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Yours sincerely

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ECONOMIC AND LEGAL ASPECTS OF BIOFUEL PRODUCTION FOR OWN USE

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Abstract. The purpose of this paper has been to assess the costs and profitability of producing oilseed rape (OSR) methyl esters and using them on own farmstead. The breakdown of costs involved in converting OSR into esters included the following stages: feedstock (raw material production, pressing oil from seeds and converting oil into fuel (estrification). The production costs were calculated per annum and the revenue derived from selling by-products was added. A field study was carried out on a farm covering 1,200 ha situated Warmia-Mazury Voivodship. The cost of making 1 liter of esters was 3.28 PLN, but when the by-product (rapeseed meal – pulp) was utilized, the cost dropped to 1.76 PLN. Production of esters based on purchased feedstock (the current price is 180 PLN·dt^{-1}) is an unprofitable undertaking since the unit production cost is higher than the price of diesel oil. Ultimate values of the analyzed economic indices depended on the costs of growing feedstock (shaped by agritechnical treatments, type of seed material, fertilization rates and necessary plant protection treatments), the way the by-products are utilized (sale, valuable feed in animal nutrition, energy carrier). The biodiesel producer must take into account the alternative cost fuel production. The paper presents legal regulations pertaining to the production of biofuel for own use; additionally, costs of this alternative fuel versus conventional one were compared.

Key words: alternative fuels, methyl esters, biodiesel production plant, production costs

INTRODUCTION

In the current political and economic position of Poland, most of crude oil used for fuel production is imported, which generates many negative consequences, such as highly volatile prices of fuels and almost unpredictable price tendencies. The economic and social outcome of the above situation consists in cyclic economic problems in all branches of domestic economy, with the worst difficulties experienced in transport and in agriculture [Dzieniszewski 2009].

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Poland belongs to the biggest oilseed rape (OSR) producers in Europe [Europe in figures... 2010]. After Poland's access to the European Union, production of OSR has become a nearly strategic branch in plant production. The reason is the large content of oil in rape seeds, which can be used as feedstock for production of OSR oil esters – a fuel used to run diesel engines.

Each farmstead needs a supply of energy carriers, used for household needs or for agricultural production. Among such carriers, the leading role is played by diesel oil (DO), the fuel without which the contemporary, motorized agriculture could not thrive, since as much as 50% of the total fuel consumption per farm is made up of diesel oil (acc. to energy consumption per energy carriers) [Szeptycki and Wójcicki 2003]. Consequently, replacing diesel oil with some cheaper fuel could significantly diminish agricultural production costs. Biodiesel, fatty acid methyl esters (FAME) or pure plant oil (PPO), obtained from pressing oilseeds, could become such cheaper fuel [Bocheński 2003].

The most popular method used for processing OSR oil is transestrification. In this process, plant oil reacts with alcohol in the presence of an acid or alkaline catalyst. An ester (ethyl or methyl) of higher fatty acids is a product of this reaction. It is a renewable fuel having properties similar to those of diesel oil produced from crude oil [Żmuda 2003, Demirbas 2007a]. Apart from being eco-friendly [Demirbas 2007b, Koh and Ghazoul 2008], FAME has a considerable influence on many branches of economy [Jeżowski 2001, Frąckowiak 2002, Podkówka 2004].

It is not easy to make a complete breakdown of costs and benefits of producing biodiesel for own use. What needs to be done is to sum up the costs which are incurred at every stage of biodiesel production, including cultivation of the oil crop, pressing oil from seeds, transestrification and management of the production waste.

The objective of this paper has been to try and define the economic effects of replacing diesel oil with biofuel produced from OSR seeds and used on own, privately-owned farm[1]. In order to achieve this aim, it was necessary to determine production costs of oilseed rape seeds, OSR oil and esters.

METHODOLOGY

The farm, where the following profitability analysis of growing OSR for biodiesel production was conducted, lies in Warmia-Mazury Voivodship. The total area of the farm is 1,200 ha (all arable land), of which 330 ha is dedicated to growing winter oilseed rape. The farm has own machines for pressing oil as well as a drying room and a storehouse for keeping OSR seeds.

For our analysis of the biofuel production profitability, we assumed that:

– the feedstock (OSR) for production of esters will originate from own farm and has been valued at the level of costs of growing it on farm,

[1]This paper has been written under the project "Commercialisation of R&D results and creation of entrepreneurial attitudes by the UWM in Olsztyn through training jobs, training sessions and other activities raising the business awareness among the academic community" a project co-financed by the EU from the European Social Fund.

- the above feedstock costs were increased by adding costs of pressing seeds and processing oil to biofuel (the oil pressing and fuel production plant running costs were included, as well as the costs of products used for estrification, equipment depreciation, repairs and services of the machinery; it was also assumed that one employee would operate the oil pressing machine and supervise production of biofuel),
- the due excise duty such as 0.01 PLN·l^{-1} was added to the production costs,
- the calculations did not include area support.

The volume of fuel production corresponds to the annual demand of the farm for fuel. The ester production costs include the revenue from selling the by-products of the estrification process (oilseed rape meal), which lowered the fuel production costs. It was assumed that no income was obtained from selling the glycerin phase. The investment profitability was calculated from the difference between the price of diesel oil and the cost of produced biodiesel, and the difference is the producer's income.

The winter oilseed rape production costs were calculated with the method worked out by the IBMER [Goć and Muzalewski 1997]. In this method, the costs of using tractors and other machinery include the total costs of their maintenance and exploitation. The unit cost of the exploitation of tractors and machines was computed according to their current price, standard use during the working life, working life, repairs index and exploitation efficiency of particular machines. All the above unit components of the production costs were expressed in PLN·h^{-1}.

The maintenance costs include: depreciation, housing and maintenance as well as insurance. The exploitation costs comprise the costs of repairs, fuel, oils and fuel consumption. It was assumed that one hour of human labour cost 10 PLN. Prices of industrial means of production were determined according to the prices in April-June 2011.

LEGAL CONTEXT OF PRODUCTION OF BIOFUELS FOR OWN USE

The principal legal act governing development of the biofuel market in Europe is the Directive of the European Parliament 2003/30/EC of 8 May 2003 on the promotion of the use of biofuels and other renewable fuels for transport, which sets the minimum market share of biofuels. However, the legal act which governs the production of biofuels for own use in Poland is the Act of 25 August 2006 on biocomponents and liquid biofuels (Journal of Law 2006, No 169, Item 1199). This act regulates production, storage and turnover of biocomponents and liquid biofuels, including production of liquid biofuels by farmers for own use, marketing biocomponents and liquid biofuels, writing and submitting reports. According to Article 13, farmers are allowed to produce biofuels for own use having obtained an entry in the register of farmer biofuel producers [Bielski 2011].

In order to produce biofuels for own use, an agricultural producer should possess adequate technical appliances and facilities, which make it possible to produce fuels compliant with the firefighting, sanitary and environmental regulations. A permit to keep a tax warehouse for excise goods is also required. The liquid fuels made by farmers for own use should fulfill the quality requirements as indicated in the rules on the fuel quality monitoring and control.

The act sets an annual limit of 100 liters per 1 ha of arable land owned by the farmer for individual production of ester and pure plant oil, which in itself is fuel. After each calendar year, the farmer is obliged to submit, within 45 days, an annual report containing such data as the quantities and types of feedstock used for producing liquid biofuels for own use. The reports are submitted to the Agricultural Market Agency. Penalty fees are to be imposed on a farmer who produces liquid biofuels without an entry in the aforementioned register or who sells or otherwise disposes of it in another form. A farmer shall also be penalized if he exceeds the annual liquid biofuel production limit, impedes control actions undertaken by the register organ, fails to submit an annual report in due time or falsifies the information in the submitted report.

Another important legal act is the one of 11 May 2007 on amending the act on excise duty and amending some other acts (Journal of Law 2007, No 99, Item 666). This document introduces some considerable changes to the biofuel sector, for example rates of excise duties on biocomponents which in themselves are fuels were set at 10 PLN per 1,000 l regardless the CN code. Agricultural producers were also granted an additional financial incentive such as 45 euros per ha of energy crops, which include crops delivered for production of biocomponents.

ELEMENTS OF THE TECHNOLOGICAL PROCESS OF PRODUCING BIODIESEL

The technological process of making biofuel from oil plants consists of the following steps:

- production of OSR seeds – feedstock for biofuel production,
- securing sufficient amounts of OSR seeds for an annual production of biofuel,
- the so-called oil cold-pressing on a pressing technological line,
- converting oil into biodiesel on an estrification technological line,
- distribution of biofuel.

While making biofuel from OSR seeds, by-products are generated, which may either decrease or increase the total costs of making biodiesel, depending on how they are utilized. It is possible to lower the costs when the by-products have market value and find consumers or can be used by the fuel producer on his own farm. In contrast, when by-products must be recycled because they can be neither sold nor used, the production costs will rise. By-products are generated in considerably large amounts and how they will be dealt with should be determined as early as during the design of a biofuel production facility [Juliszewski 2007]. By-products can be divided into two groups: by-products of oil pressing, i.e. extraction meal and cake, and by-product of transestrification, i.e. the glycerin phase.

The former group of by-products can be used as a valuable feed component in farm animal nutrition to replace soyabean meal. Oilseed cake, in turn, is a product of cold--pressing of seeds that is not subjected to removal of fat. Cake can therefore be incinerated in furnaces (the calorific value is comparable to that of coal) [Juliszewski 2007].

The latter group of by-products consists of the glycerin phase. The fact that there is methanol in the glycerin layer makes it rather difficult to utilize in households. The

glycerin layer contains around 5–20% of methanol. Such product cannot be utilized unless under special supervision. The glycerin phase utilization must be strictly controlled, although once it is purified and methanol-free, it can be used in several industries (e.g. cosmetics, tobacco, pharmaceutical, food processing, etc.) [Gaca 2006].

RESULTS OF THE ANALYSIS AND DISCUSSION

Costs of ester production. Costs of securing raw product for production of esters

The following economical calculations pertain to the actual yields per 1 ha of winter oilseed rape cropped farmland (with the technology applied on the analyzed farm, the average yield is 31 dt·ha^{-1}). The data obtained from the farm served as a basis for calculating the costs of feedstock production in the present study.

The cost of producing seeds of winter oilseed rape with the technology used on the analyzed farm reached 2,733 PLN·ha^{-1}. The cost of producing 1 dt of seeds was therefore 88.1 PLN. In a study reported by Dobek [2008], on the economic efficiency of biodiesel production, the costs of producing OSR seeds ranged from 67 to 78.1 PLN·dt^{-1} (depending on cultivation technologies). The highest variable costs were incurred by mineral fertilization (1,092 PLN·ha^{-1}), which corresponded to 40% of all variable costs. The second most expensive element was the preparation of a oilseed rape plantation for harvest and the harvest itself (18.9%); these costs were followed by weed control and soil tillage (10.2 and 10.1%, respectively). Disease control and sowing generated similar costs (8.4 and 8.5%). The lowest share in the costs breakdown was attributed to pest control (just 3.9%).

OSR esters production costs

Crude OSR seeds can be pressed in small or moderate capacity cold-pressing mills. The farm analyzed in this paper will use two Farmet Duo oilseed presses, each worth 17,500 PLN. Esters will be produced in a Hydrapress W400 biorefinery of 420 liters daily capacity.

The investment outlay for the purchase of machines and other equipment for rapeseed oil production reached 80,500 PLN (Table 1). Other costs (which add to the costs of fuel production) cover repairs and servicing of the machinery as well as its depreciation (15 years).

It was assumed that the farm used 100 l diesel oil per 1 ha of arable lands annually for crop production. As Pągowski claims [2003], OSR oil esters have a lower calorific value (by 8 to 10%) than diesel oil, therefore a 10% higher fuel consumption by machines equipped with self-ignition engines was assumed. In order to produce 132,000 liters of biofuel annually (12,000 l used on the farm plus 10% higher use of esters), the amount of OSR seeds should be 3,828 dt (Table 2). The acreage needed to obtain such yield is 123.5 ha (which is 37.4% of the present-day farmland cropped with oilseed rape). The cost of producing 1 liter of esters was 3.28 PLN. This price does not include the income derived from selling cake or meal. The amount of oilseed rape meal obtained from processing the required volume of seeds is considerable and equals 2,507 dt. However, it will not be

Table 1. Investment expenses for biofuel production equipments (PLN)
Tabela 1. Nakłady inwestycyjne na urządzenia do produkcji biopaliwa (PLN)

Specification	Value
Biorafinery Hydrapress W400	25,500
Oilseed press Farmet Duo	35,000
Oil and tanks, division phase	10,000
Room adaptation (ventilation systems, pipes, poison warehouse, e.g.)	10,000
Total investment expenses	80,500
Other costs	
Depreciation expense (depretiation time 15 years)	5,367
Repair and maintenance cost	6,440
Total other costs	11,807

Source: Own research.
Źródło: Badania własne.

Table 2. Costs of the methyl esters production from own-planted rape seeds
Tabela 2. Kalkulacja kosztów produkcji estrów metylowych oleju rzepakowego z własnych nasion

Specification	Unit	Quantity	Price	Value
Costs of the rapeseed oil production				
Seeds	dt	3,828	88.10	337,426
Energy	kWh	4,022	0.56	24,652
Labour cost	h	1,914	8.00	15,312
Costs of the methyl esters production				
Methanol	l	20,114	1.60	32,183
Potassium hydroxide	kg	2,263	4.50	10,183
Energy cost	kWh	1,478	0.56	828
Depreciation (oil and esters production)				11,807
Total costs				432,391
By-products value (pulp)	dt	2,507	80.0	200,587
The cost of 1l esters production without by-products use				3.28
The cost of 1l esters production after by-products use				1.76

Source: Own calculation.
Źródło: Obliczenia własne.

difficult to deal with this quantity of meal on the farm as valuable feed for animal production. Having accounted for the income from selling the by-products, the annual cost of producing esters is now 231,807 PLN and the cost of 1 liter of esters produced on the analyzed farm falls to 1.76 PLN. The calculations performed by Bieniek et al. [2010] set the cost of production of 1 liter of OSR oil methyl esters, at the annual production output of 8,000 liters, at 4.90 PLN (this price did not include the income from selling oilseed rape cake or meal or the glycerin phase). Such a high unit price was certainly a consequence of a very high price of the feedstock used for production of these esters (112.1 PLN·dt^{-1}).

Evident savings can also be achieved when feeding engines with crude (unprocessed) plant oil [Pasyniuk 2009]. However, crude oil cannot be used to feed an unmodified diesel engine [Podkówka 2002, 2004; Pasyniuk 2009]. Using such fuel requires special systems to heat the fuel before it is fed into the injector of an engine [Dzieniszewski and Piekarski

2006] or else it can be used in Elsbett's engines, specially designed and constructed for this type of fuel [Frąckowiak 2002]. The disadvantage of the latter engines is that they are very costly to make.

The income from selling glycerin was not included in the present analysis. Initially, it was thought that glycerin could be an additional source of income or it could be used as fertilizer or animal feed supplement. However, it turns out that the glycerin used in the pharmaceutical, food processing of feed manufacturing industries is pure glycerol of a specific composition whereas the by-product obtained while making biodiesel in small-scale biorefineries, contains many undesirable substances apart from glycerol and is not sellable due to high contamination [Dzięgielewska 2006]. Gaca [2006] claims that this problem should be dealt with in the early stage of biodiesel production and the fate of the glycerin phase should be then determined.

The economic effect of using esters

This analysis relies on the assumption that all the diesel oil consumed at the farm has been replaced by biofuel produced by the farmer. According to Bieranowski [2006], biodiesel produced from OSR oil (OSR oil methyl ester) can be used in all types of compression-ignition engines without making any changes in their construction. Such oil can be burnt in its pure form or in mixtures with traditional diesel fuel made from petroleum.

The price of diesel oil in our calculations was that of 24 August 2011, i.e. 5.03 PLN·l^{-1}. The data in Table 3 clearly indicate that by using biofuel made from the feedstock grown on own farm, the farm can actually lower the costs of agricultural production. The savings can reach as much as 280,000 PLN annually. The production profitability is most heavily affected by two factors: the market price of diesel oil and the costs of oilseed rape seed production. Costs of producing biofuel would be evidently much higher if the feedstock was supplied externally. The current prices for OSR seeds[2] are on average 180 PLN·dt^{-1}, which makes production of esters unprofitable, even when oilseed rape meal is sold (the price per 1 l of esters is then around 4.42 PLN, which makes it 0.12 PLN higher than the price of diesel oil sold for agricultural purposes).

Table 3. Effect of replacing fossil diesel oil with methyl esters from own-planted seeds
Tabela 3. Efekt zastąpienia oleju napędowego estrami wyprodukowanymi z własnych nasion

Specification	Unit	Quantity	Price (PLN)	Value (PLN)
Fossil diesel consumption	l	120,000	4.30[a]	515,880
Biofuel consumption	l	132,000	3.28[b]	432,394
Biofuel consumption	l	132,000	1.76[c]	231,807
Alternative cost of biodiesel production				173,160

[a]Subsidy for agricultural fuel included, [b]biofuel cost without by-products sale, [c]biofuel cost with by-products sale.
Source: Own calculation.
Źródło: Obliczenia własne.

[2]http://www.farmer.pl/agroskop/ceny_rzepaku (Accessed on 26.08.2011).

According to Stiglitz [2004], when a private company is to make an investment decision, it considers possible variant solutions, estimates projected outlays and revenues, calculates the profitability of investment projects and selects one of these projects. At this stage, it is also recommendable to analyse alternative costs (costs of lost opportunities), which in the relevant literature [Begg 2003, Milewski 2003, Klimczak 2011] are defined as an equivalent of the output that a given factor of production could generate, should it be used in another, possibly optimal way. Analysis of alternative costs of biodiesel production for own use is justifiable because rapeseed is a mobile resource, i.e. they can be transferred to different, alternative uses. In this case, the financial losses of a producer incurred by not using the best opportunities are considerably high. By selling raw material to make biofuel – according to the current prices on rapeseed – the producer can get 689,040 PLN. When buying conventional fuel in the amounts needed on the farm, the producer will spend 515,880 PLN. Economically speaking, when the above values are compared, it becomes clear that the alternative monetary cost of the producer who decides to produce biofuel from rapeseed will reach about 173,000 PLN. Moreover, it is possible to invest the capital allocated to constructing the biofuel production facilities. An alternative cost is not always associated with a monetary value. It is also borne if the production of biodiesel is abandoned. The alternative cost of undertaking biodiesel production is for example increased emission of pollutants to the atmosphere (especially greenhouse gasses) due to combustion of fossil fuels rather than biodiesel (ecological aspect) or – from a broader perspective – lack of diversification in the fuel sector, poorer development of the agricultural product market or not employing a person needed to run the biodiesel installation (social aspect).

It should be noted that a complete evaluation of marketing biofuels on an industrial scale is influenced by several other factors [Tys et al. 2003]. Wójcicki [2007] believes that the major factor restraining production of biocomponents and biofuels in Poland is their high production costs versus the retail prices of conventional fuels. Thus, their economic effectiveness is low or sometimes negative at a simultaneous negative energy effectiveness.

CONCLUSIONS

It can be concluded from the above analyses that using OSR oil esters produced on a given farm can generate measurable financial benefits and the return on investment rate can be very high, but the result is highly dependent on the fuel demand on that farm. The more fuel is consumed, the lower the unit cost of biofuel production. Another important element which can improve the profitability of biofuel production is the utilization of by-products. The cost of securing OSR seeds, however, remains the most significant cost--creating element. It is unprofitable to use purchased seeds (at their current price) to produce methyl esters (even when by-products are sold). The unit cost of producing biofuel is higher than the cost of buying diesel oil.

Resources of rapeseed on the farm is limited, however, can be used in many ways. One way is the biofuel production (in place of the sale at current market price). However, the producer must take into account, that the financial benefits lost due to the chosen way to use the resource. It should be emphasized, that the alternative cost is subjective by nature and is always sustain by the person taking a decision.

Although there are relatively simple and inexpensive machines and facilities for estrification of OSR oil available on the market today, this solution is not easy to implement in real-life practice. Apart from much burdensome paperwork, the technical aspects can be troublesome as well. Methyl ester, which is used for production of esters, is a dangerous poison, and its turnover and storage are strictly controlled. The same can be said about the catalyst – potassium hydroxide (KOH) – which is a highly caustic substance and therefore its use is regulated by the work safety rules. Batches of pressed OSR oil may differ from one another in the chemical composition and – when same amounts of alcohol and catalyst are used – the end product may be of different quality. Utilization of the glycerol waste could also raise problems as this substance is dangerous to the environment. In short, producing biofuel on a farm for own use can prove to be a very complicated undertaking. How difficult it can actually be is verified by the fact that it has been five years since the law was made to enable farmers to produce biofuels for own use and the biofuel producers register has just four entires[3]. One must therefore agree with Wójcicki [2007], who concluded that if the price relations were favorable for biocomponents and biofuels than, under conditions of the market economy, no other incentives for biofuel producers would be necessary for biofuels to be used on a wide scale.

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EKONOMICZNE I PRAWNE ASPEKTY PRODUKCJI BIOPALIWA NA WŁASNY UŻYTEK

Streszczenie. Celem pracy była ocena kosztów oraz opłacalności produkcji estrów metylowych oleju rzepakowego i wykorzystanie go we własnym gospodarstwie. Analiza kosztów produkcji estrów rzepakowych obejmowała następujące etapy produkcji: produkcję surowca, tłoczenie oleju z nasion i przetworzenie oleju na paliwo (estryfikacja). Koszty produkcji obliczono w skali roku i uwzględniono dochód ze sprzedaży produktów ubocznych. Badania przeprowadzono w gospodarstwie rolnym o powierzchni 1200 ha w woj. warmińsko-mazurskim. Wyprodukowanie 1 litra estrów wyniosło 3,28 zł, w przypadku zagospodarowania produktów ubocznych (wytłoków) cena spada do 1,76 zł. Ostateczne wskaźniki ekonomiczne zależą przede wszystkim od kosztów pozyskania surowca (na które wpływają

między innymi zabiegi agrotechniczne, rodzaj materiału siewnego, intensywność nawożenia oraz niezbędne zabiegi ochrony roślin), wykorzystania produktów ubocznych procesu estryfikacji (sprzedaż, cenna pasza w żywieniu zwierząt lub jako nośnik energii). Producent biodiesla musi liczyć się również z kosztami alternatywnymi podjętej działalności. Przedstawiono uwarunkowania prawne produkcji biopaliw na własne potrzeby, a także dokonano porównania kosztów paliwa alternatywnego odniesione do paliwa konwencjonalnego.

