Local Data Bank, CSO.

An irregular decrease in the labour productivity in section A has occurred since 2013 (Fig. 4). At the same time, the construction industry recorded its superior growth. The rate of remunerations is illustrated in Figure 5.

Since 2004, we may observe the rise in the remunerations for labour in agriculture, which is mainly the result of financial instruments of the Common Agricultural Policy. Therefore, the rate of changes in remunerations in section A differs so much from other sections (B-F). However, this rate is not due to the improved labour productivity, which significantly distorts the processes of structural transformation in the countryside and slows down the outflow of some employees to other sectors. The lack of the optimal allocation of labour resources consequently impedes the economic growth and reduces the competitiveness of the Polish economy. This affects the fact that the remuneration and labour productivity ratio in this sector is, as we showed above, the most favourable.

Figure 6 shows clearly how disproportionately the remuneration for labour increases in relation to its pro-

ductivity. In the period from 2013, when this productivity decreases – the remuneration still grows significantly. This is shown in red in Figure 6.

In the light of the graphically presented ratios it results that agriculture (and more precisely, section A) draws benefits from the cross-sectoral division. Here, it is difficult to talk about the transfer of value worked out in agriculture to other sectors. The situation is reverse. In section A, the remuneration is higher than the labour productivity. In addition, this sector also makes use of political rent (CAP grant), as already mentioned. However, it is worth stressing that the phenomenon applies mainly to the south-eastern regions (the table), which are the most problematic for the economy not only in the case of section A.

In order to illustrate in a more synthetic manner, the grounds for the discussed relationships for section A, Figure 7 has been made where the variables analysed so far have been compared. With the labour inputs, which are relatively constant over time (within the range of 1,915–1,937) and their productivity decreases (gross value added per employee; in 2010 equal to PLN 16,871, in 2013 – PLN 21,334 and in

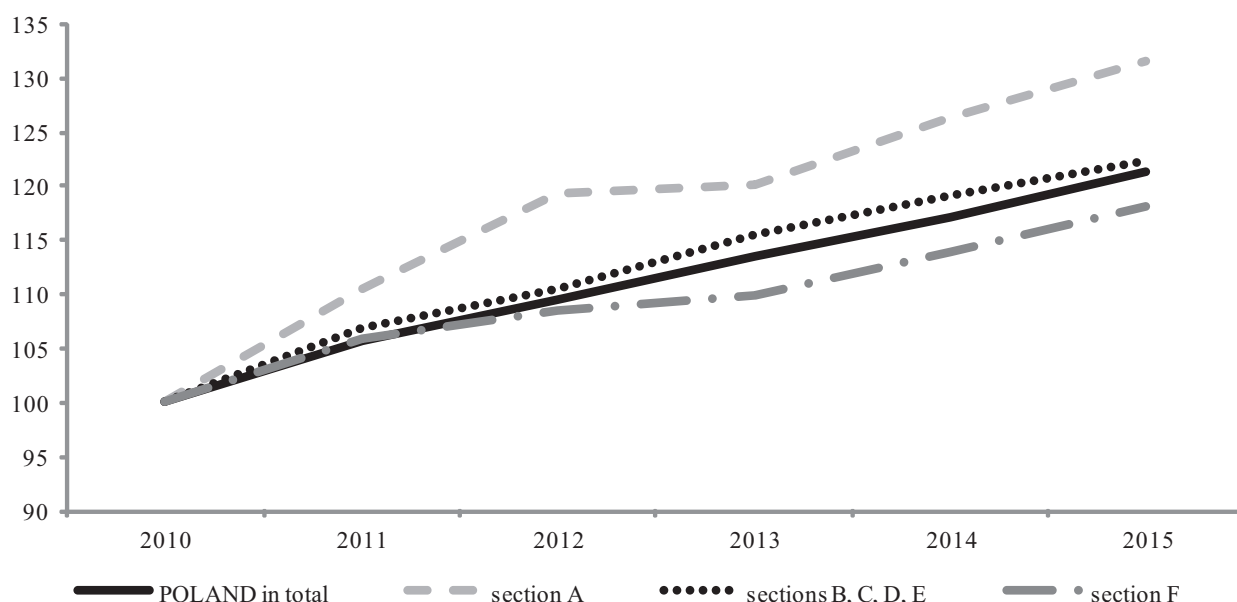


Fig. 5. Comparing the rate of changes in remunerations in the economy sectors

Source: Local Data Bank, CSO.

