Articles

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PROBLEM OF CAPITALISATION OF SUBSIDIES IN AGRICULTURE

Abstract

The capitalisation of the subsidies is a process of depositing them in the rental rates, prices of farmland and values of farm's assets. For example, the capitalisation of direct payments is the part of rent increase due to the introduction of these payments. Generally, it is evaluated as a negative impact, which may be in conflict with the improvement of competitiveness of farms. The capitalisation of support is a major source of inefficiency of direct transfers to agriculture, particularly those designed to improve the income situation of farmers. Empirical studies differ as to the level of capitalisation, its mechanisms, dynamics and conditions. To sum up the foregoing and the results of previous studies, it is clear that the capitalisation of subsidies in agriculture is a fact. Its source, nature, intensity and consequences are conditioned in many ways.

Introduction

The authors of the paper aimed to confirm that capitalisation of subsidies is an actual issue which has not been sufficiently analysed in scientific studies so far. This phenomenon requires multifaceted characterisation, and evaluation of its impact on the national and the EU economy, as it is an important side effect of interventionism in agriculture. The authors reviewed the works of American and European researchers[1] and, at the end, illustrated the analysed phenomenon by an example based on the Polish market of agricultural land.

[1] At this point, it should be emphasised that so far an overwhelming number of research and analyses devoted to the issue has been done by American researchers (ca. 80%).

Capitalisation of subsidies is the process of their deposition in the rental rates, and in the value and prices of fixed assets, especially arable land. Since Polish farmers have started to benefit from the instruments of the Common Agricultural Policy of the European Union, the rental rates and agricultural land prices have been growing abruptly[2]. For example, capitalisation of support is this part of rent increase (increment) which results from the introduction of the payments. As assumed, direct payments were to improve and stabilise the income situation of the "professionally active farmers" (the so-called active farmers) while, in fact, they are largely channelled, as higher rent, to landowners, who are not active farmers as they leased their own land. Preferential treatment in purchase of, e.g., machinery, tractors and other fixed assets causes a rise in their prices and, consequently, results in taking over of subsidies by the agricultural surroundings. The literature terms the phenomenon as budget support outflow, which is yet another side effect of subsidising agriculture, but to cover the issue a completely new paper is needed.

Nonetheless, it should be pointed out that capitalisation of support, subsidies outflow and opportunistic behaviour of the very farmers in agricultural markets, and also liveliness of their investments (recently, for instance, among our fruit farmers) provoke a careful response to the arguments for retransfer of the value generated in agriculture by state intervention mechanisms (Czyżewski A. 2007; Czyżewski B. 2008).

Remuneration of factors of production

The term "factor of production" appeared in connection with attempts to explain how various incomes are generated in society and how they are distributed. *An Inquiry into the Nature and Causes of the Wealth of Nations*, by A. Smith (1723-1790), failed to present a clear view on the origin of wage, rent and profit. D. Ricardo (1772-1828), a follower of the A. Smith's theory, distinguished three basic social classes, each of which has its share in the global income: landowners receive their rents, workers – wages, and capitalists – profits. A change in the theory of value and the theory of distribution started in the 1870s in the subjective and marginalist trend in economics. The founder of the neoclassical school – A. Marshall (1842-1924), changed the focus of the value analysis from costs incurred in production to demand and consumption as value determinants. He based the very theory of income distribution on the concept of marginal productivity of the factors of production. An elaborate theory of distribution was developed by an American economist, J.B. Clark (1847-1938), in his work: *The Distribution of Wealth* published in 1899. He made a reference to the law of diminishing returns and broadly used the concept of marginal productivity. Land value depends mainly on the value of yielded crops. The theory of marginal productivity, by J.B. Clark, was a decisive

[2] It should be kept in mind that the prices of agricultural machinery and equipment, fodder, mineral fertilisers and plant protection products rose as well. It is clear that a significant share of aid funds for agriculture is taken over by its surroundings (suppliers and contractors).

step in determining the market valuation of the factors of production: land, labour and capital goods[3].