Słowa kluczowe: paliwa alternatywne, estry metylowe, wytwórnia biodiesla, koszty produkcji

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ACTA SCIENTIARUM POLONORUM *Oeconomia 11 (3) 2012, 17–25*

ANALIZA PORÓWNAWCZA SERII „ACTA SCIENTIARUM POLONORUM" W OKRESIE 2002–2010

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Streszczenie. Przedmiot badań stanowiło ogólnopolskie czasopismo rolnicze „Acta Scientiarum Polonorum" wydawane w piętnastu seriach tematycznych. Analizie poddano periodyk ukazujący się w latach 2002–2010, w formie papierowej i elektronicznej. Omówiono go pod względem częstotliwości ukazywania się, liczby artykułów, wielkości powierzchni tekstów, liczby autorów zagranicznych i płci autorów. Porównano trzynaście serii „Acta Scientiarum Polonorum" regularnie się ukazujących, wyniki przedstawiono liczbowo i procentowo, w formie tabeli i wykresu. Indeksowanie serii ASP w bazach polskich i zagranicznych również przedstawiono w tabeli. Wyniki dostarczają interesującego materiału na temat periodyku „Acta Scientiarum Polonorum" po dziesięciu latach istnienia.

Słowa kluczowe: czasopisma naukowe, czasopisma elektroniczne, „Acta Scientiarum Polonorum", bazy bibliograficzne

WSTĘP

W 2012 roku mija 10 lat od wydania pierwszych numerów czasopisma naukowego „Acta Scientiarum Polonorum" (ASP). Artykuł jest próbą porównania serii, ogólnego spojrzenia z perspektywy 10 lat ukazywania się pisma. W wyniku porozumienia i podpisania deklaracji przez rektorów polskich uczelni rolniczych 20 czerwca 2001 roku powołano ogólnopolskie czasopismo naukowe. „Acta Scientiarum Polonorum", które jest wydawane w języku polskim i angielskim. Publikowane są w nim oryginalne prace naukowe w piętnastu seriach tematycznych zgodnie z dyscyplinami naukowymi Centralnej Komisji do Spraw Stopni i Tytułów. Czasopismo wydawane jest przez dziewięć wydawnictw uczelnianych: Agronomia – UTP w Bydgoszczy; Biologia – AP w Siedlcach; Biotechnologia, Geodezja i Kartografia, Weterynaria – UP we Wrocławiu; Inżynieria Rolnicza, Ogrodnictwo – UP w Lublinie; Zootechnika, Rybactwo – ZUT w Szczecinie; Leśnictwo i Drzewnictwo, Technologia Żywności i Żywienia – UP w Poznaniu; Gospodarka

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Przestrzenna – UWM w Olsztynie; Budownictwo, Ekonomia – SGGW w Warszawie; Kształtowanie Środowiska – UR w Krakowie. Artykuły są recenzowane, a lista recenzentów jest jawna i ukazuje się w ostatnim numerze roku. Serie różnią się liczbą punktów za publikacje umieszczane w czasopiśmie (tab. 1). Czasopisma naukowe nieposiadające Impact Factora (IF) są oceniane za ostatnie dwa lata swojego funkcjonowania. Aktualna lista punktowanych czasopism znajduje się na stronie internetowej Ministerstwa Nauki i Szkolnictwa Wyższego.

Tabela 1. Analiza zawartości serii „Acta Scientiarum Polonorum" za lata 2002–2010
Table 1. Analysis of the contents of "Acta Scientiarum Polonorum" in the period of 2002–2010

Seria	Liczba punktów	Liczba numerów	Liczba artykułów	Liczba (%)	Liczba stron	Liczba (%)
Administratio Locorum	6	22	164	5,9	2087	7
Agricultura	6	26	302	10,9	3161	10,6
Architectura	6	23	162	5,8	1928	6,4
Biotechnologia	6	21	101	3,6	1139	3,8
Formatio Circumiectus	6	23	196	7,0	2124	7,1
Geodesia et Descriptio Terrarum	6	22	120	4,3	1432	4,8
Hortorum Cultus	20	26	274	9,9	2796	9,3
Medicina Veterinaria	6	26	208	7,5	1964	6,6
Oeconomia	9	25	401	14,4	4296	14,3
Silvarum Colendarum Ratio et Industria Lignaria	6	25	242	8,7	2706	9,0
Technica Agraria	2	17	115	4,1	1116	3,7
Technologia Alimentaria	9	26	266	9,6	2963	9,9
Zootechnica	6	23	230	8,3	2241	7,5

Źródło: Opracowanie własne.
Source: Own elaboration.

Pierwsze numery „Acta Scientiarum Polonorum" wydano w 2002 roku. Początkowo czasopismo ukazywało się dwa razy do roku, a od 2007 roku wydawane jest jako kwartalnik cztery razy w roku. Od 2006 roku niektóre serie ukazują się tylko w języku angielskim, ze streszczeniami oraz opisami tabel i rysunków w języku polskim. Za poziom merytoryczny i edytorski serii odpowiedzialne są Rady Programowe i Naukowe zmieniające się co trzy lub cztery lata. Przewodniczącym Rady Programowej trzecią kadencję jest prof. Jerzy Sobota z Wrocławia. Pozostałymi członkami Rady Programowej są profesorowie: Janusz Falkowski (Olsztyn), Florian Gambuś (Kraków), Franciszek Kluza (Lublin), Janusz Prusiński (Bydgoszcz), Stanisław Socha (Siedlce), Waldemar Uchman (Poznań), Kazimierz Banasik (Warszawa), a obecnie prof. Wiesław Nagórko. Ze Szczecina w kadencji 2009–2012 członkiem Rady jest prof. Bogdan Lasota, a wcześniej profesorowie Edward Niedźwiecki i Mikołaj Protasowicki. W Radach Naukowych poszczególnych serii zasiadają polscy i zagraniczni przedstawiciele nauki.

MATERIAŁ BADAWCZY

Praca zawiera prezentację i omówienie wyników badań przeprowadzonych metodą analizy zawartości piętnastu serii czasopisma naukowego „Acta Scientiarum Polonorum". Pismo ukazuje się od 2002 roku. Badanie przeprowadzono w grudniu 2011 roku. Analizowano 9 lat wydawniczych czasopisma, od 2002 do 2010 roku (łącznie), ponieważ nie wszystkie numery serii z 2011 roku zostały opublikowane. Z serii „Biologia" wydano numery do 2009 roku, a z serii „Rybactwo" do 2008 roku. Ze względu na opóźnienia w ukazywaniu się, nie ujęto tych serii w badaniu.

Celem badania było omówienie i porównanie serii „Acta Scientiarum Polonorum". W wyniku analizy badanych serii pod względem rozkładu ilościowego artykułów, liczby autorów zagranicznych, płci autorów, wielkości powierzchni tekstów, liczoną na podstawie liczby stron powstała baza danych. Opierając się na niej, sporządzono tabele i wykres danych ujętych w formie ilościowej oraz procentowej. Omówiono także serie „Acta Scientiarum Polonorum" pod względem indeksowania ich w bazach polskich i zagranicznych.

WYNIKI I DYSKUSJA

Jednym z najbardziej podstawowych źródeł informacji dla pracowników nauki są czasopisma naukowe. Artykuły w nich publikowane są najczęściej czytanym typem dokumentów przez naukowców wszystkich dziedzin, czego dowodzą badania [Tenopir i King 1998]. Informacje zawarte w artykułach są aktualne, a wydawcy zapewniają wysoką jakość publikowanych materiałów, zaspokajając potrzeby czytelników.

W Encyklopedii wiedzy o prasie [1976] za czasopisma rolnicze uznaje się ogół czasopism poświęconych zagadnieniom rolniczym, służących podnoszeniu kultury rolnej, upowszechnianiu postępu w rolnictwie oraz rozwojowi nauki w tej dziedzinie. Wśród czasopism rolniczych można wyodrębnić trzy grupy:

- naukowe, zawierające głównie wyniki oryginalnych badań, wydawane przez odpowiednie instytuty (omawiane czasopismo);
- fachowe, dla kadry zatrudnionej w gałęziach przemysłu rolnego;
- ogólnorolnicze, przeznaczone dla szerszych kręgów odbiorców zatrudnionych w rolnictwie [Encyklopedia wiedzy… 1976].

Przedmiotem badań było czasopismo wydawane w formie tradycyjnej – papierowej oraz elektronicznej posiadające p-ISSN i e-ISSN nadawane przez Narodowy Ośrodek ISSN w Warszawie.

FORMA ELEKTRONICZNA CZASOPISMA „ACTA SCIENTIARUM POLONORUM"

Kling i Callahan [2002] ze względu na formę ukazywania się rozróżnili cztery rodzaje czasopism elektronicznych:

- e-czasopisma, których tekst jest dystrybuowany wyłącznie w formie cyfrowej;

- E-p czasopisma, dystrybuowane w formie elektronicznej, ale z możliwością bardzo ograniczonej dystrybucji w formie papierowej;
- P-e czasopisma, dystrybuowane głównie w formie papierowej, ale posiadające także formę elektroniczną;
- P+E czasopisma, tworzone równolegle w formie papierowej i elektronicznej, co ułatwia szeroką dystrybucję [Kling i Callahan 2002]; w tej grupie znajduje się omawiane czasopismo.

Innymi kryteriami podziału czasopism naukowych elektronicznych są [Nahotko 2007]:

- częstotliwość ukazywania się (miesięcznik, kwartalnik itp.);
- sposób dystrybucji (Web, e-mail, CD-ROM itp.);
- stosowane formaty (PDF, RTF, ASCII, DjVu itp.);
- zakres prezentowanych materiałów (pełne teksty lub ograniczony zakres, w tym spisy treści i abstrakty);
- dostęp (czasopisma komercyjne – płatne, i Open Access – bezpłatne z punktu widzenia użytkownika).

Open Access oznacza „wolny dostęp do informacji naukowej online". Użytkownik nie płaci za materiały, do których ma dostęp [Morris 2006]. W przypadku gdy wersja papierowa czasopisma jest sprzedawana w prenumeracie, a wersja elektroniczna jest dostępna od razu za darmo, mamy model zdublowanego Open Access [Nahotko 2007, Szczepańska 2008]. Cztery serie mają e-ISSN: „Biotechnologia" 2083-8654, „Geodezja i Kartografia" 2083-8662, „Weterynaria" 2083-8670, „Technologia Żywności i Żywienia" 1898-9594. „Acta Scientiarum Polonorum", podobnie jak większość polskich czasopism naukowych, są w tym modelu publikowane. Przesyłając tekst do publikacji, autorzy przenoszą prawa autorskie na wydawcę. Wydawca daje czytelnikom darmowe, trwałe prawo dostępu do artykułów, udziela pozwolenia na kopiowanie i wykorzystanie pod warunkiem zachowania atrybucji autorskich.

„Acta Scientiarum Polonorum" jest wydawnictwem ciągłym, numery ułożono chronologicznie, ze streszczeniami i pełnymi tekstami w formacie PDF (portable document format) w języku polskim i angielskim. Strona główna pisma dostępna jest użytkownikom pod adresami: www.aqua.ar.wroc.pl/acta/pl/main.php; www.acta.media.pl. Seria „Technologia Żywności i Żywienia" ma adres www.food.actapol.net/, a seria „Leśnictwo i Drzewnictwo" www.forestry.actapol.net/. Wersje elektroniczne innych serii umieszczono na stronach wydawnictw, w których się ukazują.

FORMA PAPIEROWA CZASOPISMA „ACTA SCIENTIARUM POLONORUM"

W okresie badanym pismo zachowało porządek numeryczny, niezmiennie ukazuje się w formacie B5. Od 2002 roku był to półrocznik, niektóre serie wydawały jeden numer podwójny. W 2007 roku zwiększono częstotliwość ukazywania się pisma do czterech razy w roku, jako kwartalnik. Jednolita szata graficzna pozostaje niezmieniona od 2002 roku, autorem projektu okładki jest Daniel Morzyński. Strona tytułowa zawiera pełną nazwę pisma, tytuł serii, numer roku wydawniczego, w nawiasie numer periodyku oraz rok wydania oznaczone cyframi arabskimi. „Acta Scientiarum Polonorum" ukazy-

wała się w zróżnicowanym nakładzie od 100 do 350 egzemplarzy, w zależności od serii. Niski nakład pisma w formie papierowej wiąże się z bezpłatnym udostępnianiem go w formie elektronicznej. Wynika to ze statystyk zamieszczonych na stronie online pisma, gdzie liczba odwiedzających stronę, aktywnie korzystających z pełnych tekstów i streszczeń stale rośnie. Najliczniejszą grupę stanowią użytkownicy z Polski, następnie z USA i Europy. Najpopularniejszą serią, według pobrań pełnych tekstów, jest „Agricultura" (24,11%), następnie „Hortorum Cultus" (11,97%) i „MedicinaVeterinaria" (9,24%).

Artykuły z dziedziny nauk rolniczych, biologicznych, leśnych, technicznych, weterynaryjnych przygotowane były przez indywidualnych autorów lub zespoły. Najbardziej rozbudowaną serią pod względem liczby artykułów (401) oraz liczby stron (14,3%) jest „Oeconomia". Następnie seria „Agricultura", która ma ponad 300 artykułów i zajmuje 10,6% powierzchni pisma w badanym okresie. Trzecią pod względem wielkości liczby artykułów jest seria „Hortorum Cultus" (274), a pod względem powierzchni pisma – „Technologia Alimentaria" (9,9%). Najmniej publikacji liczy seria „Technica Agraria" (115) i zajmuje najmniejszą powierzchnię w strukturze pisma (3,7%). Wiąże się to z pewnością z faktem, że za publikacje w tej serii przyznawana jest najmniejsza liczba punktów (2) – tabela 1. Należy podkreślić, że w konkursie o nagrodę Rektorów Polskich Uczelni Rolniczych „Praca Roku w Acta Scientiarum Polonorum" to właśnie pięć oryginalnych publikacji z serii „Technika Agraria" zdobyło pierwszą nagrodę. „Hortorum Cultus" jest wiodącą serią pod względem punktacji za opublikowany artykuł – autorzy dostają 20 punktów (zmiana punktacji nastąpiła w 2011 roku). Została umieszczona przez Thomson Reuters Scientific na liście czasopism Science Citation Index Expanded. Serie „Acta Scientiarum Polonorum" od 2007 roku zwiększyły liczbę publikowanych w ciągu roku zeszytów, zachowując ich objętość (do 12 stron), systematycznie zwiększały liczbę artykułów w poszczególnych numerach (oraz wymagania dotyczące ich jakości).

W tabeli 2 przedstawiono liczbę autorów poszczególnych serii w badanym okresie, natomiast na rysunku 1 przedstawiono dane w ujęciu procentowym.

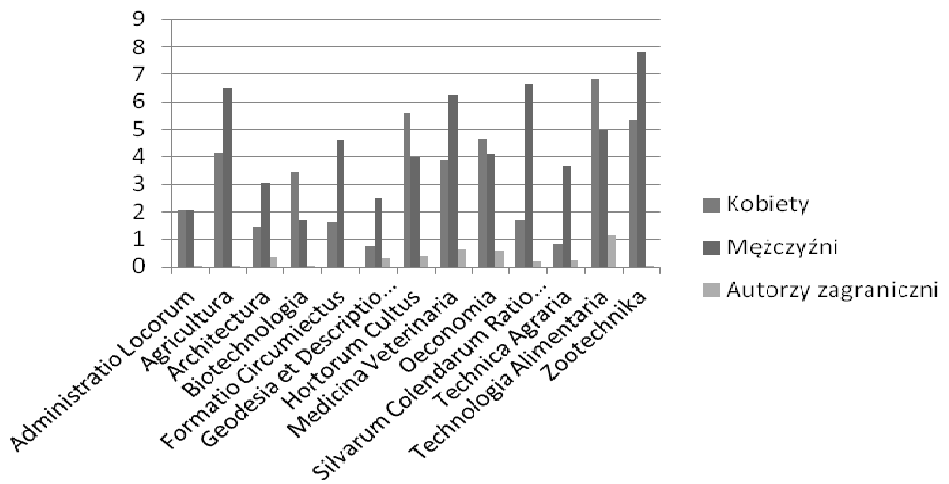
W badaniu uwzględniono kryterium płci, które od 2013 roku ma być obowiązujące w publicznych badaniach statystycznych. W ogólnej liczbie autorów artykułów 57,8% stanowili mężczyźni, a 42,2% kobiety. Wśród badanych serii najliczniejszą grupę stanowili autorzy-mężczyźni z serii „Zootechnica" (493) – 7,8%, najmniej liczną z serii „Biotechnologia" (107) – 1,7% ogółu autorów. Najwięcej kobiet-autorów publikowało w serii „Technologia Alimentaria" (429), czyli 6,8% ogółu autorów, natomiast najmniej w serii „Geodesia et Descriptio Terrarium" (46) – 0,7%. Seria „Zootechnica" ma największą liczbę autorów (827) – 13,1%. W „Acta Scientiarum Polonorum" autorami są ludzie zatrudnieni na uczelniach polskich i zagranicznych, głównie rolniczych i przyrodniczych. W każdej serii największą liczbę stanowią autorzy bezpośrednio związani ze środowiskiem akademickim, gdzie jest wydawane pismo. Autorami są również osoby pracujące w innych jednostkach naukowych, instytutach badawczych, a także niezwiązane z nauką.

W ASP mamy również do czynienia z zagraniczną afiliacją autorów, gdyż są oni zatrudnieni w jednostkach naukowych w krajach innych niż kraj, w którym wydawane jest czasopismo. Autorzy zagraniczni publikujący w periodyku stanowią 4% ogółu autorów. Artykuły publikują środowiska naukowe pochodzące głównie z Europy, ale również z Kanady, USA, Nigerii, Egiptu, Libii, Indii, Turcji, Rosji i Chin. Seria „Technologia Ali-

Tabela 2. Struktura autorów serii „Acta Scientiarum Polonorum” za lata 2002–2010
Table 2. Structure of authors in “Acta Scientiarum Polonorum” in the period of 2002–2010

Seria	Kobiety		Mężczyźni		Autorzy zagraniczni	
	liczbowo	procentowo	liczbowo	procentowo	liczbowo	procentowo
Administratio Locorum	129	2,05	129	2,05	4	0,06
Agricultura	261	4,15	409	6,50	4	0,06
Architectura	92	1,46	192	3,05	20	0,32
Biotechnologia	216	3,43	107	1,70	3	0,05
Formatio Circumiectus	101	1,60	290	4,61	14	0.22
Geodesia et Descriptio Terrarum	46	0,73	156	2,48	18	0,29
Hortorum Cultus	352	5,60	250	3,97	23	0,37
Medicina Veterinaria	244	3,88	393	6,25	38	0,60
Oeconomia	292	4,64	260	4,13	36	0,57
Silvarum Colendarum Ratio et Industria Lignaria	106	1,68	417	6,62	10	0,16
Technica Agraria	51	0,81	230	3,65	12	0,19
Technologia Alimentaria	429	6,81	314	4,99	71	1,13
Zootechnica	334	5,31	493	7,83	2	0,03

Źródło: Opracowanie własne.
Source: Own elaboration.



Rys. 1. Procentowy udział autorów serii „Acta Scientiarum Polonorum” w latach 2002–2010
Fig. 1. Percentage structure of authors in “Acta Scientiarum Polonorum” in the period 2002–2010
Źródło: Opracowanie własne.
Source: Own elaboration.

mentaria” ma największą liczbę publikujących autorów zagranicznych (71). W badanym okresie w tej serii publikowali mieszkańcy 14 krajów: Portugalii (15), Turcji (15), Nigerii (9), Słowacji (6), Kanady (4), Bułgarii (4), Niemiec (3), Egiptu (3), Włoch (3), Rumunii (3), Austrii (2), Indii (2), Finlandii (1), USA (1).

Znaczący udział autorów zagranicznych wynika z tego, że w Radzie Naukowej serii „Technologia Alimentaria" 58,8% stanowią przedstawiciele środowiska naukowego z zagranicy.

Według MNiSW kryteriami oceny czasopism naukowych kwalifikowanych do grupy nauk ścisłych, przyrodniczych, medycznych i technicznych są między innymi:

- indeks cytowań PIF (predicted impact factor);
- zagraniczna afiliacja autorów, odsetek autorów z afiliacją zagraniczną w stosunku do całkowitej liczby autorów za ostatnie dwa lata;
- indeksacja w bazach danych, liczba baz indeksacyjnych, w których czasopismo jest indeksowane;
- liczba artykułów naukowych publikowanych w ciągu roku, średnia liczba publikacji naukowych za ostatnie dwa lata powyżej 24;
- dostępność online wszystkich artykułów naukowych;
- język publikacji, publikacje są w języku angielskim lub innym języku kongresowym (francuskim, hiszpańskim, niemieckim, rosyjskim);
- umiędzynarodowienie recenzentów, liczba członków zagranicznych rady naukowej jest większa niż połowa całkowitej liczby członków danej rady;
- częstotliwość wydawania, czasopismo ukazuje się w sposób ciągły w formie online bądź jest wydawane regularnie co kwartał lub częściej[1].

W tabeli 3 przedstawiono bazy, w których są indeksowane „Acta Scientiarum Polonorum".

MNiSW przy ocenie czasopism naukowych za referencyjne uznaje siedemnaście baz: Agro, Astrophisics Data System (ADS), BazTech, Biological Abstracts, BIOSIS Preview/ /BIOSIS, Cambridge Scientific Abstracts (CSA, Proquest), CEEOL (Central and Eastern European Online Library), CEJSH, Chemical Abstracts (CAS), EMBASE, Index Copernicus, INSPEC, ISI Web of Science (WoS), JSTOR, Medline/Pubmed, SCOPUS, Zoological Record.