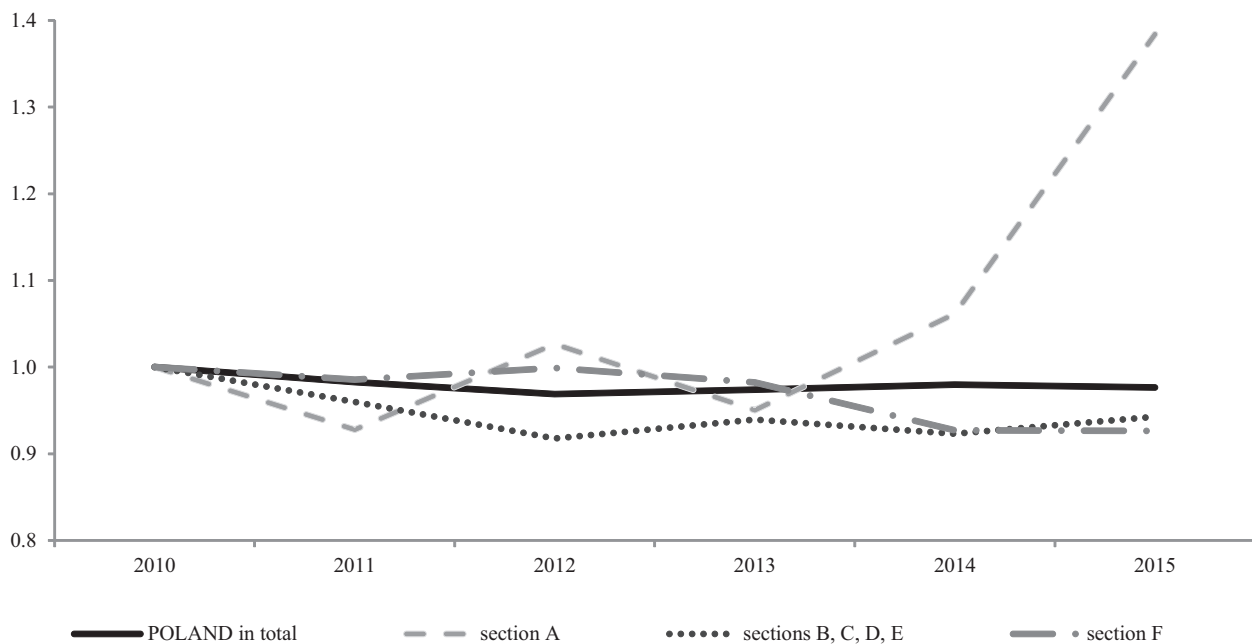


Fig. 6. Comparing changes in remunerations to changes in the labour productivity in the economy sectors

Source: Local Data Bank, CSO.

Table. Labour productivity and remunerations in section A in Poland by voivodeships in 2010–2015

Specification	Gross value added per employee (labour productivity) (PLN)					Average monthly gross remunerations (PLN)	
	2010	2011	2012	2013	2014	2010	2015
Poland	16 871	20 074	19 600	21 334	20 071	3 304	4 348
Dolnośląskie	18 763	23 385	22 001	21998	21054	3 475	4 383
Kujawsko-Pomorskie	22 471	25 793	26285	30604	28113	3 069	4 194
Lubelskie	10 294	13 572	12 577	13 776	12 117	3 412	4 439
Lubuskie	29 325	35 978	35 476	37 890	38 144	3 389	4 494
Łódzkie	16 309	19 337	18 021	19 692	20 558	3 338	4 501
Małopolskie	6 570	8 027	7393	7 227	7 294	3 236	4 329
Mazowieckie	24 353	29 500	28 424	32 933	29 532	3 594	4 331
Opolskie	23 05	28 272	27 075	25 587	23 603	3 158	4 208
Podkarpackie	4 235	5 381	4 881	5 444	4 934	3 441	4 703
Podlaskie	18 888	21 725	20 840	24 747	21 579	3 770	5 283
Pomorskie	25 154	29 032	30 512	31 962	32 503	3 300	4 370
Śląskie	13 914	16 809	17 108	16 850	15 881	3 375	4 655
Świętokrzyskie	9 337	11 637	10 469	11 418	11 017	3 774	4 865
Warmińsko-Mazurskie	31 727	38 116	36 735	37 493	36 383	3 386	4 397
Wielkopolskie	24 993	27 670	29 285	30 885	29 540	2 990	3 996
Zachodniopomorskie	33 826	36 084	37 762	41 707	39 433	3 353	4 258

Source: Local Data Bank, CSO.