Popularność baz danych dziedzinowych systematycznie wzrasta w środowisku akademickim. Stają się one specjalistycznymi informatorami i przewodnikami po literaturze fachowej. Polskie dziedzinowe, bibliograficzne bazy danych zawierają informacje wykraczające poza zwykły opis bibliograficzny. Zawierają afiliację autora, adres wydawcy, linki do innych dokumentów autora, do wydawcy, do zawartości czasopisma. W opisie uwzględniono streszczenia polskie i angielskie, wprowadzono charakterystykę wyszukiwawczą dokumentu w językach obcych. Zakres przekazywanych w rekordzie dokumentu informacji jest porównywalny z zakresem informacji w rekordach baz zagranicznych [Sadowska 2009].

WNIOSKI

Na podstawie przeprowadzonych badań można wyciągnąć następujące wnioski:

1. Nie można jednoznacznie ocenić, która z trzynastu serii „Acta Scientiarum Polonorum" dominuje pod względem wszystkich badanych cech.

[1]http://www.nauka.gov.pl/fileadmin/user_upload/Finansowanie/finansowanie_nauki/Dzialalnosc_statutowa/20111125_zasady_glowne.pdf

Tabela 3. Indeksowanie serii „Acta Scientiarum Polonorum" w bazach polskich i zagranicznych
Table 3. Indexation in "Acta Scientiarum Polonorum" within Polish and foreign databases

Seria	Referowane
Administratio Locorum	SIGŻ
Agricultura	Copernicus Index, Directory of Open Access Journals, EBSCO, Polish Scientific Journals Contents: Life Sciences, AGROBASE, AGRIS-FAO, SIGŻ
Architectura	AGRIS-FAO, SIGŻ
Biotechnologia	Copernicus Index, Polish Scientific Journals Contents: Life Sciences (PSJC), EBSCO
Formatio Circumiectus	SIGŻ
Geodesia et Descriptio Terrarum	BAZTECH, EBSCO
Hortorum Cultus	AGRIS-FAO, AGRO-AGEN, AGRO-LIBREX, Polish Scientific Journals Contents: Life Sciences (PSJC), CAB, DOAJ, Journal Citation Reports/Science Edition, Science Citation Index Expanded/Sci Search, Copernicus Index, SIGŻ
Medicina Veterinaria	Polish Scientific Journals Contents: Life Sciences (PSJC), SIGŻ, EBSCO, SIGŻ
Oeconomia	AGRIS-FAO, Copernicus Index, EBSCO, SIGŻ
Silvarum Colendarum Ratio et Industria Lignaria	AGRO-AGEN, AGRO-LIBREX, IBL
Technica Agraria	AGRIS-FAO, EBSCO, SIGŻ
Technologia Alimentaria	Copernicus Index, EBSCO, CABI International, Directory of Open Access Journals (DOAJ), Ulrich PD, Ulrich's Periodicals Directory, SIGŻ
Zootechnica	AGRIS-FAO, SIGŻ

Źródło: Opracowanie własne.
Source: Own elaboration.

2. Seria „Oeconomia" od 2007 do 2010 roku sukcesywnie zwiększała liczbę artykułów w numerach, a przez to swoją powierzchnię, w rezultacie czego znalazła się na pierwszym miejscu wśród badanych serii.

3. Wśród autorów tekstów dominują mężczyźni, a największą liczbę autorów ogółem zauważa się w serii „Zootechnica".

4. Seria „Technologia Alimentaria" wykazuje się największą liczbą autorów zagranicznych.

5. Jedyną serią umieszczoną na liście czasopism Science Citation Index Expanded jest „Hortorum Cultus".

6. Wersja elektroniczna serii „Agricultura" miała największą liczbę pobrań pełnych tekstów.

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A COMPARATIVE ANALYSIS OF "ACTA SCIENTIARUM POLONORUM" IN THE PERIOD 2002–2010

Abstract. Polish national agricultural journal "Acta Scientiarum Polonorum", issued in fifteen thematic series, has been of primary concern to this article. The analysis focuses on issues between 2002–2010, when the magazine was published both in paper and electronic version. The journal has been described by the frequency of being published, the number of articles it includes, their size, the number of foreign writers and the sex of those writers. Thirteen series of regularly issued "Acta Scientiarum Polonorum" have been compared. The results have been presented both as numbers and percentages, in the form of tables and charts. ASP's indexes in Polish and foreign databases have also been shown in the table in this article. The results of the study give us an interesting insight in "Acta Scientiarum Polonorum" after 10 years of being in the market.

Key words: scientific journals, electronic journals, "Acta Scientiarum Polonorum", bibliographic database

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ACTA SCIENTIARUM POLONORUM *Oeconomia 11 (3) 2012, 27–36*

THE EFFECTIVENESS OF ACTIVE LABOR MARKET POLICIES ON THE EXAMPLE OF THE WARMIA--MAZURY PROVINCE IN POLAND

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Abstract. This paper analyzes the level of expenditure on selected programs on the labor market in a regional context and the employment effectiveness of the selected programs. It also presents the results of surveys among the unemployed from the Warmia-Mazury Province. The research shows that there is no strong correlation between the labor market situation and the employment effectiveness of the active labor market programs. It follows from the research that 75% people who received a subsidy to start their own business were not entered again into the Register of the Unemployed within 3 years from getting a subsidy. In the third year from obtaining a subsidy, more than half of them continued to operate (58.6%) and every fourth company created a workplace.

Key words: reservation wage, active labor market policies (ALMPs), unemployment, labor market

INTRODUCTION

Regional differences existing in Poland in the distribution of workplaces and in social potential of work both in quantitative and qualitative terms make that the general situation on regional labor markets usually differs from the general situation on the domestic market, which is reflected by the basic labor market indices such as the employment or unemployment rate. Therefore, the labor market policy should take into account the specific characteristics of the regions so that the activities undertaken would allow to improve labor market functioning. In the literature, the employment policy is clearly distinguished from the labor market policy. The aim of the employment policy is to influence the overall level of employment in the economy, particularly to achieve full employment, whereas the labor market policy is primarily aimed at solving structural problems of the labor market and improving the effectiveness of its functioning [Wiśniewski and Maksim

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2008]. Due to the functions of the labor market policy, there are distinguished active and passive programs. Passive programs provide, inter alia, compensation for those losing their jobs, while the main function of active programs is to adjust the structure of supply to demand for work [Jackman 1994]. The active labor market policy is an important element in the effort to combat unemployment which is taken in the European Union. High costs of ongoing programs and the unresolved problem of unemployment have become the basis for searching for methods to evaluate the effects of actions undertaken. As regards Poland, such studies were conducted by Kluve et al. [1999] and Bukowski [2008]. The research on the effectiveness is very difficult due to a limited availability and quality of information on the fate of the participants of particular programs.

METHODOLOGY AND SCOPE OF RESEARCH

Many legal regulations concerning various policies are created at the macroeconomic level but they interfere in the relations between employers and employees on the regional and local labor markets. Their impact can vary greatly due to differences in economic development between regions. Therefore, the question arises whether expenditure on the active labor market policy is more considerable in regions with a higher unemployment rate and whether a difficult situation on the labor market results in increased costs of activation of the unemployed.

The purpose of this paper is to present results of the studies in which an attempt was made to verify the effectiveness of the active labor market policy in the Warmia--Mazury Province. Having adopted this objective, the following research hypothesis was formulated, namely that the employment effectiveness of the programs is lower in regions with lower unemployment rates, and in addition it is distinguished by higher employment costs. It was also verified whether participation in active labor market programs results in greater salary expectations of unemployed persons being the subjects of the studies.

In the studies there was used the data from the Ministry of Labor and Social Policy and the Provincial Labor Office as well as the results of surveys conducted among 174 unemployed residents of the Warmia-Mazury Province. The time-frame of the studies covers the period of 2008–2010.

In the analysis of the statistical material the following methods were applied: descriptive and comparative ones as well as the Pearson correlation.

SIGNIFICANCE OF THE ACTIVE LABOR MARKET POLICY – RESULTS OF THE STUDIES

The population of the Warmia-Mazury Province is 1,428 thous. residents which constitutes 3.7% of the population of Poland. The Warmia-Mazury Province, like the provinces of Eastern Poland, is characterized by a low level of GDP per capita (73.8% average for Poland) and a low contribution to gross value added. This region is developing more slowly than the whole of Poland, and its share in gross domestic product stands at 2.8% in 2010. According to statistic from the Regional Data Bank 15.9% employees work in

agriculture, 29.7% – in industry, and 54.4% – in the service sector (in 2010). The structure of employed people according to the three economic sectors as well as the direction of its change is not significantly different from that observed in Poland. Despite these changes, since the early 90's the region has been characterized by a high proportion of people without work. Based on the registry data in 2008 and 2010, 87.4 thous. and 105.9 thous. persons were registered in the labor office statistics. In this region, 20% of the economically active population is unemployed, which is the highest rate in Poland. The existing unemployment has been a serious challenge for the active labor market policy for years.

The studies were based on the data relating to supply-oriented instruments of the active labor market policy, i.e. trainings and internships, as well as the data on subsidized employment realized through intervention works, public works, community service, and subsidies to create workplaces for the unemployed and employers. All these instruments are classified as instruments of the active labor market policy (ALMP).

A comparison of the data on the labor market situation shows that both the unemployment rate and the number of participants of the programs has increased on the regional labor markets. In Poland, on average every second person was vocationally activated. The exception is the Opole Province where in programs were attended by the majority of unemployed – more than 80% of the unemployed (Table 1). In order to determine the significance of the active labor market policy at the regional level, the percentage of the economically active population, participating in ALMP, was adopted as a measure. The studies show that a share of vocationally activated persons varied greatly in particular regions. From 3 to 11 percent of the economically active population was covered by active labor programs. In the Warmia-Mazury Province benefited from these instruments 9% of the economically active population (Table 1).

A rise in the number of persons vocationally activated is associated with increased spending on the active labor market policy. Although expenditure on ALMP is low in comparison to that of Western European countries, an increasing tendency can be observed. In Poland, the expenditure on active labor market instruments equaled 0.6% GDP in 2008 and 1.3% GDP in 2009 [OECD Library].

Table 2 shows the level of spending on selected programs in a regional context as well as the cost of activation of one person and the effect of a particular program measured as the ratio of the number of people who following the termination of participation in a specific form of activation, were not registered again in the District Labor Office within 3 months after completion of the program [MPiPS 2011].

In Poland, about half of people are not entered again into the Register of the Unemployed following participation in a particular program. One can expect more difficulty in finding employment in regions with the highest unemployment rate.

The analysis shows that there is no strong correlation between the unemployment rate in the region and the re-employment rate. There is no strong correlation, either, between the situation on the regional labor market and the cost of activation of one unemployed person and the cost of re-employment although it may seem that the more difficult labor market situation, the more people will be employed, as a result of which the unit cost will be much higher. The results relating to the correlation coefficient are shown in Table 3. The results are determined by a number of reasons. First of all, funds available to poviat self-governments for the implementation of the tasks are distributed according to the

Table 1. Participants of the active labor market programs in 2008 and 2010
Tabela 1. Uczestnicy aktywnych programów rynku pracy w 2008 i 2010 roku

Item	Number of vocationally activated persons		Persons taking part in ALMP as a percentage of the economically active population		The unemployed covered by ALMP (%)		Unemployment rate (%)	
	2008	2010	2008	2010	2008	2010	2008	2010
Poland	652,314	788,674	4	5	44.3	53.5	9.5	12.4
Lower Silesia Province	48,625	57,592	4	5	42.7	50.6	10.0	13.1
Kujawy-Pomerania Province	48,956	57,734	6	7	44.4	52.4	13.3	17.0
Lublin Province	38,887	50,673	4	6	38.3	49.9	11.2	13.1
Lubuskie Province	30,856	41,344	8	11	66.6	89.3	12.5	15.5
Łódź Province	43,564	52,948	4	5	43.9	53.4	9.2	12.2
Małopolska Province	38,124	50,420	3	4	39.0	51.5	7.5	10.4
Mazovia Province	63,878	73,729	3	3	35.9	41.4	7.3	9.7
Opole Province	22,992	29,167	6	8	64.4	81.7	9.8	13.6
Podkarpacie Province	39,303	49,638	4	5	34.0	43.0	13.0	15.4
Podlasie Province	19,595	25,063	4	5	42.8	54.7	9.7	13.8
Pomerania Province	36,957	42,248	5	5	54.5	62.3	8.4	12.3
Silesia Province	62,104	71,138	3	4	50.6	58.0	6.9	10.0
Świętokrzyskie Province	29,711	38,456	5	7	38.2	49.5	13.7	15.2
Warmia-Mazury Province	40,857	48,635	8	9	46.7	55.6	16.8	20.0
Wielkopolska Province	45,790	52,907	3	4	50.1	57.9	6.4	9.2
West Pomerania Province	42,115	46,982	7	8	51.0	56.9	13.3	17.8

Source: Author's calculation, data from the Ministry of Labor and Social Policy [2009, 2011].
Źródło: Obliczenia własne, dane MPiPS [2009, 2011].

algorithm, and their level depends in large part on an outflow from unemployment to employment, the unemployment rate and the number of unemployed people aged up to 25 years. The likelihood of a higher outflow from unemployment can be observed in case of people who are out of work for a short time, who are better educated and already have work experience. Assistance is often given to those unemployed persons who are in the best position on the labor market. The effect of "pointless loss" occurring here could be lower if there functioned an unemployment profiling system to identify those at risk of a long-term unemployment and to select appropriate activation programs.

PARTICIPATION IN ACTIVE LABOR MARKET PROGRAMS

In Poland, most labor market programs are addressed exclusively to a selected group of people being in a special situation on the labor market. These are only job placement services and trainings that are directed to a wider group of people. The result is that only some people have a possibility to perform subsidized work or improve their skills, even though they so desire and need support.

Table 2. Information on the re-employment rate and the cost incurred in the Polish regions in 2008 and 2010

Tabela 2. Informacje o wskaźniku ponownego zatrudnienia i poniesionych kosztach w regionach Polski w 2008 i 2010 roku

Item	Re-employment rate (%)		Cost of activation of 1 person (PLN)		Cost of re-employment (PLN)	
	2008	2010	2008	2010	2008	2010
Poland	56.0	54.2	4,768.79	6,749.90	9,147.54	12,947.66
Lower Silesia Province	57.3	54.7	5,119.19	7,136.75	9,362.84	12,998.73
Kujawy-Pomerania Province	52.8	52.6	4,524.85	6,331.24	8,848.36	12,777.11
Lublin Province	50.5	48.7	5,034.88	7,006.65	10,911.23	15,404.06
Lubuskie Province	68.3	65.6	3,057.40	4,086.17	4,622.43	6,572.46
Łódź Province	60.3	55.9	5,238.87	6,891.79	9,435.12	13,057.55
Małopolska Province	53.7	52.8	4,854.42	6,710.00	9,680.90	13,184.66
Mazovia Province	44.1	44.3	5,272.48	7,816.15	13,149.90	18,015.98
Opolskie Province	56.6	47.0	3,828.61	5,623.65	6,995.75	12,208.78
Podkarpacie Province	52.3	53.1	4,919.83	7,779.09	11,011.00	15,720.32
Podlasie Province	57.0	52.8	4,688.84	6,718.07	8,881.37	12,796.39
Pomerania Province	64.5	62.2	4,763.54	6,605.75	7,443.50	11,186.90
Silesia Province	57.1	55.8	4,644.03	6,843.24	8,847.84	12,725.18
Świętokrzyskie Province	53.4	54.3	5,059.76	7,140.31	9,673.15	13,088.07
Warmia-Mazury Province	52.5	50.9	4,668.79	6,551.80	9,344.68	13,191.21
Wielkopolska Province	62.7	61.7	4,883.07	6,744.72	8,560.34	11,229.59
West Pomerania Province	60.5	57.8	4,693.81	6,575.40	8,840.38	12,207.11

Source: Author's own compilation, data from the Ministry of Labor and Social Policy [2009, 2011].
Źródło: Obliczenia własne, dane MPiPS [2009, 2011].

Table 3. Pearson correlation coefficient for the unemployment rate and selected properties in the Polish regions in 2008 and 2010

Tabela 3. Współczynnik korelacji Pearsona dla stopy bezrobocia i wybranych cech w regionach Polski w 2008 i 2010 roku

Item	2008	2010
Number of vocationally activated persons	–0.31	–0.37
Persons taking part in ALMP as percentage of the economically active population	0.78	0.81
The unemployed covered by ALMP (%)	–0.02	0.13
Re-employment rate (%)	–0.10	0.01
Cost of activation of 1 person (PLN)	–0.20	–0.27
Cost of re-employment (PLN)	–0.10	–0.18

Source: Author's own compilation, data from the Ministry of Labor and Social Policy [2009, 2011].
Źródło: Obliczenia własne, dane MPiPS [2009, 2011].

In the Warmia-Mazury Province a third of vocationally activated unemployed persons took part in internships which are addressed mainly to young people and in trainings and community service (Table 4). Both trainings and community service are characterized by low efficiency in the short-term but they are relatively cheap instruments (the cost of participation of one person in the training is about 3,000 PLN and in community service – 552 PLN).

Table 4. Employment effectiveness and the share of the unemployed in particular programs (%)
Tabela 4. Efektywność zatrudnieniowa i udział bezrobotnych w poszczególnych programach (%)

Item	Structure of persons participating in programs (%)				Re-employment rate in 2010 (%)	
	Warmia-Mazury Province – WM		Poland			
	2008	2010	2008	2010	WM	Poland
Training (with scholarships)	25.4	17.8	29.4	23.1	38.5	36.7
Intervention works	12.1	9.6	8.0	5.5	63.1	70.8
Public works	8.9	12.6	7.8	9.5	45.6	46.0
Community service	15.7	13.9	11.2	8.6	29.0	39.8
Internships	25.5	33.8	29.7	38.0	47.2	48.4
Funds to take up the business activity	7.3	7.0	9.1	9.8	100.0	100.0
Additional equipment and equipment for a workplace	5.1	5.4	4.9	5.7	100.0	100.0

Source: Author's own compilation, data from the Ministry of Labor and Social Policy [2009, 2011].
Źródło: Obliczenia własne, dane MPiPS [2009, 2011].

There was also observed a change in the structure of employed persons between 2008 and 2010. The share of people who took part in trainings and intervention works declined, while the share of persons participating in internships increased. The analyzed region noted a significant rise in the proportion of people who received funds to take up the business activity (an increase by 4.6 percentage points). At the national level, the change was smaller – percentage of people who set up their own businesses rose by 1.7 percentage points. Trainings and internships are directed to a large group of people, whereas only a small percentage of people benefits from a subsidy to start their own company. They are expensive and help a few people who are mostly residents of cities (only 30% were rural residents) and most are men (60%) [A subsidy granted... 2008]. As regards the assessment of a subsidy to start one's own company, the effectiveness should be evaluated in the long-term since in a short-term the re-employment rate is 100%. Moreover, the threat of reimbursement of a subsidy, if the company exists less than one year, mobilizes people to meet this requirement even when the actual business activity does not bring any profit. It is clear that some of these companies will not remain on the market longer than 1 year since in Poland most entities give up their businesses after the first year of the activity (1/3), and after 5 years the survival rate of firms run by natural persons is 32.7% [Conditions of formation... 2009]. Studies conducted in Germany show that the rate of survival of firms is not affected by the fact that the founder was formerly employed or unemployed [Hinz and Jungbauer-Gans 1999]. Due to the specific terms of repayment of a subsidy, to

evaluate the effectiveness, there is needed the data on the functioning of these entities for a period longer than 3 months.

In the Warmia-Mazury Province the studies were conducted among persons who received a subsidy to start their own company three years before. These studies show that 58.6% of companies (930 companies) continued their business activity. In addition, 17.7% entities (in 212 companies) established in 2005 created 352 new jobs. The vast majority, as much as 72%, of those who received a subsidy was not entered again into the Register of the Unemployed within 3 years [The effectiveness of subsidies... 2009]. One can only assume that despite the failure in running one's own business, some people found another job. This shows that subsidies are an effective instrument to combat unemployment. They foster the development of entrepreneurship in the region and creation of new jobs, and therefore expenditure on the development of micro enterprises should be gradually increased, especially since in other provinces (e.g. the Małopolska and Wielkopolska Province) subsidies to start a company constitute one third of total expenditure, whereas in the Warmia-Mazury Province – 19% (in 2008) [Klembowska 2011]. Studies conducted in Sweden indicate that the chances of becoming unemployed again are two times lower for people who have benefited from subsidies than in the case of subsidized employment [Carling and Gustafson 1999]. Therefore, it can be concluded that subsidies contribute to more stable workplaces, although it should be borne in mind that some companies would still be established without any subsidy. It is difficult to eliminate an aimless cost and limited opportunities to obtain capital from other sources makes that many people will strive for this capital, by registering as unemployed ones.

EFFECT OF PARTICIPATION IN LABOR MARKET PROGRAMS VERSUS RESERVATION WAGE

The active labor market policy is an out-of-market mechanism of reallocation of the labor force which helps to overcome, through its instruments, structural mismatches. Active labor market programs are to maximize employment and reduce unemployment duration by increasing the economic attractiveness of the unemployed for the employer – through trainings or subsidizing workplace equipment or financing some labor costs charged to the employer. In the literature, the attention is drawn to the fact that, e.g. participation in active programs such as trainings, on the one hand, raises the qualifications or results in retraining and, on the other hand, it may increase the reservation wage, that is a minimum acceptable rate of pay at which the unemployed person will be willing to work.

Therefore, it was studied whether participation in active labor market programs is related to the reservation wage. Participation in internships and performance of subsidized work gives the opportunity to gain work experience, while training has an impact on improving the quality of human capital. Therefore, one would expect that the increase of skills and qualifications of the unemployed is paralleled by an increase in their salary expectations. It turned out that the average reservation wage of respondents who participated in at least one form of activation is 1,369.8 PLN, which is by 10% lower than the average for a group of people who did not participate in active programs targeted at the unemployed (Table 5).

Table 5. Reservation wage versus participation in the activities addressed to the unemployed organized by Labor Offices
Tabela 5. Płaca progowa a udział w działaniach skierowanych do bezrobotnych organizowanych przez urzędy pracy

Item		Average	Standard deviation
Participation in the activities addressed to the unemployed	ALMP (internship, training, intervention works)	1,369.80	278.87
	Unemployment benefit	1,417.24	403.62
	I have not benefited from it	1,578.10	616.66

Source: Author's own research.
Źródło: Badania własne.

The theoretical and empirical findings of Krueger and Meyer [2002] show that unemployment benefits result in an increase of salary expectations of the unemployed persons. The obtained results of analysis of variance indicated that there is a statistically significant difference between the average reservation wage of beneficiaries of active programs and benefits and people who did not take advantage of these programs at all.

Unemployed respondents who were receiving benefits for a certain period of time indicated higher pay than those who benefited only from active programs. However, the highest expectations were observed in the group of people who did not take advantage of any form of activation of the unemployed (Table 5). Perhaps this is due to the fact that the first group of people is most engaged in a search for a job, has the greatest contact with employers and professionals involved in the activation of the unemployed. In the Warmia-Mazury Province, the average pay is lower by 17% than the average for Poland, and in many counties in the region the minimum pay is half the average pay [Regional Data Bank – Wages]. One can assume that pay expectations may be a barrier to starting to work.

CONCLUSIONS

The active labor market policy, especially in regions with a high unemployment rate, allows to reduce structural mismatches on the labor market, however without an increase in the demand for labor and mobility of the unemployed, no permanent employment effects could be achieved. In the Warmia-Mazury Province, more than half of registered unemployed persons was encompassed by ALMP which represented 9% of the economically active population. Although this is a region with the highest percentage of the unemployed among the economically active population and the efficiency index of the labor market policy is lower than that for Poland; however, it is much higher than the re-employment rate for the Mazovia Province which has the lowest unemployment rate. In almost all over the country there was noted a decline in the employment rate of the unemployed with the exception of the Mazovia Province where it is virtually unchanged. There is no strong link between the situation on the regional labor market and the costs of the conducted active labor market policy. High costs of employment of one unemployed person are also for regions with a relatively better situation on the labor market.

As regards instruments such as subsidies for taking up a business activity or for additional equipment and equipment for a workstation granted to employers hiring the unemployed persons, in order to calculate the employment effectiveness, one should take into account a much longer period. As the studies show, three quarters of those who received a subsidy are not entered again into the Register of the Unemployed. Moreover, in the third year from receiving a subsidy, over half of the companies continued to operate on the market (58.6%), and one in four of them employed a worker. These results suggest that it is worth seeking to increase resources to support business development in the region.

The active labor market policy through training influences the increase of quality of human capital, improvement of qualifications or reskilling. However, participation in trainings or other programs which are the instruments of this policy did not result in higher salary expectations. The highest reservation wage was declared by those who did not benefit from the active labor market programs or unemployment benefits.

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EFEKTYWNOŚĆ AKTYWNEJ POLITYKI RYNKU PRACY NA PRZYKŁADZIE WOJEWÓDZTWA WARMIŃSKO-MAZURSKIEGO

Streszczenie. W artykule dokonano analizy poziomu wydatków na wybrane programy rynku pracy w ujęciu regionalnym oraz analizy efektywności zatrudnieniowej wybranych programów. Przedstawiono również wyniki badań ankietowych wśród osób bezrobotnych z województwa warmińsko-mazurskiego. Z badań wynika, że brak jest silnej korelacji pomiędzy sytuacją na rynku pracy a efektywnością zatrudnieniową aktywnych programów rynku pracy. Z badań wynika, że 75% osób, które otrzymały dotację na założenia własnej firmy, nie powróciło do rejestru bezrobotnych w okresie do 3 lat od przyznania dotacji. W trzecim roku od przyznania dotacji ponad połowa nadal funkcjonowała (58,6%) i co czwarta firma stworzyła miejsce pracy.

Słowa kluczowe: płaca progowa, aktywna polityka rynku pracy (APRP), bezrobocie, rynek pracy

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THE REDISTRIBUTIVE ROLE OF FINANCIAL BURDEN ON PERSONAL INCOME IN THE YEARS 2008–2010

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Abstract. Polish fiscal system contains different taxes as well as other tax-like payments. These are different payments, ie. obligatory public charges such as social insurance and health insurance contributions. These payments influence taxpayers' income and consequently also on the level of their welfare. The aim of this paper is to present the characteristics of the personal income tax (PIT), as well as the empirical evaluation of influence of PIT and social and health insurance contributions on the income situation of taxpayers. To reach the objective, the authors use two types of methods: assessment of conditions under which the personal income tax system becomes progressive and measures of structural progression.

Key words: personal income tax, taxpayers, fiscal system in Poland, measures of structural progression

INTRODUCTION

The Polish system of financial burden embraces many taxes as well as other tax-like payments. Those include various types of payments, especially compulsory charges imposed on citizens by state, especially social security and health insurance contributions. They constitute financial burden on taxpayers' income, which subsequently influences their level of wealth.

This paper attempts to determine the role of the personal income tax and empirically evaluate the influence of that tax along with social security and health insurance contributions (i.e. own retirement pension insurance, disability pension insurance, accident and sickness insurance) on taxpayers' income.

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In order to address this paper's aim, the following data was applied:
- assessment of conditions under which the personal income tax system becomes progressive, as defined in the work of N. Kakwani and P.J. Lambert [1997],
- measures of structural progression, i.e. a liability progression (LP) measure and a residual progression (RP) measure, applied by P.J. Lambert [2001].

A source information for the paper's subject matter was derived from POLTAX (the Polish system of tracking and recording data about Polish taxpayers). Data gathered refers to taxpayers who filed their personal income tax return forms (PIT) for the income years 2008–2010 to Fiscal Office in Siedlce.

A DESCRIPTION OF THE PERSONAL INCOME TAX SYSTEM

Evaluation of the structure of budget revenue presented in Table 1 indicates that direct and indirect taxes constituted over 86% of total budget revenue in 2008, over 78% in 2009 and nearly 89% in 2010. The personal income tax comprised a very important part of the national budget revenue. Tax revenue represented over 15% of total budget revenue received in 2008, over 13% in 2009 and over 14% in 2010. However, most of this tax revenue derived from goods and services tax and excise duty – over 60% of total budget revenue in 2008, nearly 56% in 2009 and over 60% in 2010.

Table 1. The structure of budget revenue in the years 2008–2010
Tabela 1. Struktura dochodów budżetowych w latach 2008–2010

No	Revenue items	Projected revenue (mln PLN)			Budget outturn (mln PLN)		
		for 2008	for 2009	for 2010	for 2008	for 2009	for 2010
Revenue from the following:		281,892.1	272,911.5	249,006.6	253,547.3	274,183.5	250,302.8
1	Indirect tax	164,890.0	147,462.0	160,370.0	153,677.7	154,957.7	165,189.7
	including goods and services tax and excise duty	163,900.0	145,900.0	159,270.0	152,272.9	153,381.6	163,564.8
2	Corporate income tax	27,150.0	24,000.3	26,300.0	27,159.7	24,156.6	21,769.9
3	Personal income tax	36,154.0	34,350.0	36,085.0	38,658.5	35,763.7	35,592.5
4	Tonnage tax and annulled taxes	0.4	0.0	0.0	3.5	0.8	0.5
5	Non-tax revenue	18,415.6	25,335.7	22,411.2	19,308.9	27,433.4	24,501.6
6	Non-refundable funds from the European Union and other sources	35,282.1	41,763.5	3,370.4	14,739.0	31,871.3	3,248.6

Source: Budget outturn report, Ministry of Finance, State Budget Department (www.mf.gov.pl).
Źródło: Sprawozdanie operatywne z wykonania budżetu państwa, Ministerstwo Finansów, Departament Budżetu Państwa (www.mf.gov.pl).

The structure of budget revenue presented in Table 1 indicates that the complex analysis of the amount and the distribution of tax burden requires also taking into consideration, besides the personal income tax, an indirect tax (and above all, goods and services tax and excise duty). In this paper, due to the very same reason, other relevant charges on personal income will also be taken into account, including: compulsory social security and health insurance contributions. Types of insurance enumerated in Table 2 are

undoubtedly closely related to the personal income tax. They are deductible against taxable income and against calculated tax due. Table 2 presents the amounts of particular contributions.

Table 2. Social security and health insurance contributions in the years 2008–2010
Tabela 2. Składki na ubezpieczenia społeczne i składka zdrowotna w latach 2008–2010

Type of insurance	Insurance percentage rate incurred by	
	an employee (%)	an employer (%)
Own retirement pension insurance	9.76	9.76
Disability pension insurance	1.50	4.50
Sickness insurance	2.45	–
Accident insurance	–	from 0.67 to 3.33[a]
Health insurance	9.00	9.00

[a]The principle of differentiating percentage rates of premiums in social insurance against accidents is defined in the Act of 30 October 2002 on social insurance in case of occupational accident or disease (consolidated text, Journal of Laws, 2009, No 167, Item 1322) and Regulation of the Minister of Labour and Social Policy of 29 November 2002 on differentiating percentage rates of premiums in social insurance against occupational accident and traumatic disease subject to different hazards and their effects (Journal of Laws, 2002, No 200, Item 16923, as amended).
Source: Self-prepared on the basis of information published by ZUS (Social Insurance Company).
Źródło: Opracowanie własne na podstawie informacji ogłaszanych przez Zakład Ubezpieczeń Społecznych.

Social security and health insurance premiums, as it has already been mentioned, are some type of expenses which are subject to deductions when calculating the tax amount due. The health insurance contribution rate in the years 2008–2010 amounted to 9%. Only 7.75% of that contribution's base was subject to tax deduction, not total amount of it. The amounts of premiums paid for own retirement pension, disability pension and sickness insurance were subject to deduction from income, that is they caused reduction of taxable base. Labour Fund and Employment Fund Contribution premiums consitute some indirect burden on income. Nevertheless, they will not be taken into account in the further analysis as they do not impose any direct influence on the amount of income tax.

By assumption, the personal income tax from the moment of its introduction on 1 January 1992 has been a progressive tax. Its progression results from marginal tax rates increasing over certain thresholds. Table 3 and 4 show the method of calculating tax. Such a structure indicates an existence of tax-exempt sum, which amounted to 3,089 PLN in the years 2008–2010, as well as an existence of marginal rates, which in 2008 amounted to: 19, 30 and 40%, while in the years 2009–2010 came to 18 and 32%. The personal income tax system also incorporates some preferential ways of taxation (joint taxation of spouses or taxation of persons single-handedly raising children), as well as tax allowances and exemptions. Owing to such a structure, personal income tax differentiates the amounts of burden imposed on certain groups of taxpayers and has an influence on the secondary distribution of income. Therefore, the progressive personal income tax is commonly used in order to reduce income inequality. Its redistributive role comprises its basic feature, next to its fiscal function. Generally, redistribution means, that as a result of certain taxation, inequalities are diminishing, that is the income of poorer people becomes relatively higher while the income of more affluent people becomes relatively lower.

Table 3. Tax brackets in force in the fiscal year 2008
Tabela 3. Skala podatkowa obowiązująca w roku podatkowym 2008

Taxable base (PLN)		Tax amount (PLN)
above	up to	
	44,490.00	19% – 585.85
44,490.00	85,528.00	7,866.25 + 30% of excess above 44,490.00
85,528.00		20,177.65 + 40% of excess above 85,528.00

Source: Art. 10 sec. 2 of the Act of 16 November 2006 on amending the act on personal income tax and amending other acts (Journal of Laws, 2006, No 217, Item 1588).
Źródło: Art. 10 ust. 2 Ustawy z dnia 16 listopada 2006 r. o zmianie ustawy o podatku dochodowym od osób fizycznych oraz o zmianie innych ustaw (Dz.U. z 2006 r. nr 217, poz. 1588).

Table 4. Tax brackets in force in the fiscal years 2009–2010
Tabela 4. Skala podatkowa obowiązująca w latach podatkowych 2009–2010

Taxable base (PLN)		Tax amount (PLN)
above	up to	
	85,528.00	18% – 556.02
85,528.00		14,839.02 + 32% excess above 85,528.00

Source: Art. 27 sec. 1 of the Act of 26 July 1991 on personal income tax, in the wording as of the date of 1 January 2009 (Journal of Laws, 2010, No 51, Item 307, as amended).
Źródło: Art. 27 ust. 1 Ustawy z dnia 26 lipca z 1991 r. o podatku dochodowym od osób fizycznych, w brzmieniu obowiązującym od 1 stycznia 2009 r. (Dz.U. z 2010 r. nr 51, poz. 307 z późn. zm.).

Personal income tax rate progression may be evaluated in the context of progressivity conditions suggested by Kakwani and Lambert [1997], according to which:

– firstly, the minimum principle of progression was defined as

$$x_i \geq x_j \Rightarrow t_i \geq t_j . \tag{1}$$

– secondly, the principle of progression was defined as

$$x_i \geq x_j \text{ and } t_i \geq t_j \Rightarrow \frac{t_i}{x_i} > \frac{t_j}{x_j}, \tag{2}$$

where: x_i, x_j – pretax income;
t_i, t_j – tax amount due.

The condition defined in formula (1) signifies the minimal rate of increase of the tax amount due as the income increases. According to the above, imposing the very same tax on both higher and equal income is an essential precondition for tax progression. Tax progression as defined in formula (2) means not only higher amount of the tax burden but also higher income share that is payable as a tax. Every tax system which does not meet that requirement is defined as regressive. The condition (2) relevant herein, excludes a flat tax rate, for which an average tax rate $\frac{t}{x}$ does not depend on the amount of income x.

FINANCIAL BURDEN ON PERSONAL INCOME

Data in Tables 6, 7 and 8 presents personal income tax rates as well as social security and health insurance contributions in the years 2008–2010 respectively. They were defined depending on the amount of taxpayers' income.

Exclusively data about taxpayers engaged in non-agricultural business activities who filed their tax returns PIT-37 for the tax years 2008–2010 was applied to calculate certain amounts of burden. This group in 2008 consisted of 60.76% of all taxpayers in Siedlce and its administrative district, of 57.46% in 2009 and of 57.96% in 2010. Table 5 presents the structure of taxpayers, taking into consideration a type of tax return filed by them.

Table 5. The structure of taxpayers in relation to a type of tax return filed
Tabela 5. Struktura podatników ze względu na rodzaj składanego zeznania podatkowego

A type of tax return filed	Number of taxpayers			Structure (%)		
	in 2008	in 2009	in 2010	in 2008	in 2009	in 2010
PIT-36	6,918	6,429	6,756	7.56	7.81	8.26
PIT36L	1,382	1,603	1,549	1.51	1.95	1.89
PIT-37	**55,595**	**47,277**	**47,390**	**60.76**	**57.46**	**57.96**
PIT-40	2,041	1,580	1,230	2.23	1.92	1.50
PIT-40A	25,563	25,392	24,851	27.94	30.86	30.39
Total	91,499	80,701	81,776	100.00	100.00	100.00

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

The results referring to personal income tax liabilities as well as social security and health insurance contributions that are presented in Tables 6, 7 and 8 indicate the redistributive role of those liabilities.

It needs to be underlined that the results displayed in Tables 6, 7 and 8 indicate that the tax burden analysed herein shows an upward tendency, taking into consideration the gross income received. The taxpayers whose yearly gross income did not exceed 5,000 PLN ranked lowest for tax burden reflected in percent (0.56% in 2008, 0.40% in 2009, 0.42% in 2010), whereas the taxpayers whose yearly gross income exceeded 120,000 PLN ranked highest (17.90% in 2008, 12.20% in 2009, 12.18% in 2010). The burden of compulsory social security contributions to the greatest degree was borne by persons with the lowest income of below 5,000 PLN (13.68% in 2008, 13.08% in 2009 and 13.66% in 2010), while it had the lowest influence on those with the income over 120,000 PLN (7.81% in 2008, 7.99% in 2009 and 8.06% in 2010). The reason for that is the fact that a taxpayer whose income exceeds the amount of 30 times the average monthly salary in economic organisations stops paying own retirement pension insurance and disability pension insurance premiums. Earning thresholds above which social security contributions plummeted were as follows: 90,000 PLN in 2008, 85,528 PLN in 2009 and 70,000 PLN in 2010. The rate of health insurance contributions was similar in 2008 as well as in 2009 and 2010, regardless of the income obtained (it ranged 7.00–7.89% in 2008, 6.86–

Table 6. Personal income tax liabilities along with social security and health insurance contributions in 2008

Tabela 6. Obciążenia z tytułu podatku dochodowego od osób fizycznych oraz z ubezpieczeń społecznych i ubezpieczenia zdrowotnego w 2008 roku

Specification	Annual gross income	Social security contributions	Health insurance contributions	Personal income tax	Total
	PLN	%			
I tax bracket	up to 5,000	13.68	5.41	0.56	19.65
	5,000–10,000	12.10	7.46	2.82	22.38
	10,000–15,000	13.31	7.89	3.96	25.16
	15,000–20,000	12.35	7.67	4.94	24.96
	20,000–25,000	12.13	7.63	5.42	25.18
	25,000–30,000	12.34	7.62	5.72	25.68
	30,000–35,000	12.59	7.62	5.91	26.12
	35,000–40,000	12.53	7.52	6.32	26.37
	40,000–44,490	12.49	7.44	6.55	26.48
II tax bracket	44,490–50,000	12.49	7.31	7.32	27.12
	50,000–55,000	12.20	7.28	7.98	27.46
	55,000–60,000	12.33	7.17	7.92	27.42
	60,000–65,000	12.33	7.26	8.50	28.09
	65,000–70,000	12.37	7.31	8.63	29.31
	70,000–75,000	12.34	7.13	8.89	28.36
	75,000–80,000	12.24	7.31	9.16	28.71
	80,000–85,528	12.21	7.34	9.33	28.88
III tax bracket	85,528–90,000	12.10	7.19	9.75	29.04
	90,000–95,000	11.56	7.26	10.20	29.02
	95,000–100,000	10.51	7.54	11.16	29.21
	100,000–105,000	11.53	7.27	11.83	30.63
	105,000–110,000	10.74	7.05	12.45	30.24
	110,000–115,000	8.92	7.00	12.77	28.69
	115,000–120,000	10.16	7.39	13.69	31.24
	over 120,000	7.81	7.39	17.90	33.10

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

7.86% in 2009 and 6.83–7.92% in 2010). It did not concern the taxpayers whose income was less than 5,000 PLN. That burden amounted to: 5.41, 5.61 and 5.64% relatively).

Moreover, it needs to be taken into account that the analysed personal income tax became a regressive tax in the following brackets: 50,000–55,000 PLN in 2008, 90,000––95,000 PLN in 2009, 15,000–20,000 PLN and 90,000–95,000 PLN. In the above mentioned brackets, the conditions defined by formulas (1) and (2) are not fulfilled, which means that tax burden of those taxpayers does not increase with the income growth. This, in turn, means that tax liabilities are not growing in relation to the higher income.

The characteristic of tax system to a large extent depends on the structure of income tax. The evaluation of the tax system properties may be conducted, among others, with

Table 7. Personal income tax liabilities along with social security and health insurance contributions in 2009
Tabela 7. Obciążenia z tytułu podatku dochodowego od osób fizycznych oraz z ubezpieczeń społecznych i ubezpieczenia zdrowotnego w 2009 roku

Specification	Annual gross income	Social security contributions	Health insurance contributions	Personal income tax	Total
	PLN		%		
I tax bracket	up to 5,000	13.08	5.61	0.40	19.09
	5,000–10,000	11.43	7.28	2.38	21.09
	10,000–15,000	13.02	7.86	3.52	24.40
	15,000–20,000	12.42	7.68	4.47	24.57
	20,000–25,000	12.09	7.61	4.88	24.58
	25,000–30,000	12.23	7.55	5.41	25.19
	30,000–35,000	12.35	7.55	5.56	25.46
	35,000–40,000	12.40	7.53	5.87	25.80
	40,000–45,000	12.37	7.45	6.18	26.00
	44,490–50,000	12.39	7.35	6.42	26.16
	50,000–55,000	12.18	7.31	6.78	26.27
	55,000–60,000	12.02	7.29	6.98	26.29
	60,000–65,000	12.02	7.26	7.34	26.62
	65,000–70,000	12.13	7.34	7.42	26.89
	70,000–75,000	12.18	7.19	7.62	26.99
	75,000–80,000	11.97	7.24	7.69	26.90
	80,000–85,528	12.32	7.27	7.99	27.58
II tax bracket	85,528–90,000	11.76	7.19	8.34	27.29
	90,000–95,000	11.20	7.08	8.60	26.88
	95,000–100,000	11.94	7.44	8.59	27.97
	100,000–105,000	11.52	7.28	8.68	27.48
	105,000–110,000	11.27	7.66	9.09	28.02
	110,000–115,000	10.93	6.76	9.21	26.90
	115,000–120,000	10.19	6.86	9.72	26.77
	over 120,000	7.99	7.26	12.20	27.45

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

the help of measures of structural progression applied by P.J. Lambert in 2001. Especially two measures of structural progression are crucial.

The first, defined as liability progression (*LP*), is expressed with the following formula:

$$LP(x) = \frac{m(x)}{a(x)} \tag{3}$$

where: $a(x) = \frac{t}{x}$ – is an average tax rate due for an income x;

$m(x) = \frac{\hat{}t}{\hat{}x}$ – is a marginal tax rate due for an income x.