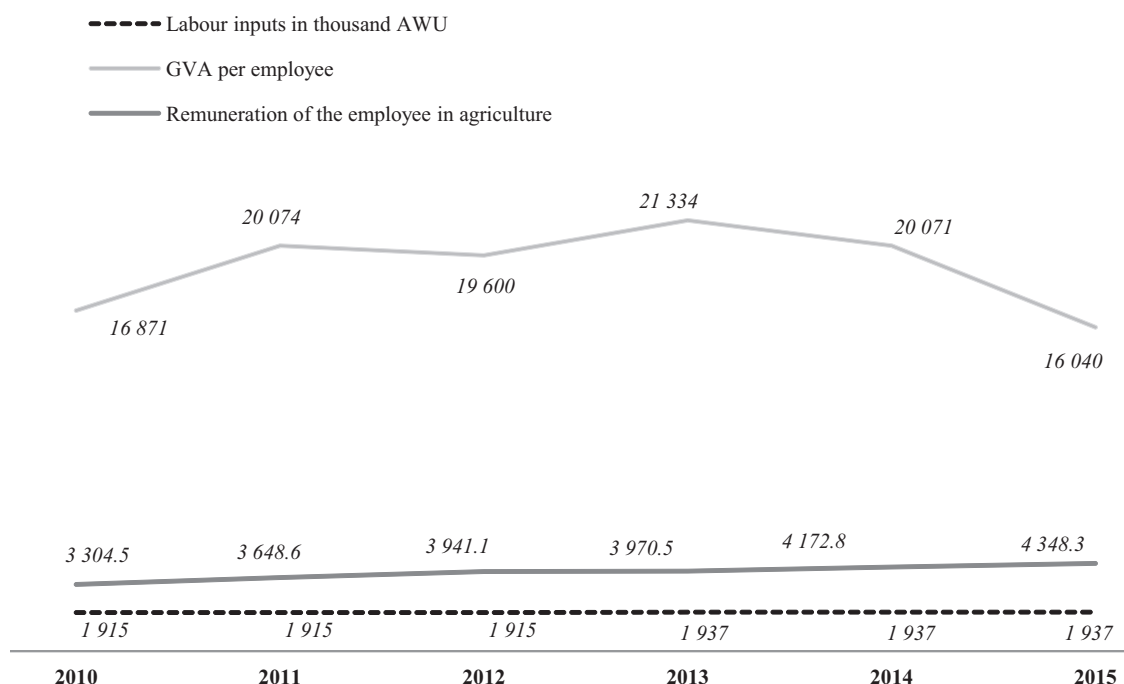


Fig. 7. Comparing labour inputs, gross value added (GVA) per employee and remunerations of the employed in agriculture in Poland, in the years 2010–2015

Source: Local Data Bank, CSO.

2015 – only PLN 16,040), the average monthly gross remuneration increased from PLN 3,304.5 in 2010 to PLN 4,348.3 in 2015.

SUMMARY

The article raises the issue of the remuneration/labour productivity ratio. A comparative analysis has been carried out as regards the ratio of agriculture to other economy sectors classified according to the PKD 2007 sections. From the Kuznets, Lewis, Schultz or Jorgenson models it results that agriculture can be characterised in this respect by the less favourable remuneration/productivity ratios. The economic development requires the movement of persons from the lower productivity sector and thus resulting lower remunerations to the higher productivity sectors.

In the light of the empirical data presented in the paper, we may conclude that in section A this ratio is seriously disturbed and distorted. The remuneration does not depend in this case on the labour productivity. In other words, the remuneration is overvalued in rela-

tion to the labour productivity. This ratio is not a positive testimony to the reasonableness of management in the sense of agricultural producers' equilibria. In order to improve this state, a reasonable activity would be to strive for a rapid improvement in the labour productivity in agriculture, which undoubtedly must involve the allocation of the labour factor to other sectors. This is confirmed by the continuous topicality of the quoted Lewis, Kuznets models.

REFERENCES

- Czyżewski, A., Kryszak, Ł. (2016). Współzależności międzygałęziowe w sektorze rolnym w świetle modelu input-output a poziom finansowego wsparcia rolnictwa w wybranych krajach. *Problemy Rolnictwa Światowego*, 16 (31), 2, 55–65.
- Gadomski, A. (2015). Najpierw wydajność, potem wynagrodzenia. *Obserwator Finansowy* from 17.08.2015.
- Gołaś, Z. (2010). Wydajność i dochodowość pracy w rolnictwie w świetle rachunków ekonomicznych dla rolnictwa. *Zagadnienia Ekonomiki Rolnej*, 3, 19–42.