Table 8. Personal income tax liabilities along with social security and health insurance contributions in 2010
Tabela 8. Obciążenia z tytułu podatku dochodowego od osób fizycznych oraz z ubezpieczeń społecznych i ubezpieczenia zdrowotnego w 2010 roku

Specification	Annual gross income	Social security contributions	Health insurance contributions	Personal income tax	Total
	PLN		%		
I tax bracket	up to 5,000	13.66	5.64	0.42	19.72
	5,000–10,000	11.50	7.29	2.43	21.22
	10,000–15,000	13.01	7.92	3.54	24.47
	15,000–20,000	12.49	7.64	5.14	25.27
	20,000–25,000	12.17	7.63	4.58	24.38
	25,000–30,000	12.10	7.53	5.44	25.07
	30,000–35,000	12.35	7.52	5.76	25.63
	35,000–40,000	12.31	7.49	6.15	25.95
	40,000–45,000	12.32	7.41	6.39	26.12
	44,490–50,000	12.34	7.37	6.63	26.34
	50,000–55,000	12.23	7.26	6.91	26.40
	55,000–60,000	11.98	7.29	7.17	26.44
	60,000–65,000	11.98	7.39	7.33	26.70
	65,000–70,000	12.10	7.10	7.58	26.78
	70,000–75,000	11.67	7.22	7.66	26.55
	75,000–80,000	11.64	7.13	7.80	26.57
	80,000–85,528	11.50	6.83	7.92	26.25
II tax bracket	85,528–90,000	11.17	6.90	8.16	23.23
	90,000–95,000	11.23	6.93	8.63	23.79
	95,000–100,000	10.77	7.19	8.55	26.51
	100,000–105,000	10.96	7.17	8.67	26.80
	105,000–110,000	10.94	7.26	9.22	27.42
	110,000–115,000	11.15	7.17	9.31	27.63
	115,000–120,000	9.89	7.52	9.53	26.94
	over 120,000	8.06	7.30	12.18	27.54

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

Tax brackets are progressive if for any level of income where tax amount due is more than 0, so a(x) > 0, the following condition $m(x) > a(x)$ is fulfilled, that is $LP(x) > 1$.

The second measure is residual progression (RP):

$$RP(x) = \frac{1 - m(x)}{1 - a(x)} \tag{4}$$

The condition for progressive tax rates is fulfilled for $RP(x) < 1$.

Values specifying the ranges of liability progression $LP(x)$ and residual progression $RP(x)$ in Table 9 for the year 2008, in Table 10 for the year 2009 and Table 11 for the year 2010, were calculated relatively according to formulas (3) and (4) in points referring to an average income from a particular bracket.

Table 9. Liability progression and residual progression in 2008
Tabela 9. Progresja zobowiązań oraz progresja resztowa w 2008 roku

Specification	Annual gross income (PLN)	Average tax rate (%)	Marginal tax rate (%)	$LP(x)$	$RP(x)$
I tax bracket	up to 5,000	0.56	3.58	6.39	0.97
	5,000–10,000	2.82	5.98	2.12	0.97
	10,000–15,000	3.96	7.19	1.82	0.97
	15,000–20,000	4.94	7.09	1.44	0.98
	20,000–25,000	5.42	7.03	1.30	0.98
	25,000–30,000	5.72	7.00	1.22	0.99
	30,000–35,000	5.91	8.92	1.51	0.97
	35,000–40,000	6.32	8.43	1.33	0.98
	40,000–44,490	6.55	13.74	2.10	0.92
II tax bracket	44,490–50,000	7.32	13.97	1.91	0.96
	50,000–55,000	7.98	7.26	0.91	1.01
	55,000–60,000	7.92	15.14	1.91	0.92
	60,000–65,000	8.50	10.19	1.20	0.98
	65,000–70,000	8.63	12.48	1.45	0.96
	70,000–75,000	8.89	12.97	1.46	0.96
	75,000–80,000	9.16	11.81	1.29	0.97
	80,000–85,528	9.33	16.95	1.82	0.92
III tax bracket	85,528–90,000	9.75	18.47	1.89	0.90
	90,000–95,000	10.20	28.29	2.77	0.80
	95,000–100,000	11.16	25.10	2.25	0.84
	100,000–105,000	11.83	25.47	2.15	0.85
	105,000–110,000	12.45	19.22	1.54	0.92
	110,000–115,000	12.77	36.29	2.84	0.73
	115,000–120,000	13.69	27.44	2.00	0.84
	over 120,000	17.90			

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

Calculations shown in Tables 9, 10 and 11 indicate that:

- First of all, the income tax in the following brackets is not a progressive tax: 50,000––55,000 PLN in 2008, 90,000–95,000 PLN in 2009, 15,000–20,000 PLN and 90,000––95,000 PLN in 2010. It does not meet the condition for progression included in formula (3) according to which $LP(x) > 1$. Moreover, it needs to be taken into account that the tax is only slightly progressive in the other income ranges, i.e. 15,000––40,000 PLN, 60,000–80,000 PLN and 105,000–110,000 PLN in 2008, 15,000–20,000 PLN, 25,000–55,000 PLN, 60,000–75,000 PLN, 95,000–100,000 PLN and 105,000––110,000 PLN in 2009, 20,000–85,528 PLN, 95,000–100,000 PLN and 105,000––115,000 PLN in 2010. The biggest progression can be seen in the following income tax brackets: 0–5,000 PLN, 90,000–95,000 PLN and 110,000–115,000 PLN in 2008, and 0–5,000 PLN in 2009 and 2010. It means that in those income ranges income inequalities are reduced to a larger extent.
- Second of all, considering the assumption reflected in formula (4), according to which the condition for progression is fulfilled for $RP(x) < 1$, the tax brackets for the taxpay-

Table 10. Liability progression and residual progression in 2009
Tabela 10. Progresja zobowiązań oraz progresja resztowa w 2009 roku

Specification	Annual gross income (PLN)	Average tax rate (%)	Marginal tax rate (%)	$LP(x)$	$RP(x)$
I tax bracket	up to 5,000	0.40	3.11	7.78	0.97
	5,000–10,000	2.38	5.28	2.22	0.97
	10,000–15,000	3.52	6.80	1.93	0.97
	15,000–20,000	4.47	6.27	1.40	0.98
	20,000–25,000	4.88	7.79	1.60	0.97
	25,000–30,000	5.41	6.42	1.19	0.99
	30,000–35,000	5.56	7.88	1.42	0.98
	35,000–40,000	5.87	8.47	1.44	0.97
	40,000–45,000	6.18	8.50	1.38	0.98
	45,000–50,000	6.42	10.17	1.58	0.96
	50,000–55,000	6.78	9.34	1.38	0.97
	55,000–60,000	6.98	11.23	1.61	0.95
	60,000–65,000	7.34	8.35	1.14	0.99
	65,000–70,000	7.42	10.32	1.39	0.97
	70,000–75,000	7.62	8.76	1.15	0.99
	75,000–80,000	7.69	12.30	1.60	0.95
	80,000–85,528	7.99	14.20	1.78	0.93
II tax bracket	85,528–90,000	8.34	13.36	1.60	0.95
	90,000–95,000	8.60	8.48	0.99	1.00
	95,000–100,000	8.59	10.51	1.22	0.98
	100,000–105,000	8.68	17.26	1.99	0.91
	105,000–110,000	9.09	11.95	1.31	0.97
	110,000–115,000	9.21	20.91	2.27	0.87
	115,000–120,000	9.72	17.60	1.81	0.91
	above 120,000	12.20			

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

ers from Siedlce and its administrative district, in force in the fiscal years 2008–2011, were not progressive in the following income ranges: 50,000–55,000 PLN in 2008, 90,000–95,000 PLN in 2009, 15,000–20,000 PLN and 90,000–95,000 PLN in 2010. In the remaining income ranges brackets were close to the proportional (flat) ones. In those income ranges the value of residual progression measure was within the following bounds: 0.92–0.99 in the first tax bracket, 0.92–0.98 in the second tax bracket and 0.73–0.92 in the third one in 2008. Whereas, in the years 2009–2010 it was within the range of 0.93–0.99 and 0.90–0.99 in the first tax bracket and 0.87–0.98 in the second one respectively. That allows to draw a conclusion that personal income tax in the years 2008–2010 to a small extent helped in reducing taxpayers' income inequality.

Table 11. Liability progression and residual progression in 2010
Tabela 11. Progresja zobowiązań oraz progresja resztowa w 2010 roku

Specification	Annual gross income (PLN)	Average tax rate (%)	Marginal tax rate (%)	$LP(x)$	$RP(x)$
I tax bracket	up to 5,000	0.42	3.11	7.40	0.97
	5,000–10,000	2.43	5.21	2.14	0.97
	10,000–15,000	3.54	7.16	2.02	0.96
	15,000–20,000	5.14	7.08	0.98	1.00
	20,000–25,000	4.58	6.79	1.48	0.98
	25,000–30,000	5.44	7.52	1.38	0.98
	30,000–35,000	5.76	8.69	1.51	0.97
	35,000–40,000	6.15	8.21	1.33	0.98
	40,000–45,000	6.39	8.65	1.35	0.98
	45,000–50,000	6.63	9.62	1.45	0.97
	50,000–55,000	6.91	9.89	1.43	0.97
	55,000–60,000	7.17	9.15	1.28	0.98
	60,000–65,000	7.33	10.72	1.46	0.96
	65,000–70,000	7.58	8.76	1.16	0.99
	70,000–75,000	7.66	9.75	1.27	0.98
	75,000–80,000	7.80	9.70	1.24	0.98
	80,000–85,528	7.92	12.07	1.52	0.95
II tax bracket	85,528–90,000	8.16	17.49	2.14	0.90
	90,000–95,000	8.63	7.00	0.81	1.02
	95,000–100,000	8.55	11.12	1.30	0.97
	100,000–105,000	8.67	20.29	2.34	0.87
	105,000–110,000	9.22	11.32	1.23	0.98
	110,000–115,000	9.31	14.35	1.54	0.94
	115,000–120,000	9.53	17.88	1.88	0.94
	above 120,000	12.18			

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

TAX ON PERSONAL INCOME

In 2008 nearly 79% of all taxpayers in Siedlce and its administrative district who filed a PIT-37 tax return form fell in the first tax bracket, 14% fell in the second tax bracket and nearly 7% in the third one. That has been shown in Table 12.

Whereas:

– In 2009[1], as shown in Table 13, the income of over 95% of all taxpayers in Siedlce and its administrative district who filed a PIT-37 tax return form fell into the first

[1]Important changes in the personal income tax came into effect on 1 January 2009. They have significantly influenced the amount of tax burden and personal income distribution. The introduction of two tax brackets was one of the most crucial changes implemented. Instead of the three tax rates valid from 31 December 2008: 19, 30 and 40%, starting from 1 January 2009 only two following tax rates have been in force: 18 and 32%.

tax bracket. The income of only 7% of them was taxed at a rate in the second tax bracket.

– As shown in Table 14, in 2010 the income of over 95% of all taxpayers in Siedlce and its administrative district who filed a PIT-37 tax return form fell into the first tax bracket. The income of only 5% of them was taxed at a rate in the second tax bracket.

Table 12. Structure of taxpayers (by tax brackets) who filed a PIT-37 tax return form in the fiscal year 2008

Tabela 12. Struktura podatników według przedziałów podatkowych rozliczających się na formularzu PIT-37 w roku podatkowym 2008

Taxable base (PLN)		Number of taxpayers	Structure (%)	Tax due	Structure (%)
above	up to				
–	43,405	41,998	78.83	27,982,134	37.52
43,405	85,528	7,604	14.27	24,155,581	32.39
85,528	–	3,672	6.90	22,443,455	30.09

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

It is indicated in Tables 12, 13 and 14 that, in comparison to 2008, in the years 2009––2010 the share of taxpayers with an income less than 85,528 PLN increased from 93.10% to 95.21 and 94.77% respectively. However, it should be taken into consideration that despite the increase in the share of the above mentioned group of taxpayers, in comparison to 2008, their share in the tax due (they have payed) decreased by 2.32% in 2009 and by 2.64% in 2010. That means that the decrease in the share of taxpayers with an income higher than 85,528 PLN had an influence on the increase of their share in the tax due by 2.32% in 2009 and by 2.64% in 2010 in comparison to 2008.

Table 13. Structure of taxpayers (by tax brackets) who filed a PIT-37 tax return form in the fiscal year 2009

Tabela 13. Struktura podatników według przedziałów podatkowych rozliczających się na formularzu PIT-37 w roku podatkowym 2009

Taxable base (PLN)		Number of taxpayers	Structure (%)	Tax due	Structure (%)
above	up to				
	85,528	45,011	95.21	61,790,738	67.59
85,528		2,266	4.79	29,627,879	32.41

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

Personal income tax differentiates the amount of burden imposed on particular groups of taxpayers and affects the redistribution of income. That results from the system of tax brackets (progressive tax system), tax allowance and exemption system including the deduction of social security contributions from an income and health insurance contribution from the tax as well as the existence of an exempt amount. Moreover, it needs to be added that the system of personal income tax is closely connected to the system of social security insurance.

Table 14. Structure of taxpayers (by tax brackets) who filed a PIT-37 tax return form in the fiscal year 2010
Tabela 14. Struktura podatników według przedziałów podatkowych rozliczających się na formularzu PIT-37 w roku podatkowym 2010

Taxable base (PLN)		Number of taxpayers	Structure (%)	Tax due	Structure (%)
above	up to				
	85,528	44,910	94.77	66,667,995	67.27
85,528	–	2,480	5.23	32,441,151	32.73

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

Tables 15, 16 and 17 present an effective imposition of personal income tax and tax-like contributions (social security and health insurance contributions).

Table 15. Effective tax rate by tax brackets for taxpayers who filed a PIT-37 tax return form in the fiscal year 2008
Tabela 15. Efektywna stopa podatkowa według przedziałów skali podatkowej podatników rozliczających się na formularzu PIT-37 w roku podatkowym 2008

Taxable base (PLN)		Tax rate (%)	Effective tax rate (%)	The result of subtraction in percentage points (3–4)
above	up to			
–	44,490	19	5.23	13.77
44,490	85,528	30	8.30	21.70
85,528		40	14.47	25.53
Total		–	7.87	–

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

In 2008 an effective tax rate for the taxpayers in Siedlce and its administrative district who gained an income higher than 85,528 PLN amounted to 14.47%. In the years 2008–2010 it was 10.46% and 10.44% respectively for the same group of taxpayers. It indicates that changes in marginal tax rates from 2009 in the personal income tax proved to be most beneficial for the taxpayers who earned more than 85,528 PLN. Those changes also proved to be beneficial for the taxpayers in Siedlce and its administrative district whose income fell in between the range limits of 44,490–85,528 PLN The reason for that was the fact that the effective tax rate dropped by 2.57% in 2009 and by 2.33% in 2010. Yet, for the taxpayers whose income did not exceed 44,490 PLN, the effective tax rate slightly increased: by 0.50% in 2009 and by 0.74% in 2010. That means that changing the marginal tax rates was not beneficial at all or only slightly beneficial for that group of taxpayers.

The sum total of the effective income tax incurred by all taxpayers in 2008 was fluctuating around the level of 7.87%, in 2009–6.74% and in 2010–6.94%. The reduction in the

Table 16. Effective tax rate by tax brackets for taxpayers who filed a PIT-37 tax return form in the fiscal year 2009
Tabela 16. Efektywna stopa podatkowa według przedziałów skali podatkowej podatników rozliczających się na formularzu PIT-37 w roku podatkowym 2009

Taxable base (PLN)		Tax rate (%)	Effective tax rate (%)	The result of subtraction in percentage points (3–4)
above	up to			
–	85,528	18	5.73	12.27
85,528.00	–	32	10.46	21.54
Total		–	6.74	–

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

Table 17. Effective tax rate by tax brackets for taxpayers who filed a PIT-37 tax return form in the fiscal year 2010
Tabela17. Efektywna stopa podatkowa według przedziałów skali podatkowej podatników rozliczających się na formularzu PIT-37 w roku podatkowym 2010

Taxable base (PLN)		Tax rate (%)	Effective tax rate (%)	The result of subtraction in percentage points (3–4)
above	up to			
–	85,528.00	18	5.97	12.03
85,528.00	–	32	10.44	21.56
Total		–	6.94	–

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

sum total of the effective tax rate by 1.13% in 2009 and by 0.93% in 2010 in comparison to 2008 signifies that progression in the tax is weakened[2].

The result of calculating an effective tax burden on the taxpayers from Siedlce and its administrative district whose income did not exceed the amount of 85,528 PLN comes out of the fact that effective tax rate is an average for the whole tax bracket, which held 93.10% of taxpayers in 2008, 95.21% in 2009 and 94.77% in 2010. That group of taxpayers includes also such persons who gained income lower than (or equal) 5,000 PLN. There were 8,576 such taxpayers in 2008, 7,428 in 2009 and 7,061 in 2010. The group also consists of persons who earned nearly 85,528 PLN. There were 426 such taxpayers in 2008, 439 in 2009 and 480 in 2010. As an example, Table 18 shows a gross income burden of a personal income tax by effective tax rate for the taxpayers from Siedlce and its administrative district whose income in the years 2008–2010 fell within the range limits of 5,000–10,000 PLN and 80,000–85,528 PLN.

Analysis of the example from Table 18 enables to notice that in 2008 the effective tax rate is only slightly more than 3 times higher for an income nearly 11 times higher. In

[2]A weakening of the tax progression signifies that the personal income tax fullfils its redistributive role to a lesser extent.

Table 18. Effective tax rate for tax brackets 5,000–10,000 PLN and 80,000–85,528 PLN of the taxpayers from Siedlce and its administrative district who filed a PIT-37 tax return form in the fiscal years 2008–2010

Tabela 18. Efektywna stopa podatkowa dla przedziałów dochodowych od 5000 zł do 10 000 zł oraz od 80 000 zł do 85 528 zł podatników miasta Siedlce i jego powiatu rozliczających się na formularzu PIT-37 w latach podatkowych 2008–2010

Taxable base (PLN)		Average income (PLN)	Effective tax rate (%)
above	up to		
		2008	
5,000	10,000	7,732.29	2.82
80,000	85,528	82,771.78	9.33
		2009	
5,000	10,000	7,481.10	2.38
80,000	85,528	82,769.13	7.99
		2010	
5,000	10,000	7,478.41	3.54
80,000	85,528	82,820.13	7.92

Source: Self-prepared calculation based on the data from the Tax Office in Siedlce POLTAX system.
Źródło: Obliczenia własne na podstawie danych z systemu POLTAX Urzędu Skarbowego w Siedlcach.

the years 2008–2010 for an income over 11 times higher, the effective tax rate is, respectively, only over 3 times higher and over twice as high. The conclusion can be drawn that dependency between the amount of income earned by the taxpayers from Siedlce and its administrative district and the amount of the effective tax rate can be described as mildly progressive.

CONCLUSIONS

On the basis of the above reflections, a conclusion may be drawn that for a significant majority of taxpayers who do not conduct any non-agricultural business activities in Siedlce and its administrative district and who file a PIT-37 tax return form, the personal income tax system is mildly progressive. It is indicated by the volume of burden imposed by the above mentioned tax in the years 2008–2010, which only slightly increases with income. That is also shown in the calculation of the following measures: liability progression and residual progression. Nevertheless, it needs to be taken into account that progressivity of personal income tax is not identical for every tax bracket.
Furthermore, in the following tax brackets:

- 50,000–55,000 PLN in 2008,
- 90,000–95,000 PLN in 2009,
- 15,000–20,000 and 90,000–95,000 PLN in 2010,

personal income tax is a regressive tax as the personal income tax rate falls with an increase in income. That is also shown in the calculated measures of liability progression and residual progression.

In case of the tax-like burden, it needs to be pointed that social security contributions are regressive. The burden rate imposed by them slightly declines with an increase

of taxpayers' income. Whereas, in case of the analysed health insurance contributions, the results for the average burden rate imposed by them indicate its proportional (flat) character.

All in all, personal income tax system together with the social security system in the years in question herein had a very slight impact on the amount and differentiation of the income of its taxpayers. The reasons for insignificant influence on the distribution of personal income and the amount of tax burden are as follows:

- Firstly, tax burden only slightly increases with income, which indicates that tax liability does not relatively increase with income level (this statement is also confirmed by an example shown in Table 18). In a few cases it even decreases as income rises, which subsequently means that in those cases the tax burden on higher incomes is lower.
- Secondly, calculation of the following measures: liability progression and residual progression shows that income taxation system is only slightly progressive or even regressive.

Moreover, it should be stated that the redistributive role of personal income tax weakened after the introduction of a two-rate income tax scale in 2009. Changes introduced in tax rates proved to be most advantageous to taxpayers whose income exceeded an amount of 85,528 PLN (there was the steepest decrease in the effective tax rate for that particular group of taxpayers in comparison to 2008). Whereas, those changes had no beneficial effect on the taxpayers who obtained income of up to 44,490 PLN. They have observed an increase in the effective tax rate in comparison to 2008. The total reduction of the effective tax rate for all taxpayers in the years 2008–2009 in comparison to 2008 resulted in reduced tax progression (in the years 2009–2010 the personal income tax played much smaller redistributive role in comparison to 2008).

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REDYSTRYBUCYJNA ROLA OBCIĄŻEŃ FINANSOWYCH OSÓB FIZYCZNYCH W LATACH 2008–2010

Streszczenie. Polski system obciążeń finansowych obejmuje wiele podatków, jak też inne świadczenia o charakterze parapodatkowym. Są to różnego rodzaju opłaty, a przede wszystkim obowiązkowe obciążenia publiczne, szczególnie składki na ubezpieczenia społeczne i składka zdrowotna. Stanowią one obciążenie dochodów podatników, wpływając tym samym na poziom ich dobrobytu. Celem opracowania jest próba określenia właściwości podatku dochodowego od osób fizycznych oraz empiryczna ocena jego wpływu i obciążeń z tytułu ubezpieczeń społecznych (tj. ubezpieczenia emerytalnego, rentowego, chorobowego oraz wypadkowego) i ubezpieczenia zdrowotnego na sytuację dochodową podatników.

Autorzy artykułu wykorzystują ocenę warunków progresywności systemu podatku dochodowego od osób fizycznych oraz miary progresji strukturalnej.

Słowa kluczowe: podatek dochodowy od osób fizycznych, podatnicy, system podatkowy w Polsce, miary progresji strukturalnej

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TERRITORIAL DIFFERENTIATION IN ENTERPRISE POPULATION DYNAMICS IN POLAND – CLUSTER ANALYSIS

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Abstract. Enterprise population processes are very similar to the processes observed in human population. The dynamics of enterprise population is conditioned by changes in basic processes: births, deaths and migrations. Similar techniques and models to those in demography can be applied in the evaluation of enterprise population dynamics. A methodological framework for business demography was set by Eurostat. The sum of birth and death rates shows the ability of enterprise market to adjust to changing economic conditions allowing to reallocate resources according to Schumpeter's creative destruction. This paper focuses on territorial differentiations in the processes of shaping enterprise population and their correlations with the economic development of the country. For this purpose the cluster analysis method was applied.

Key words: business demography, enterprise dynamics, Schumpeter's theory of enterprises, cluster analysis

BUSINESS DEMOGRAPHY – BACKGROUND

Business demography was used for the evaluation of enterprise population dynamics in Poland. The population of enterprises can be treated as a population that is influenced by typical processes such as births, deaths and migrations. All these processes can be analysed to assess their influence on the structure and dynamics of population.

The following quote of A. Noga gives us some insight into this new research discipline idea: "The analysis of this specific business 'demography' is a serious research method of the theory of economy which allows us to explain why some enterprises develop, other just exist staying 'alive' and other go bankrupt. Within the frame of this method different 'demographers' will assume different criteria according to which it can be said that an

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enterprise has already started or reached a specific size of activity, which influences processes in the meso and macro scale" [Noga 2009].

The analysis of business demography is usually presented in the following areas [Ptak-Chmielewska 2010a, 2010b]:

- number of births and birth rates,
- number of deaths and death rates,
- survival rates,
- influence on employment.

The classification used in comparisons is as follows:

- the size of a company measured by number of people employed,
- sector of enterprise's activity,
- geographical situation (UE, new members and candidate countries).

The dynamics of a given population is measured by the difference between its birth rate and death rate. Additionally, the flexibility of subpopulation adjustment to the changing market requirements is measured by "churn" rate. "Churn" rate is defined as the sum of birth rate and death rate. It is a measure of enterprise retention in the market.

The data for Poland are presented for years 1997–2009 and cluster analyses are done on voivodeship level. The analyses of births and deaths are based on data from REGON register and information on active enterprises published by CSO. Data cover only private enterprises without section J (financial activity, according to PKD 2004).

SCHUMPETER'S THEORY OF ENTERPRISES

Among popular economic theories, Schumpeter's theory of creative destruction is frequently cited in business demography [Schumpeter 1934]. The creation of new enterprises and closure of existing ones are key elements of the global dynamics of economy. The reallocation of assets from low productivity sectors (companies) to highly effective ones by creating new enterprises and elimination of ineffective enterprises is the main idea of this economic theory. Reallocation puts pressure on existing enterprises making them subject to increasing competitiveness in order to keep their position on the market. Weaker companies are eliminated and make room for new, more effective enterprises in the process of natural selection. This initiates the process of self-education of enterprises and shapes their life-cycle. "Churn" ratio, according to Schumpeter's theory, is a measure of turbulences on the market. This ratio is considered as the ability of the market to adopt the production structure to changing market requirements. In the case of highly competitive economies birth rate and death rate are rather high in the given period [Nunes and Sarmento 2010]. Economies with the majority of small and micro enterprises (as Poland) are characterized by a high level of "churn" ratio. The high level of this ratio in Poland indicates a high ability of enterprises to adapt to changing market conditions.

BASIC MEASURES OF BUSINESS DEMOGRAPHY

Birth rates and death rates are calculated as a proportion of entries and exits of enterprises during a reference year to the mean number of active enterprises in the reference

year (given in percent). The difference between these ratios gives the real dynamics of enterprise population in a given year. The sum of these ratios is a measure of enterprise retention in the market called "churn" ratio.

Birth rates and death rates are calculated according to the following formulae [Ptak-Chmielewska 2009]:

$$\text{birth rate}_t = \frac{\text{number of births}_t}{\text{mean number of active enterprises}_t} \cdot 100\% \quad (1)$$

$$\text{death rate}_t = \frac{\text{number of deaths}_t}{\text{mean number of active enterprises}_t} \cdot 100\% \quad (2)$$

The processes of births and deaths are presented for years 1997–2009 on the following figures (see Figure 1 and 2).

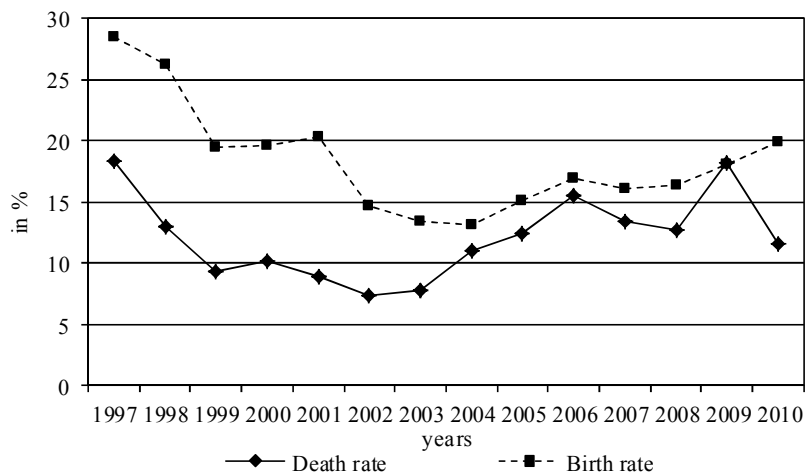


Fig. 1. Enterprise birth rates and death rates in Poland, 1997–2009
Rys. 1. Współczynnik „urodzeń" i współczynnik „zgonów" przedsiębiorstw w Polsce, 1997–2009
Source: CSO data in REGON register, CSO publications: Conditions of start-up... [2007, 2010b], Activity of non-financial enterprises… [2010a].
Źródło: Dane GUS z rejestru REGON, publikacje GUS: Warunki powstania i działanie... [2007, 2010b], Działalność przedsiębiorstw niefinansowych... [2010a].

The influence of economic conditions on entries and exits of enterprises from the market can be considered from the macro and micro perspective. Correlations between macroeconomic measures and business demography figures are presented in the following figure (see Figure 3). Some conclusions can be derived from correlations between factors determining an entry/exit of an enterprise from the market (and birth rates) and a macroeconomic situation on the market. For 19 EU countries a negative correlation was found (correlation ratio –0.44) between their birth rate and GDP as a measure of economic development. A positive but rather weak correlation was found between their unemploy-

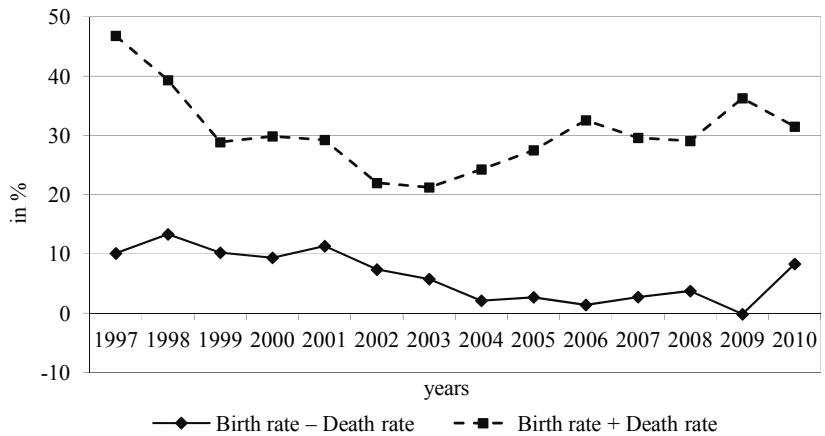


Fig. 2. Difference between and the sum of birth rates and death rates in Poland, 1997–2010
Rys. 2. Różnica oraz suma współczynnika „urodzeń" i „zgonów" w Polsce, 1997–2010
Source: CSO data in REGON register, CSO publications: Conditions of start-up... [2007, 2010b], Activity of non-financial enterprises… [2010a].
Źródło: Dane GUS z rejestru REGON, publikacje GUS: „Warunki powstania i działania... [2007, 2010b], Działalność przedsiębiorstw niefinansowych… [2010a].

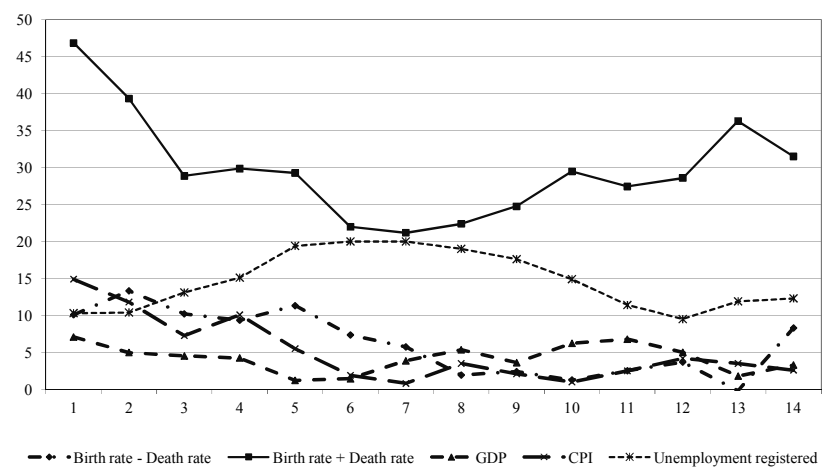


Fig. 3. Basic macroeconomic variables and business demography ratios, Poland 1997–2010
Rys. 3. Podstawowe zmienne makroekonomiczne i współczynniki demograficzne, Polska 1997–2010
Source: CSO data in REGON register, CSO publication: Conditions of start-up... [2007, 2010b], Activity of non-financial enterprises… [2010a].
Źródło: Dane GUS z rejestru REGON, publikacje GUS: Warunki powstania i działania... [2007, 2010b], Działalność przedsiębiorstw niefinansowych… [2010a].

ment rate and birth rate. In the event of high unemployment people are motivated to find a job by self-employment or start their own businesses. In such conditions what matters most is push factors. Both correlations are not supported by strong evidence to prove their significance. A Eurostat research report on 2004 denies the hypothesis assuming that high unemployment stimulates people to arrange self-employment. According to this report, high unemployment rate is only connected to weak economy. The report confirmed a correlation between the number of newly born enterprises and GDP. A high economic development level stimulates formation of new enterprises. There are also some opinions that there is a strong correlation between the enterprise population dynamics and the economic development in Poland [Szymański 2008]. A strong correlation was also confirmed in Ireland, Portugal and England but neglected in Belgium and no correlation was found in Italy and Austria. In Poland basing on the short time period 1997–2009 some correlations can be found between macroeconomic measures and demographic ratios (see Figure 3).

METHODS OF ANALYSIS

For the analysis of territorial differences in innovations of enterprises and a correlation with macroeconomic factors, cluster analysis methods were used (available in SAS).

A hierarchical cluster analysis with the average linkage method was used and confirmed by the *k*-means method. Segment profile was described by simple statistics:

- business demography variables: "churn" ratio (2003, 2008 – no data for 2009),
- macroeconomic variables: GDP per capita in PLN (2001, 2007), unemployment per 100 people in a working age group in % (2003, 2009), inflation CPI (2002, 2008).

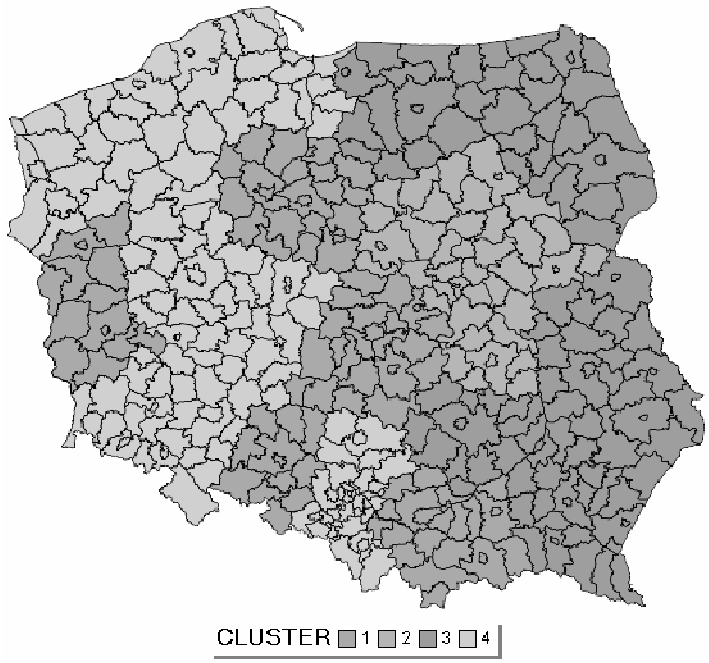
Coverage of analysis: voivodeship (16 administrative regions). Time: two selected periods 2002/2003 and 2008/2009.

SELECTED RESULTS

For the purpose of cluster analysis Poland (16 voivodeships) was divided into 4 clusters (see Figure 4 and 5). The results for the hierarchical method were very close to the results obtained by the *k*-means method.

The results for 2002/2003 model:

- "East-wall" region characterized by high "churn" ratio and very low GDP level, very high unemployment rate and low inflation. The dynamics (difference between birth rate and death rate) of enterprise population is the lowest in comparison to other regions (see Table 1 and 2).
- Central-west region, where "churn" ratio is at medium level, GDP at medium level and medium level of unemployment and inflation in comparison to other regions (see Table 1).
- Mazovia Voivodeship is a separate region (cluster) where "churn" ratio is the lowest but the dynamics of enterprise population is the highest (see Table 1 and 2). GDP for this region is the highest and unemployment is the lowest whereas inflation is also high.



CLUSTER 1: Łódzkie, Małopolskie, Lubuskie, Opolskie, Kujawsko-Pomorskie
CLUSTER 2: Mazovia
CLUSTER 3: Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie, Warmińsko-Mazurskie
CLUSTER 4: Śląskie, Wielkopolskie, Zachodniopomorskie, Dolnośląskie, Pomorskie

Fig. 4. Results of clustering, according to 2002/2003 model
Rys. 4. Wyniki analizy skupień, dla modelu 2002/2003
Source: Own calculations.
Źródło: Opracowanie własne.

Results for 2008/2009 model:

There are no significant changes between the classification into clusters between 2002/2003 model and 2008/2009 model. A small shift had place within the central-west region.

- "East-wall" region is characterized by high "churn" ratio, very low GDP, high unemployment and low inflation. The dynamics of enterprise population in this region is the lowest compared to other parts of the country. In comparison to 2002/2003 "churn" ratio significantly increased and the dynamics of enterprise population decreased.
- In central-west region "churn" ratio increased to the level comparable to the "east--wall". GDP in this region is at the medium level, unemployment is also at the medium level and inflation is comparable to the east wall.
- As mentioned in the previous model, Mazovia Voivodeship is the only region with the lowest "churn" ratio and the highest enterprise population dynamics. GDP for this region is the highest and unemployment remains at the level comparable to the central-west region, inflation is the lowest, which is a big difference when compared to 2002/2003.

CLUSTER 1: Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie, Warmińsko-Mazurskie
CLUSTER 2: Mazovia
CLUSTER 3: Łódzkie, Małopolskie, Lubuskie, Zachodniopomorskie, Opolskie, Kujawsko-Pomorskie
CLUSTER 4: Śląskie, Wielkopolskie, Dolnośląskie, Pomorskie

Fig. 5. Results of clustering, according to 2008/2009 model
Rys. 5. Wyniki analizy skupień, dla modelu 2008/2009
Source: Own calculations.
Źródło: Opracowanie własne.

Table 1. Mean (and standard deviation) for variables used in cluster analysis, 2002/2003
Tabela 1. Średnia (i odchylenie standardowe) dla zmiennych wykorzystanych w analizie skupień, 2002/2003

Cluster	„Churn" ratio in 2003	GDP per capita in 2001 (PLN)	Unemployed per 100 population in working age group in 2003	Inflation 2002
1	23.91 (3.87)	17,775.6 (854.21)	13.94 (2.66)	1.52 (0.19)
2	21.32 (.)	31,844.0 (.)	11.30 (.)	1.60 (.)
3	26.30 (4.93)	15,114.2 (652.38)	14.72 (2.96)	1.16 (0.35)
4	22.71 (1.60)	20,886.6 (845.80)	13.70 (2.71)	1.54 (0.17)

Source: Own calculations.
Źródło: Opracowanie własne.

Table 2. Basic demographic ratios for clusters, 2002/2003 model
Tabela 2. Podstawowe współczynniki demograficzne dla skupień, model 2002/2003

Cluster	Variable	Number	Mean	Std	Min.	Max
1	Birth rate	5	15.078	1.298	13.65	17.06
	Death rate		8.832	2.676	6.78	13.50
	Dynamics[a]		6.246	1.637	3.56	7.59
2	Birth rate	1	14.480		14.48	14.48
	Death rate		6.840		6.84	6.84
	Dynamics		7.640		7.64	7.64
3	Birth rate	5	15.850	1.293	14.53	17.70
	Death rate		10.452	3.868	5.92	16.29
	Dynamics		5.398	2.987	1.41	8.61
4	Birth rate	5	14.542	1.088	13.30	15.77
	Death rate		8.168	1.743	6.40	10.56
	Dynamics		6.374	2.427	2.74	9.01

[a]Difference between birth rate and death rate.
Source: Own calculations.
Źródło: Opracowanie własne.

Table 3. Mean (and standard deviation) for variables used in cluster analysis, 2008/2009 model
Tabela 3. Średnia (i odchylenie standardowe) dla zmiennych wykorzystanych w analizie skupień, 2008/2009

Cluster	„Churn" ratio in 2008	GDP per capita in 2007 (PLN)	Unemployed per 100 population in working age group in 2009	Inflation 2008
1	30.83 (3.87)	22,268.0 (1318.2)	9.88 (1.49)	4.32 (0.15)
2	26.77 (.)	49,415.0 (.)	6.70 (.)	3.90 (.)
3	34.44 (4.93)	27,049.2 (975.6)	8.30 (1.51)	4.27 (0.12)
4	30.52 (1.60)	32,247.5 (1345.7)	6.57 (0.95)	4.32 (0.49)

Source: Own calculations.
Źródło: Opracowanie własne.

CONCLUSIONS

Basic conclusions from the above presented statistics and cluster analysis are as follows:

1. Enterprise population dynamics is decreasing despite an increase in birth rate. Only for Mazovia Voivodeship the dynamics of enterprise population is at the same high level.

2. Increasing level of "churn" ratio indicates growing competitiveness in the Polish market. The ability of enterprises to adapt to the market is increasing. This is particularly visible in the eastern part of the country.

3. The division into the "east-wall", central-west region and Mazovia Voivodeship is clear, and there are no significant changes in clusters between 2002/2003 and 2008/2009.

4. Differences in basic macroeconomic measures like GDP, inflation and unemployment between the "east-wall" and central-west region has decreased with time.

Table 4. Basic demographic ratios for clusters, 2008/2009 model
Tabela 4. Podstawowe współczynniki demograficzne dla skupień, model 2008/2009

Cluster	Variable	Number	Mean	Std	Min.	Max
1	Birth rate	5	17.360	1.634	15.65	19.19
	Death rate		13.468	0.883	12.46	14.49
	Dynamics[a]		3.892	0.758	3.19	4.72
2	Birth rate	1	17.000		17.00	17.00
	Death rate		9.770		9.77	9.77
	Dynamics		7.230		7.23	7.23
3	Birth rate	6	17.827	2.147	15.11	20.69
	Death rate		16.610	6.593	11.49	29.75
	Dynamics		1.217	5.173	–9.06	4.56
4	Birth rate	4	17.440	2.712	14.00	20.20
	Death rate		13.085	0.810	12.07	14.04
	Dynamics		4.355	2.482	0.77	6.16

[a]Difference between birth rate and death rate.
Source: Own calculations.
Źródło: Opracowanie własne.

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PRZESTRZENNE ZRÓŻNICOWANIE DYNAMIKI POPULACJI PRZEDSIĘBIORSTW W POLSCE – ANALIZA SKUPIEŃ

Streszczenie. Techniki i metody analiz stosowane w demografii mogą również służyć do oceny dynamiki populacji przedsiębiorstw w Polsce. Dynamika populacji przedsiębiorstw jest uwarunkowana zmianami w podstawowych procesach: urodzeń, zgonów i migracji. Ramy metodologiczne do nowej dziedziny, jaką jest demografia przedsiębiorstw, zostały określone przez Eurostat. Suma współczynnika urodzeń i zgonów pokazuje, jak szybko rynek przedsiębiorstw reaguje na zmiany w gospodarce, pozwalając na realokację zasobów zgodnie z zasadą Schumpeterowskiej kreatywnej destrukcji. Artykuł pokazuje terytorialne zróżnicowanie (na poziomie województw) procesów zachodzących w populacji przedsiębiorstw i ich powiązanie ze zróżnicowaniem rozwoju gospodarczego kraju. Zastosowane zostały w tym celu techniki analizy skupień.

Słowa kluczowe: demografia przedsiębiorstw, dynamika przedsiębiorstw, teoria Schumpetera, analiza skupień

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INFLUENCE OF SPECIALIZATION ON ECONOMIC RESULTS OF PIG FARMS[1]

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Abstract. The aim of the research presented in the article was to determine an influence of specialisation on economic results of pig farms. The analysis included 80 pig farms with large-scale production located in eight voivodeships of the greatest concentration of these animals' rearing in Poland. In the economic and agricultural literature there are a number of specialisation's definitions, as well as different measurement methods and criteria are applied. This hinders comparability of the gained results. Specialisation is favourable to achieving advantages resulting from the growth in production scale. In the analysed farms, the higher level of specialisation was connected with the growth of land and labour productivity, as well as increased production profitability and return on equity. Only specialized farms of great production scale are able to cope with the growing competition on pig market.