- Gołaś, Z., Kozera, M. (2008). Strategie wydajności pracy w gospodarstwach rolnych. *Journal of Agribusiness and Rural Development*, 1 (7), 73–87.
- GUS (2017). Zatrudnienie i wynagrodzenia w gospodarce narodowej w 2016 r. [Employment, wages and salaries in the national economy in 2016]. Zakład Wydawnictw Statystycznych, Warszawa.
- Kołodziejczak, W., Wysocki, F. (2013). Bezrobocie ukryte w polskim rolnictwie w 2010 roku – próba symulacji skali zjawiska. *Roczniki Naukowe SERiA*, 15 (2), 158–164.
- Kosmalski, R. (2010). Zróżnicowanie poziomu wydajności pracy i jego przyczyny w polskich województwach. *Studia Regionalne i Lokalne Uniwersytetu Warszawskiego*, 3, 99–113.
- Kusideł, E., Modranka, E. (2014). Prognozy liczby pracujących w przekroju sektorów i grup zawodów. *Polityka społeczna. Prognozowanie Zatrudnienia*, 1, 29–36.
- Kusz, D., Misiak, T. (2017). Wpływ technicznego uzbrojenia pracy i postępu technicznego na wydajność pracy w rolnictwie. *Roczniki Naukowe SERiA*, 19 (2), 145–150.
- Lewis, A. (1954). *Economic Development with Unlimited Supplies of Labour*. The Manchester School, 22 (2), 139–191.
- Mankiw, N.G., Romer, D., Weil, D. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 107, 2, 407–437.
- Olipra, J. (2016). Uwolnić potencjał polskiej wsi. *Obserwator Finansowy* from 12.09.2016.
- Pawlak, K. (2013). Typologia krajów Unii Europejskiej według potencjału konkurencyjnego sektora rolnego. *Roczniki Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich*, 100, 1, 9–21.
- Puzio-Waławik, B. (2006). Trójsektorowa struktura zatrudnienia w Polsce na tle krajów Unii Europejskiej. *Zeszyty Naukowe PTE*, 4, 97–111.
- Rembisz, W. (2013). Kwestie ryzyka, cen, rynku, interwencji i stabilności dochodów w rolnictwie, *Vizja Press & IT*, Warszawa, 162–187.
- Rembisz, W. (2016). Relacja wynagrodzenia i wydajności czynnika pracy w rolnictwie na tle gospodarki narodowej i jej sektorów w Polsce w okresie 2005–2012. *Więś i Rolnictwo*, 2 (171), 41–57.
- Rembisz, W., Floriańczyk, Z. (2014). Modele wzrostu gospodarczego w rolnictwie. *IERiGŻ-PIB*, Warszawa.
- Strzelecki, P. (2010). Projekcja liczby pracujących w rolnictwie indywidualnym w Polsce w latach 2008–2035. *Zeszyty Naukowe Instytutu Statystyki i Demografii SGH*, 6, 8–41.
- Tokarski, T. (2003). Wzrost gospodarczy a rynek pracy w neoklasycznych modelach wzrostu. *Studia Ekonomiczne INE-PAN*, 3 (38), 163–189.
- Tokarski, T. (2010). Przestrzenne zróżnicowanie łącznej produktywności czynników produkcji w Polsce. *Gospodarka Narodowa*, 3, 23–39.
- Włodarczyk, J. (2013). Nierówności dochodowe w Polsce według rozkładów Pareto i Boltzmann-Gibbsa. *Studia Ekonomiczne Uniwersytetu Ekonomicznego w Katowicach, Problemy Gospodarki Rynkowej: Polska i Świat*, 130, 76–87.
- Woś, A. (1967). O koncepcji produktywności czynników wytwórczych. *Annales Universitatis Mariae Curie-Skłodowska, Sectio H, Oeconomia*, 1, 21–42.
- Woś, A. (1979). *Związki rolnictwa z gospodarką narodową*. PWRiL, Warszawa.

WYNAGRODZENIA I WYDAJNOŚĆ PRACY W ROLNICTWIE NA TLE POZOSTAŁYCH SEKTORÓW GOSPODARKI

STRESZCZENIE

Optymalna alokacja zasobów, w tym osób pracujących, w różnych sektorach skutkuje zrównoważonym rozwojem całej gospodarki (teoria optymalnej alokacji zasobów Kantonowicza i Koopmansa). Według badań Tinbergena nadmiar rąk do pracy w jednym z nich rodzi problemy społeczne i gospodarcze. O takiej sytuacji mówimy w przypadku polskiego rolnictwa. Celem rozważań teoretycznych oraz badań empirycznych niniejszej publikacji jest analiza relacji między wynagrodzeniem pracy a jego wydajnością w różnych sektorach gospodarki ze szczególnym zwróceniem uwagi na sektor rolny. Autorzy nawiązują również do teorii Lewsa i Schultza, którzy badali problemy rolnictwa krajów rozwijających się, a także do modelu wzrostu gospodarczego Solowa z funkcją produkcji Cobba-Douglassa i postępowaniem technicznym w sensie Harroda. W świetle przedstawionych w pracy danych empirycznych można stwierdzić, że w sekcji A Polskiej Klasyfikacji Działalności ta relacja jest poważnie zaburzona i zniekształcona. Wynagrodzenie jest przewartościowane w stosunku do wydajności pracy. Taka relacja nie świadczy pozytywnie o racjonalności gospodarowania w sensie równowag producentów rolnych.

Słowa kluczowe: relacja wynagrodzenia do wydajności pracy, ujęcie sektorowe, rolnictwo