Key words: specialisation, pig farms, productivity and profitability of farms

INTRODUCTION

Specialization of farms and an increase in the scale of production connected to this issue is one of the most significant factors of the agricultural sector development; especially, in the conditions of fragmented agricultural structure and low economic efficiency of individual farms. The current conditionings of Polish farming development created by the European Union membership and a resultant pressure of sustainability of Polish agriculture and rural areas have caused that the analyses concerning the influence of specialization and scale of production on efficiency of farms in Poland are assuming the nature of multidimensional analyses. These analyses not only consider economic results but also the above-mentioned processes' consequences for social and environmental balance in rural areas. Still, the producers choose to first improve economic efficiency. And

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only if there is a significant improvement in this scope, the environment variables get a chance to become more important.

In Poland, there are both many-sided and simplified, as well as specialized productions functioning. The former production type constituted a large part and it is approximately 63%, while in Hungary it does not exceed 30%, and in Germany it reaches only 17%. These numbers indicate that a higher level of the particular state's economic development is conducive to a process of specialization of farms [Józwiak and Juźwiak 2007]. A short range of specialization visible in Poland results from a limited scale of business entities' agricultural activity, amount of resources, capital barrier, low profitability of production, and lack of farming stability [Grzelak 2007].

Pig rearing is an important part of the agricultural economy of Poland. Pig livestock sales constituted 15% of agricultural market output and 27.5% of animal market output in 2009. Pork constituted 56.7% of the general meat consumption and the consumption of this particular type of meat was 42.7 kg per capita on average in Poland. According to Polish Central Statistical Office data, Poland ranks third place in EU-27 with regard to a number of headage (after Germany and Spain), and ninth place in the world. In 2008, Polish pork constituted 8.6% of EU-27 output and 1.9% of world output [GUS 2011].

The objective of the research was to determine the influence of specialization on productivity and profitability of pig farms. The research used empirical data concerning 80 farms of great scale of production. Within the process of analysis of the collected data, regression and correlation analyses were used. The research results were presented in a form of descriptive, graphic and tabular statistics.

RESEARCH METHODS

The research covered pig farms producing 1,000 and more porkers and/or maintaining 50 and more sows. These farms were located in eight voivodeships of the most considerable concentration of these animals' rearing in Poland (Opolskie, Wielkopolskie, Kujawsko-Pomorskie, Pomorskie, Warmińsko-Mazurskie, Łódzkie, Mazowieckie and Lubelskie). Data concerning these farms for 2006 was gained on the basis of a guided interview questionnaire.

The level of specialization was determined on the basis of share of pigs in the market output value. The ratio calculated in the above-mentioned way was in the range from 56.5 to 100% in the analyzed sample and that showed a domination of pig livestock production in the examined farms. The assessment of effectiveness of the farms was conducted on the basis of the selected profitability and productivity ratios (Table 1).

Productivity ratios enable to assess the use of resources of factors of production: land, labour, and capital. The changing economic conditions and growing competition on the market force business entities to rationally manage owned resources, and the assessment of their use is indispensable for getting to know the actual earned income and defining development possibilities of farms. The calculations also took profitability ratio under consideration, which made evaluation of borne costs' transformation into production value possible. In the literature, this ratio is used in order to evaluate economic efficiency of management [Ziętara and Olko-Bagieńska 1986]. Still, as Manteuffel indicates [1981],

Table 1. The indicators proposed for the observation
Tabela 1. Wskaźniki zaproponowane do obserwacji

Indicator	Shortcut	Mass unit	Formula
Land productivity	LP	PLN·ha^{-1}	value added/utilised agicultural area
Labour productivity	LBP	PLN·person^{-1}	value added/number of full-time employee
Productivity of fixed assets	PFA	PLN·PLN^{-1}	value added/value of fixed assets
Productivity of total cost	PTC	%	production value/total cost
Return on sales	RS	%	agricultural income/value of sales
Return on assets	ROA	%	agricultural income/total assets value
Return on equity	ROE	%	agricultural income/value of equity
Return on direct costs	RDC	%	direct surplus/direct costs

Source: Own elaboration.
Źródło: Opracowanie własne.

when calculating this ratio, one should bear in mind that the considered costs must be strictly connected to production, which profitability is being assessed. In this study, total costs were related to the value of gained production.

Profitability ratios give the basis for an assessment of individuals' ability to generate agricultural income and a quality of management. These are considered to be one of the most important factors in relation to evaluation of a farm by any party interested with its condition. Sales profitability corresponds with a trade dimension and assesses efficiency in executing the main tasks of enterprises. Return on assets enables to evaluate the use of business assets, while return on equity reflects financial efficiency; that is, in the dimension of profits gained by capital donors; in other words, owners. In order to assess effectiveness of current management of enterprise, a return on direct costs ratio was also used, which is the relation between a direct surplus and direct costs. This ratio shows effectiveness of the use of working capital in pig farms.

SPECIALIZATION IN THE THEORY OF AGRICULTURAL ECONOMICS

Farm specialization or production specialization consists in a clear focus on one, at most two production activities. This facilitates gathering information rationalising economic decisions. According to Manteuffel [1981], the smaller is a farm the bigger is the need for specialization.

Specialization is treated as a specific phenomenon of distinguishing and selecting certain fields, dividing labour, and gaining proficiency in the selected scope of activity. In the literature on the subject there are two approaches to the issue of production specialization. The first one implies that specialization consists in limiting or eliminating particular branches from the production, as well as increasing other branches, which are subjects of specialization [Jerzak 1974, Manteuffel 1981]. According to this approach, specialization is identified with defining a direction of production. The second approach shows the essence of specialization as a growth of production process from the particular production branches (products), also including a market output in a quantitative sense. What is more, proficiency in the selected activity is of greater importance here, and this is reflected in

higher productivity and quality of products. However, this approach does not consider a certain branch' share in the structure of production.

Still, in the economic literature, the specialists harmoniously agree on the fact that the growth of production is an essential condition and aim of specialization. Simultaneously, specialization is a path to growth of scale of production and, in this way, to benefits resulting from economies of scale [Runowski 1994]. However, specialization cannot solely mean quantitative changes. It must be also accompanied with qualitative changes.

Prandota divided specialization into natural and economic one [quoted by: Manteuffel 1981]. The first one results from natural conditions of farms. On the other hand, economic specialization is caused by especially competitive prices for the particular products when the basic goal is maximization of profit from a farm. Jerzak [1974] distinguished technical, production, and function specialization. The first one is an effect of development of technological progress thanks to which it is possible to replace labour with machine work. Production specialization concerns quality improvement and increase in quantity of products. This is the expression of horizontal concentration. And function specialization results from the particular nature of development of social labour division; therefore, it is determined by labour specialization or vertical concentration.

Manteuffel [1981] distinguished farm, section, branch, as well as so-called narrow specialization that is present inside one production activity; whereas, the last mentioned type is only encountered with animal output. It is found when a part of final output of farm is not an end product but one of technological groups in a closed cycle. According to the above-mentioned author, one can also consider extensive and intensive specialization; however, specialized farms should be only those, in which intensity exceeds certain minimum. Furthermore, the condition that a specialized production should be carried out by a specialist of certain field is justified. The issue of specialization became the subject of interest in Poland in approximately 1960. It was connected with an influence of Anglo-Saxon economic and agricultural literature and with international contacts of Polish farmers in the countries of Western Europe, where development of economy created favourable conditions for agricultural specialization. According to Runowski [1994], specialization of production, especially in family farms, is an indispensable process for their development and a source of increase in labour efficiency and earning capacity. This is confirmed by experience of highly developed countries.

The increase in number of specialized farms is promoted by a beneficial economic situation or, at least, stabilization of the particular agricultural markets. A factor that dynamizes specialization processes is a growth of agriculture integration with food industry; for instance, through contract award procedures, which limit transaction costs and risk borne by these farms in connection to specialist assets. What is more, producer groups, which influence specialization of the particular regions, as well as concentration of food processing industry adapted to the particular specialization, are also important for processes of specialization [Grzelak 2007].

Previously, the opinions suggesting that specialization is a consequence of economic development were prevailing. Currently, they seem to be more and more often questionable with regard to environmental and social threat concerning these processes. Since there is a situation where consumers and taxpayers bear costs of agricultural producers'

support, and simultaneously, because of intensive agricultural production, the environment is polluted [Floriańczyk 2003].

ADVANTAGES AND DISADVANTAGES OF FARM SPECIALIZATION

Specialization promotes rationalization of animal output. This process involves a number of advantages; still, it can be also connected with negative phenomena. As the result of specialization, the following processes take place [Runowski 1994]:

- Increase in scale of uniform production and improvement of its quality, which enables to gain higher sale prices,
- There is a possibility of effective use of modern production technologies, and therefore, decreasing labour input and costs per a unit of output,
- Specialization facilitates mastering of production process, and; as the result, there is a growth in animal unit efficiency.

Specialization leads to the improvement in using productive resources, and therefore, it causes achievement of better production effects, reduction of unit costs, and better economic effects. The research of Józwiak and Juźwiak [2007] showed that specialized farms in Poland function more effective than farms of many-sided production organization. After 2004 there have appeared favourable conditions defined by the Common Agricultural Policy of European Union. Therefore, one can expect a growth of share of this type of farms in population of Polish farms. According to Grzelak [2007], increasing the scope of specialization caused stronger involvement of farms in the market processes, growth of this involvement's formalization as the result of vertical and horizontal integration, and more frequent use of credits or specialist services. Simultaneously, these processes impose a capital-intensive type of agricultural intensification.

Specialization is connected to the growth of management risk that is related to price fluctuation; especially, on the pig market, as well as to increased possibility of diseases. This is visible in great fluctuations of farmers' income earned in the subsequent years in connection to the presence of the so-called pig cycles. Together with specialization of farms there is the increase in threat to natural environment. The animal output is often connected with creating great herds and that causes problems with removing and rational using of animal excrement. However, a considerable part of negative results of specialization can be eliminated through implementation of technical progress effects.

MEASUREMENT METHODS OF SPECIALIZATION

A level of specialization is defined in the economic literature in a number of ways. The most often it is determined on the basis of share in the structure of final output (or market output) of the branch or production activity, which considerably predominates over others. According Manteuffel [1981], specialization is found when a share of one section, one branch, or one production activity in the structure of final or market output is sufficient (e.g. 50, 65 or 75%).

The notion of specialization is similar to the notion of economic or production course. According to criteria established by Wojtaszek [1965] a specialized (single-course) farm is a farm in which one branch constitutes over 40% in the structure of final output, and others constitute less than 30%. Klepacki [1996] has got the same opinion and he, additionally, differentiates levels of farm specialization. According to this author, farms where one branch' share is more than 50% are defined by a higher level of specialization. And the highly specialized farms are those which have one branch' share of more than 66%. Fully-specialized farms are defined as those which have a clearly dominating branch and their other branches are marginal or existing only thanks to the dominating branch. Ziętara and Olko-Bagieńska [1986] implemented specialization ratio in order to assess a level of specialization, and that ratio considered a percentage share of the particular branch in the structure of final or market output, as well as an ordering number of branch in accordance with decreasing share. This shows a level of production concentration. On the other hand, Juszczyk [2005] offered specialization depth ratio which is calculated as a quotient of value of potentially market output of the main product, and a sum of value of potentially market output of the main product, products created through the main product' processing and products coupled in percentage terms. According to the author' opinion, this ratio can play more and more significant part; especially in farms of small area that have got relatively considerable and not entirely used, labour force resources.

In other European Union states, the measurement of farm' specialization is a share of standard gross margin (SGM) of the particular activity in the sum of standard margins from the whole farm. The farm is considered as specialized if this share is above 2/3. Higher share enables to distinguish specialization levels.

Therefore, the fact that specialization is a conventional notion and its criteria are changing in time is worth emphasising. Empirical research practically decides on quantity of share of one section, branch, or production activity in the value of final or market output in order to define the particular farm as a fully specialized farm.

CHARACTERIZATION OF THE ANALYZED FARMS

The analyzed farms were specialized in pig livestock production; still, they were different in a level of specialization. On the basis of share of pig livestock in the analyzed sample of entities, three groups were distinguished. The first group included farms of specialization ratio lower than 90%, the second one consisted of units which pig livestock share in market output was between 90 do 99.9%. While the third group included fully specialized farms of specialization ratio of 100%.

The farms of the first group were characterized by the most considerable agricultural area, which on average was 151.2 ha (Table 2). In the second group, the average utilised agricultural area was over twice smaller. And the fully specialized farms had got the smallest agricultural area – 40.1 ha. The similar diversity was found within the scope of labour input. In the first group the average yearly labour input was 12,491 h. On the farms of the second group the labour input was lesser by 1/4, while in the third group it was lesser by 1/3. On the farms of the lowest specialization ratio the value of fixed assets was the highest as it was PLN 1,496. In other two groups the value of these assets was

similar (approximately PLN 1,238). A different situation was observed in connection with a debt margin, which was quite low. The lowest foreign capital share in enterprise' assets characterized the farms of the first group. And in other groups the overall debt ratio was respectively 17.3% in the second group and 16.5% in the third group.

Table 2. Selected characteristics of the surveyed farms by level of specialization
Tabela 2. Wybrane cechy badanych gospodarstw według poziomu specjalizacji

Variable	The share of pigs in market production (%)			Total
	< 90.0	90.0–99.9	100.0	
Number of farms	25	27	28	80
Utilised agricultural areas (ha)	151.2	71.7	41.0	85.8
Labour input (h·year^{-1})	12,491	9,335	8,276	9,951
Value of fixed assets (PLN thous.)	1,496	1,238	1,237	1,318
Overall debt ratio (%)	12.6	17.3	16.5	15.6
Stocking density of pigs (LU·100 ha^{-1} UAA)	142.2	524.4	1641.4	797.0
Pig livestock production (ton·year^{-1})	145.8	196.3	219.2	189.0

Source: Own research.
Źródło: Badania własne.

In the analyzed sample of farms there were also differences in the scope of herd concentration and production scale of pig livestock. On the farms of the lowest specialization ratio; on average, there were 142 livestock units (LU) of pigs per 100 ha. In the second group, a stock of this kind of animals was greater by 382 LU. And on the fully specialized farms there were as much as 1,641 LU of pigs per 100 ha. Definitely less considerable differences were visible in the scope of the production scale. In the first group 145.8 tons of pig livestock were produced. On the farms of the second group the production was greater by approximately 50.5 tons, while in the third group pig livestock production was above 219.2 tons.

PRODUCTIVITY AND PROFITABILITY OF PIG FARMS

Productivity and profitability ratios in the analyzed sample of farms were of different levels. Their statistical description is presented in Table 3. The most considerable diversity was within the scope of land productivity. This resulted from the fact that pig rearing is less connected to the land in comparison with ruminants. A part of farmers using purchase fodder in pig livestock feeding, had small agricultural areas. The sample also included those farms, which based feeding doses for pigs on own fodder, which required a great agricultural area. What is more, the considerable differences were visible within the scope of labour productivity and fixed assets. This was connected with a level of mechanization of works and different systems of pig livestock production. The most of the farms used a closed rearing cycle as a dominating one; still, with regard to the advantages of deepened specialization, in 24 units there was an open rearing cycle used. The smallest differences were visible within the scope of return on assets, equity and sales since these were farms of great production scale which most often entered into

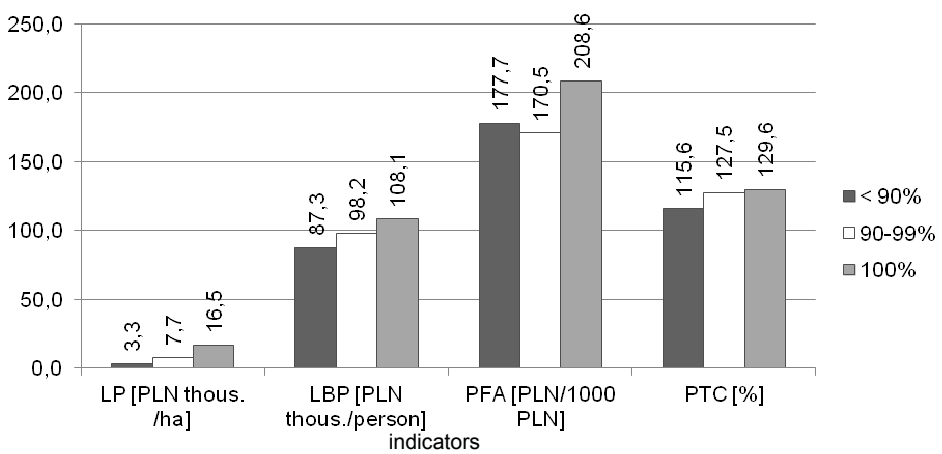
Table 3. The level of productivity and profitability ratios in the surveyed farms
Tabela 3. Poziom wskaźników produktywności i rentowności w badanych gospodarstwach

Indicator	Average	Minimum	Maximum	Standard deviation
Land productivity (PLN·ha^{-1} UAA)	9,396	1,277	126,852	17,260
Labour productivity (PLN thous./full-time employee)	98,253	25,334	288,732	51,708
Productivity of fixed assets (PLN·1,000 PLN^{-1})	186.1	73.98	490.0	91.9
Productivity of total costs (%)	124.5	85.74	184.4	21.0
Return on sales (%)	29.3	4.99	70.3	15.3
Return on assets (%)	12.2	2.80	34.1	7.4
Return on equity (%)	15.7	3.04	79.7	12.6
Return on direct costs (%)	82.5	24.55	171.5	29.7

Source: Own research.
Źródło: Badania własne.

agricultural procurement contracts with meat processing plants. Furthermore, these were characterized by low debt margin.

Depending on a level of specialization, a level of the particular productivity and profitability ratios was different. More considerable productivity of land characterized more specialized farms (Fig. 1). Admittedly, they did not have a higher level of agricultural income in relation to others; still, they had got smaller agricultural area. In the first group, from 1 ha of agricultural area there were 3.3 thousand of value added gained on average and in the third group it was 5 five times more.



Explanation of indicators as in Table 1.

Fig. 1. Selected indicators of productivity on farms of varying degrees of specialization
Rys. 1. Wybrane wskaźniki produktywności w gospodarstwach o różnym stopniu specjalizacji
Source: Own research.
Źródło: Badania własne.

Higher labour productivity was also visible on the farms of higher level of specialization. In the units of the less considerable share of pig livestock in the value of market output per a full-time employee it was PLN 87.3 thousand, and in the third group it was higher by PLN 20.8 thousand. Productivity of fixed assets was different, although the subsequent groups of farms were characterized with lesser value of these fixed assets. The highest productivity of fixed assets was in the third group, the lowest in the second group. Productivity of total costs, similarly to land and labour productivity, was higher in more specialized farms although in the subsequent groups of farms, greater and greater production costs were borne. In the first group, the average cost effectiveness of production was 15.6%, and in the subsequent two groups it was respectively 27.5 and 29.6% since more specialized farms took greater advantage of economies of scale.

On the level of statistical significance $\alpha = 0.05$, statistically significant relations were found between specialization level and land, labour, and total costs productivity. The higher level of farm specialization was connected with a greater value of these indexes. On the other hand, statistically significant relations were not found between a level of specialization and productivity ratio of fixed assets. Most probably, it resulted from the fact that these farms were highly specialized and well-equipped with fixed assets. The present relations were described with regression equations:

(1) $LP = -17{,}474.10 + 297.79 \times S$ $r = 0.249$ $p = 0.023$

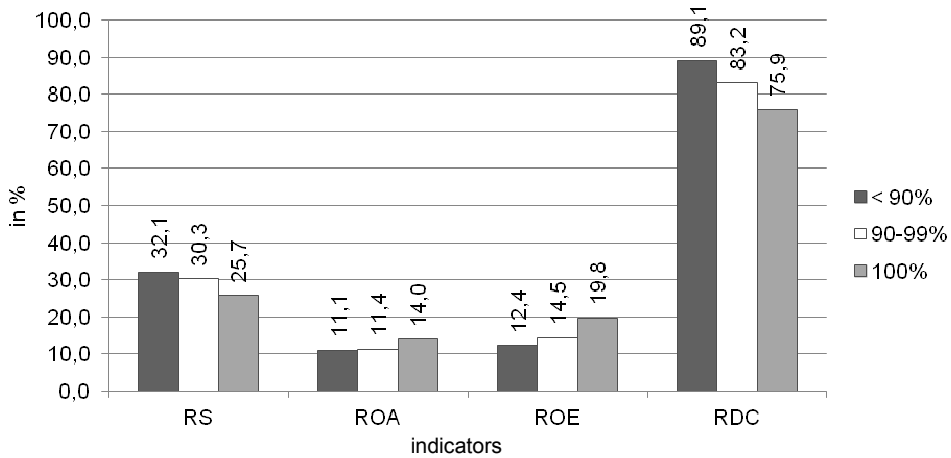
(2) $LBP = 28{,}921.95 + 768.38 \times S$ $r = 0.213$ $p = 0.056$

(3) $PFA = 153.11 + 0.37 \times S$ $r = 0.057$ $p = 0.612$

(4) $PTC = 74.10 + 0.56 \times S$ $r = 0.384$ $p = 0.000$

Within the scope of profitability ratios, different relations were found. Return on sales was lower in more specialized farms (Fig. 2). In the first group that was 32.1%, and in the third group that was 25.7%. This was connected to a smaller increase in agricultural income in relation to sales value *n* the subsequent groups. In the farms of the first group, an average sales value was PLN 814 thousand and in the third group that was higher by almost PLN 286 thousand. The similar relations were noticed within the scope of return on direct costs. The relation between direct surplus and direct costs was less considerable in more specialized farms. This resulted from a considerable difference in the level of borne costs between the particular groups. In the farms of the lowest specialization ratio, the direct costs were PLN 336 thousand on average and in the fully specialized farm units they were PLN 752 thousand.

Different relations were found within the scope of return on assets and equity. In the first two groups, return on assets ratio was approximately 11%, while in the third group it was 14%. This was connected with the higher value of assets in the more specialized farms. In the first group, the average assets value was PLN 2,193 thousand, in the second group it was higher by PLN 319 thousand, and in the third group it was over PLN 436 thousand. Even greater differences between the distinguished farm groups were found within the scope of return on equity. In the first group an average value of this ratio was 12.4%, and in the second group it was higher by 2.1 p.p. While in the fully specialized farms, return on equity was on average 19.8%. This kind of relations was connected with a higher level of debt margin of more specialized farms.



Explanation of indicators as in Table 1.
Fig. 2. Selected indicators of profitability on farms of varying degrees of specialization
Rys. 2. Wybrane wskaźniki rentowności w gospodarstwach o różnym stopniu specjalizacji
Source: Own research.
Źródło: Badania własne.

Within the scope of profitability ratios, on the level of statistical significance of $\alpha = 0.05$, the statistically significant relations were only found between the level of specialization and return on equity ratio. A correlation coefficient for these variables was 0.224.

(5) $RS = 32.56 - 0.04 \times S$ $r = -0.035$ $p = 0.761$

(6) $ROA = 3.62 + 0.09 \times S$ $r = 0.186$ $p = 0.099$

(7) $ROE = -1.99 + 0.19 \times S$ $r = 0.224$ $p = 0.045$

(8) $RDC = 99.51 - 0.189 \times S$ $r = -0.092$ $p = 0.419$

When assuming significance of $\alpha = 0.10$ a statistically significant relation was found also between the level of specialization and return on overall assets ratio. In case of other ratios, these relations were not found.

SUMMARY AND CONCLUSIONS

The study reviewed the literature concerning farms specialization and presented results of research on pig farms. On the basis of conducted analyses one can formulate several conclusions concerning the issue of specialization and results of this process in farms of great production scale.

1. In the economic and agricultural literature there are a number of definitions of specialization and there are different methods and criteria of its measurement. This hinders comparability of the gained results and objectivization of drawn conclusions. However, the researchers agree on the fact that a more considerable share of certain branch or activ-

ity in the production structure means a higher level of specialization and this process is economically justified.

2. In Poland there are both many-sided farms and farms fully specialized; among others, in pig livestock production. Still the share of the former is very considerable. This results from fragmented agricultural structure of the farms and great variability of the economic situation on the market of pig livestock. Simultaneously, farms of small production scale contribute to change in profitability of pig livestock production to a great extent.

3. Specialization is favourable to achieving advantages resulting from the increase in production scale. It also leads to improvement in taking advantage of productive resources. In the analyzed farms, the higher level of specialization was connected with the increase on land and labour productivity. More specialized farms also showed higher profitability of production and return on equity. These relations were statistically significant.

4. Only specialized farms of great production scale are able to cope with the growing competition on European and international market of pig livestock. Still, great concentration of herds leads to threat to natural environment and reducing welfare of animals. It can also trigger reducing economies of scale. Therefore, specialization should not be a goal in itself but rather it should be chosen on the basis of certain advantages that it can bring to a farm.

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WPŁYW SPECJALIZACJI NA WYNIKI EKONOMICZNE GOSPODARSTW TRZODOWYCH

Streszczenie. Celem badań przedstawionych w opracowaniu było określenie wpływu specjalizacji na wyniki ekonomiczne gospodarstw trzodowych. Analizą objęto 80 gospodarstw trzodowych o dużej skali produkcji, położonych w ośmiu województwach o największej koncentracji chowu tego gatunku zwierząt w Polsce. W literaturze ekonomiczno-rolniczej występuje szereg definicji specjalizacji i stosuje się różne sposoby oraz kryteria jej pomiaru. Utrudnia to porównywalność uzyskiwanych wyników. Specjalizacja sprzyja osiąganiu korzyści wynikających ze wzrostu skali produkcji. W badanych gospodarstwach wyższy stopień specjalizacji wiązał się ze wzrostem produktywności ziemi i pracy oraz większą opłacalnością produkcji i rentownością kapitału własnego. Jedynie gospodarstwa wyspecjalizowane o dużej skali produkcji mogą sprostać rosnącej konkurencji na rynku trzody chlewnej.

Słowa kluczowe: specjalizacja, gospodarstwa trzodowe, produktywność i rentowność gospodarstw rolnych

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DIVESTMENTS IN THE PROCESS OF DEVELOPING OFF-FARM ECONOMIC ACTIVITY BY FARMERS[1]

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Abstract. The purpose of this paper was to initiate discussion of the role of divestments in transformation of farms which diversify their activities towards off-farm economic activities. This paper is theoretical, supplemented with results of surveys conducted among farmers-entrepreneurs. Observations and studies of literature references indicate that in course of development by a farmer of off-farm economic activities, available farm resources are involved first. After a certain time, considering significant disproportionality in economic efficiency of resources involved in competing activities, and in view of difficulties in obtaining new resources from outside, a need arises for divestment within the farm. Typically, this leads to decreased significance or even marginalization or abandonment of the less profitable activity, which is typically the farming activity.

Key words: divestments, farm, economic activity

INTRODUCTION

In the concept of multifunctional rural development, actions improving the ability of farmers' families to earn additional income are strongly emphasized, which can be achieved, among other ways, through taking up jobs by persons simultaneously involved in agricultural activities, so-called pluriactivity [Wilkin 2009, Krakowiak-Bal 2010]. At the same time, both in subject-matter literature [Kaleta 2005, Klepacki 2005, Kropsz 2009] and in economic practice [Program… 2011], farm diversification is mentioned among the possible earning alternatives by farmers' families. Government documents strongly emphasize the need to diversify the activities of residents of rural areas towards off-farm activity. According to Błąd [2008], diversification should be treated as a nar-

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rower concept than pluractivity: "…most researchers agree that diversification applies to activities taken up on a farm or depending on the farm, based on land and capital resources. In this meaning, diversification can be perceived as a sub-group of the broader term pluriactivity, comprising all forms of generating incomes from non-agricultural activities, whether on or off-farm".

The key factor which determines whether a farmer's additional economic activity should be considered pluriactivity or farm diversification shall be the definition of the strength of relationship between the economic activities and farming activities. If non-agricultural economic activity carried out by landowner is functionally related to the agricultural activity (without agricultural activity, non-agricultural activity would be prevented or significantly hindered) or if there is a socio-cultural relationship between these activities (e.g. agritourism, handicrafts, crafts), then this would be a form of diversification of farm activities. On the other hand, if there is no functional relationship between the agricultural and non-agricultural activities, then it should be perceived as pluriactivity while the farm and the non-agricultural undertaking should be considered two separate entities, related by equity.

Commencement and conducting of economic activities requires involvement of labour and capital resources, often as well as land. Resources of households are a natural source of these inputs. It is common knowledge that commencement and carrying out of non-agricultural economic activities by a farmer is a good way to manage labour surplus on the farm. It also contributes to involvement of fixed assets for the purposes of non-agricultural activities, thus leading to increase and improvement of their utilization.

Increasing demand for capital during the process of business development, with limited options of obtaining funds from outside, also triggers the need for divestments, which are defined in subject-matter literature as: "…voluntary (scheduled) or enforced by a crisis (temporary) limitation of previous scope (profile) and scale of operations of an undertaking and discontinuation (withdrawal, liquidation) or disposal (mainly through sale) of certain activities" [Lovejoy 1971, Osbert-Pociecha 1998]. Funds gained from sales of the farm's assets and equity items and labour moved through reallocation can be used in newly formed or developed non-agricultural economic activities.

The primary objective of this paper was to initiate discussion of the role of divestments in transformation of farms which diversify their activities towards off-farm economic activities. Theoretical part was supplemented with available numerical data concerning scale and extent of non-agricultural economic activities carried out by families operating farms in Poland. In view of the lack of current data, the authors used data for individual farms which were engaged in agricultural activity in 2007 [GUS 2008]. To illustrate the impact of non-agricultural activities on the scale of agricultural activities, the authors used the results of a survey conducted among a group of 159 business operators from the following poviats: Dąbrowa, Kraków, Jasło, Ropczyce-Sędziszów, who were insured with the Farmers' Social Security Fund in 2011.

A FARM AS A POTENTIAL AREA FOR DIVESTMENT

Research by the Central Statistical Office showed that in 2007, 2,387.2 thousand of all the 2,575.1 thousand individual farms (92.7%) were engaged in agricultural activities

in the territory of Poland. The following tendencies continued to be observed [Frenkel 2009]:

- lowering number of individual farms,
- lowering number of farms engaged in agricultural activities,
- lowering number of smallest farms, up to 5 ha in size, with simultaneous growth of the number of larger farms, beyond 20 ha of cultivated area,
- lowering number of persons employed at farm,
- increasing number of persons combining work on farm and off-farm,
- increasing level of formal education of individual farm operators,
- increasing percentage of farms earning incomes from employment, non-agricultural economic activities, old age and disability pensions, and other non-work sources,
- decreasing percentage of households for which agricultural activity was the main source of income and of farms earning incomes mainly from non-work sources,
- increasing percentage of farms earning incomes mainly from employment and farms earning incomes mainly from non-agricultural economic activities.

Of all the farms engaged in economic activities in 2007, almost 114 thousand (ca. 4.8%) were simultaneously engaged in agricultural and non-agricultural activities[2]. The prevailing category comprised activities related functionally to the agricultural activity (Table 1). Of those farms which were simultaneously engaged in agricultural and non--agricultural activities, there was a significant group of farms using their own equipment in service activities (28.5%); moreover, a significant percentage of farms were engaged in agritourism and letting rooms (8.9%) as well as plant cultivation and breeding animals in aquatic environment (9.9%). The less frequent activities included: wood processing (5.9%), processing of agricultural produce (2.6%), crafts (1.8%), and production of renewable energy for the market. A very large group comprised activities classified as other (45.7%), but their functional relationships with the agricultural activity would usually be significantly lower. Activities consisting of energy production from renewable sources would mainly be carried out at the largest farms, while the popularity of economic activities consisting of wood processing was similar in all farm size classes. Interest in earning incomes from crafts would decrease in proportion to increase of farm size, which can be explained by lesser available labour resources with increased scale of the farm's agricultural production. In other types of studied non-agricultural economic activities, higher frequency of occurrence of non-agricultural activities was observed with increase of farm sizes. For operators of smaller farms, employment outside the farm would be a more typical way to seek extra income. Similar conclusions were reached by Paszkowski [2007] in his research, who also pointed out that farms exceeding 50 ha in size would more often combine their agricultural activity with off-farm economic activities. He also mentions that farms with scarce resources of land would more often abandon their agricultural activities and focus on non-agricultural activities only.

[2]To reach the full number of farms pursuing non-agricultural economic activities, the above specified value should be summed up with farms pursuing exclusively non-agricultural activities. In 2002, according to PSR , there were approximately 103 thousand farms engaged in non-agricultural activities only.

Table 1. The share of farms conducting non-agricultural economic activity in the number of farms pursuing agricultural activity depending on the scope of activity and farm area (2007)
Tabela 1. Udział gospodarstw prowadzących pozarolniczą działalność gospodarczą wśród gospodarstw prowadzących działalność rolniczą w zależności od zakresu działalności i powierzchni gospodarstwa (2007 rok)

Farms conducting economic activity in the field of:	Farm area groups in ha					
	0–1	1–5	5–10	10–20	20–50	> 50
	the share of farms pursuing activity different than agricultural					
– providing services using own equipment	0.8	1.4	1.6	1.7	2.0	4.1
– agritourism, room rent	0.3	0.4	0.4	0.5	0.8	1.3
– processing of agricultural products	0.0	0.1	0.2	0.2	0.3	1.0
– wood processing	0.3	0.3	0.3	0.3	0.2	0.4
– handicraft	0.1	0.1	0.1	0.1	0.1	0.0
– aquaculture[a]	0.3	0.3	0.5	1.0	1.8	2.6
– production of renewable energy for the market	0.0	0.0	0.0	0.0	0.0	0.1
– other[b]	2.0	2.4	2.1	1.9	2.1	3.9
Total	3.8	5.0	5.2	5.5	7.3	13.3

[a]Plant cultivation and animal breeding in water environment.
[b]Including fur animal husbandry.
Source: Author's own elaboration on the basis of: Charakterystyka…[GUS 2008].
Źródło: Opracowanie własne na podstawie: Charakterystyka… [GUS 2008].

Data of the Central Statistical Office indicates that the number of farmers deciding to take up non-agricultural economic activities was the highest in the following voivodeships: Małopolskie, Mazowieckie and Łódzkie [GUS... 2008]. This data is not entirely credible, considering the varying areas of these regions and varying number of farms operated in these regions. The highest percentage of farms pursuing non-agricultural activities was in voivodeships with relatively larger farm sizes, i.e. Zachodniopomorskie, Łódzkie and Warmińsko-Mazurskie. Farmers' proactive attitude in taking up non-agricultural economic activities, characteristics and scale of these activities are determined by multiple factors. Apart from location and farm area, other prevailing factors are: individual capabilities of the farmer's family members, their ability and readiness to take a risk [Basaj and Kotala 2009, Zając 2010].

DIVESTMENTS *VS.* NON-AGRICULTURAL ECONOMIC ACTIVITIES

Diversification of activity of an undertaking may take place on the basis of external or own resources. Large entities with highly valuable assets are more easily capable of obtaining an investment credit. Small farms typically seek the opportunity to finance new activities on the basis of their own funds or EU aids. The Rural Area Development Programme for 2007–2013 envisages an option to obtain funds directly for diversification of farm activities, under axis 3 measures: "Diversification towards non-agricultural activity. Formation and development of micro-enterprises. Nevertheless, involvement of own resources remains the issue of key importance. The need to make divestments would

occur very frequently: "Divestments in a farm shall mean scheduled and conscious limitation of agricultural production and/or involvement of a farmer's household resources in agricultural production activities, leading to release of certain land, labour and capital resources which can be used in other agricultural or non-agricultural activities, consequently leading to an increase of the farmer's and his family's income" [Wojewodzic 2010]. Increase of personal income[3] may be caused by increase of agricultural income, reduction of farm losses or reallocation of resources from less economically efficient activities to the more efficient ones, e.g. from agricultural to non-agricultural activity, or taking up off-farm employment in lieu of labour-consuming agricultural activity.

The following activities should be considered divestments in family-owned farms:

- with regard to production: extensification, limitation or abandonment of production, giving up of selected production activities,
- with regard to land management: renting, fallowing, exclusion from agricultural use in favour of development, afforestation, sale,
- with regard to capital management: change of utilization pattern of the farm's fixed assets (e.g. using them for purposes of non-agricultural economic activities or for family support), sale[4] or alienation of fixed assets,
- with regard to labour resources management; commencement of non-agricultural economic activities or taking up off-farm employment by persons working on farm [Wojewodzic 2010],
- with regard to organization: split of farm.

Decker and van der Valden [2006], within their resource-based approach, distinguish between two basic forms of disinvestment: repositioning and reconcentration. Repositioning involves a change of primary activity while reconcentration consists of abandonment of peripheral activities in favour of the primary activity.

Repositioning may occur through evolution or revolution. Evolution is typical of activities that are functionally related to the prior basic activity. New activities initially occur as supplementary activities. Only with market development, acquisition of new technologies will it become possible to pursue repositioning. A revolutionary change of primary activity would mainly occur in the event of shareholding changes in an undertaking. However, it may also occur as a consequence of bold decisions, adapting the undertaking's activities to changes in turbulent environment.

Similarly, reconcentration may occur slowly or rapidly but it will always ultimately lead to higher specialization of production. It may involve abandonment of production in supplementary activities with simultaneously retaining their potential in the corporate structure (in case of farming, this may be for instance fallowing of land), or division and splitting of secondary operations from the undertaking (sale, outsourcing).

A family-owned farm is an economic entity which combines the qualities of an undertaking and a household. A farmer's household and production farm jointly establish a family farm with a joint budget of the two component parts. A household offers inputs to the production undertaking and obtains incomes in exchange, i.e. remuneration for work,

[3]Personal income is the sum of incomes from a farm and incomes generated from off-farm activities.

[4]Referred to as disinvestments in related literature, e.g. Osbert-Pociecha [1998].

profit, and possibly landowners' pension. The process of creating a small non-agricultural undertaking on the basis of a farm can be divided into three major stages:

- initiation of non-agricultural economic activity,
- reallocation of the farm's resources to non-agricultural economic activities (repositioning),
- abandonment of the agricultural activity and development of non-agricultural activity (reconcentration).

In the first stage, new use is sought for available farm resources. Farm diversification towards non-agricultural activities, or commencement by a farmer of economic activities that are not functionally related to the farm will very soon exhaust the farm's available resources. Further development of non-agricultural activities requires engagement of extra resources, having their sources outside the farm (such as credit, employees) or inside the farm (e.g. divestments).

With restricted ability to obtain outside resources, the farmer is encouraged to reallocate, move his resources from these activities where they are less efficiently utilized to those where they would generate higher incomes. The flow direction is typically a movement of resources from agricultural to non-agricultural activities. Thus, divestments take place, consisting of gradually depriving the farm of its labour and capital resources. Farm production shrinkage with simultaneous growth of non-agricultural production leads to a change of primary activity, or repositioning.

The consequence of continuation of this process will be reconcentration – limitation of all activities only to the non-agricultural business. A family farm will be transformed into a household with an owner of land and a non-agricultural undertaking. Household resources will be used by non-agricultural business (undertaking) while farmland will be leased, rented, afforested, or left idle.

The dynamic process of development of a non-agricultural undertaking on the basis of a farm's resources could be considered a process of "creative destruction", through which existing activities are cannibalized by the new business initiative.

From the viewpoint of corporate theory [Osbert-Pociecha 1998], the described process of formation of a non-agricultural entity on the basis of a farmers' family resources should be considered an anticipating divestment, a part of restructuring of that business entity. Giving up one type of operations (farming) gives an opportunity for development of another type (off-farm activity). Divestments in the farm, which take place in this situation, constitute one of the elements of the process of its transformation into a non-agricultural establishment. In terms of agricultural economics, the farmer's business initiative should be perceived as formation of a new economic entity which is not a part of the existing farm. The farm has then the common owner with the newly formed undertaking, the undertaking uses the farm's input resources, and palliative divestments can be observed within the farm itself, often leading to its liquidation.

If farm land remains with the business operator as a consequence of the above described process, and the operator himself earns high profits from his business activities, he may return to agricultural activities in the future. However, it is highly probable that such activity will be pursued as a hobby or sentimental activity. Farming should be perceived among receding industries.

A survey carried out in 2011 among entrepreneurs insured by the Farmers' Social Security Fund showed that the scale of farming activity of persons engaged in non-agricultural economic activities is very small in the vast majority of cases. For over 40% of surveyed farms the population of livestock would not exceed 0.1 LSU while crop production was limited only to production for own purposes (Table 2). In the remaining group of farms, the most typical behaviour was stabilization of production on a very low level. The average number of animals in this group was 0.36 LSU per farm, and the area of 2/3 of all farms would not exceed 5 ha. It should be pointed out at the same time that the vast majority of farmers taking up non-agricultural economic activities were not engaged in agricultural activities at the time of taking up the former, while owning land only gave them access to the cheaper social security system for farmers.

Table 2. Structure of farms by changes in agricultural production
Tabela 2. Struktura gospodarstw według zmian w produkcji rolniczej

Year of commencement of non-agricultural activity by farmer	Number of farms in group	Without agricultural production in 2012	Changes in the respondent's farm production during the last 5 years		
			increase	stable	decrease
		percentage of farms			
2010–2012	17	52.9	5.9	41.2	0.0
2005–2009	39	35.9	10.3	41.0	12.8
2000–2004	50	52.0	6.0	36.0	6.0
1995–1999	30	36.7	3.3	43.3	16.7
Before 1995	23	26.1	17.4	43.5	13.0
Total	159	41.5	8.2	40.3	10.1

[a]Farms in which the number of animals does not exceed 0.1 LSU and crop production is generated for self-supply only.
Source: Own research.
Źródło: Badanie własne.

SUMMARY

In course of development by a farmer of off-farm economic activities, available farm resources are involved first. After a certain time, considering significant disproportionality in economic efficiency of resources involved in competing activities, and in view of difficulties in obtaining new resources from outside, a need arises for divestment within the farm. As a consequence of development of the more efficient activity, the less efficient operations are cannibalized, which are most commonly the agricultural activities. This process takes place in three phases. In the first phase, non-agricultural economic activity is initiated; the second phase is repositioning (replacement of primary activity from agricultural to non-agricultural); in the third phase, reconcentration occurs (abandonment of supplementary activities, including agricultural activity).

The process of repositioning a farm's production activity need not necessarily lead to ultimate discontinuation of agricultural activity. However, statistical data indicates that there is a vast number of farms engaged only in non-agricultural economic activities

(over 100 thousand). At the same time, commencement of non-agricultural business can be more and more frequently observed among land owners who have discontinued their agricultural activities and for whom a significant reason to show entrepreneurial behaviours is the preference social security system for farmers.

Both endo- and exogenous factors determine the character, extent and rate of divestment in a farm simultaneously pursuing non-agricultural activities. The impact of functional relations between the various activities, their profitability, economic potential of the farm, availability of investment resources, etc. on the rate and direction of change must be verified. To identify them and determine their strength, in-depth empirical research would be necessary.

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DYWESTYCJE W PROCESIE ROZWIJANIA POZAROLNICZEJ DZIAŁALNOŚCI GOSPODARCZEJ PRZEZ ROLNIKÓW

Streszczenie. Celem opracowania było zainicjowanie rozważań nad rolą dywestycji w transformacji gospodarstw rolniczych dywersyfikujących swoją działalność w kierunku pozarolniczej działalności gospodarczej. Opracowanie ma charakter teoretyczny uzupełniony wynikami badań ankietowych przeprowadzonych wśród rolników-przedsiębiorców. Przeprowadzone obserwacje i studia literatury wskazują, że w trakcie rozwijania pozarolniczej działalności gospodarczej przez rolnika w pierwszej kolejności angażowane są wolne zasoby gospodarstwa rolnego. Z czasem jednak, przy dużych dysproporcjach w efektywności ekonomicznej wykorzystywania zasobów zaangażowanych w konkurujących ze sobą działalnościach oraz wobec trudności w pozyskaniu nowych zasobów z zewnątrz, następuje potrzeba dokonania dywestycji w obrębie gospodarstwa. Zwykle prowadzi to do zmniejszenia znaczenia, a nawet marginalizacji lub zaniechania działalności mniej opłacalnej, a tą na ogół jest działalność rolnicza.

Słowa kluczowe: dywestycje, gospodarstwo rolne, działalność gospodarcza

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CONTENTS
SPIS TREŚCI