Land is the original and inexhaustible natural resource, and a vital factor of production in agriculture whose supply is fixed (rigid, highly inelastic). The price of such a factor is called rent or pure economic rent to determine income from land ownership. Economic rent is a special payment for using a resource or a factor of production exceeding its opportunity cost. Pure economic rent, on the other hand, is a payment for using a resource of production whose opportunity cost is zero. The supply curve of a factor of production with only one application is vertical, i.e. perfectly inelastic. The selling price of land, as opposed to the price of its use for a specified time, reflects the present value of its future economic rent. Upon selling their plots, landowners lose the income they received in the form of economic rent. Thus, they will require the land purchasers to pay an amount, which deposited in a bank, provides them with income of not less than the one received in the form of economic rent.

Theoretical bases for the analyses of capitalisation of economic rent, introduced by D. Ricardo in 1815, explained that the current price of agricultural land depends on the present value of rent and its future projected value. When assessing the effects of agricultural subsidies, other determinants of improving the economic situation of agricultural holdings must, obviously, be taken into account, namely: (1) economic climate in agriculture (profitability of agricultural production), and (2) increase in the efficiency of production and operation of agricultural holdings due to changes taking place in rural areas, growing scale of production and implementation of new technologies. It should be emphasised that both in the European Union and in Poland the number of agricultural holdings drops (on average by ca. 3% annually) because of land and production concentration. This phenomenon has a substantial impact on the market of agricultural land. Moreover, according to J.St. Zegar[4], the demand for food growing all over the world, which follows from an increase in global population figures and a change in eating habits, strongly dictates the demand for and prices of agricultural land. *Savills* analysts express similar opinions thus justifying its price increase all over the world (Table 1).

[3] It is a theory of remuneration for factors of production by their marginal productivity. It is based on the law of diminishing marginal returns assuming a perfect competition and a perfect mobility of factors of production. Land rent is here equivalent with the percentage obtained by a capitalist for commitment of capital to non-agricultural production.

[4] According to J.St. Zegar, over the next four decades (to 2050) demand for agricultural products is to double, taking into account the growth in the demand for food (by 70%) and biofuels (by 30%). The FAO analyses show that a growing demand for food is determined by three main factors: population growth by 2.1-2.3 billion people to 2050, income growth in developing countries and a change in diet to increase the share of animal products. Switching to meat diet yields even better results than population growth (J.St. Zegar, 2013). The OECD experts predict that by 2021 the global production of bioethanol and biodiesel will nearly double concentrating specifically in Brazil, the United States and the European Union (OECD-FAO 2012). Biofuels are produced mainly from agricultural products. These projections also influence the growth in the interest in agricultural land and thus determine its prices.

Table 1

Agricultural land price indices for respective world regions (2002-2010; 2002 = 100)

Region	2002	2003	2004	2005	2006	2007	2008	2009	2010
South America	100	164	208	250	305	428	512	545	599
Australia	100	182	261	286	265	329	419	400	364
North America	100	108	126	144	154	171	187	182	195
Central and Eastern Europe	100	131	218	283	337	471	600	738	758
Western Europe	100	125	150	220	297	323	332	255	235
Global average	**100**	**136**	**181**	**241**	**288**	**357**	**431**	**471**	**511**

Source: www.savills.pl of 10.09.2014.

According to the aforementioned data of the British consulting company, agricultural land prices in Poland went up by 380% in 2002-2010. As follows from Table 1, the growth in agricultural land prices is, indeed, a global trend and the average for the world at that time was 400%.

Overview of former research on capitalisation

In his papers, J.E. Floyd (1965), argued that support in the form of subsidies affects prices of the factors of production and this impact is highly dependent on: elasticity of their supply, i.e. level of mobility in the economy; technology of agricultural production (i.e. in particular, the possibility of replacing a scarce factor of production with other, cheaper one); and a programme to control entering/leaving the sector (legal restrictions). Then, the Floyd's model was referred to by: B.L. Gardner (1983); T.W. Hertel (1989, 1991); H.D. Leathers (1992); J. Dewbre (2001, 2002); OECD (2002, 2008); H. Guyomard (2004).

The OECD analyses show that changes in the amount of economic rent usually do not change the offered quantity of a good across the economy. But its level determines the allocation of land between different types of use. In the long run, changes in resource prices result in resource substitution and supply changes. The former, involves replacing a more expensive resource with another, cheaper one. The latter, consists in a change in demand for factors, which is caused by a change in production volume resulting from a change in its costs. It should be also noted that technological progress also affects demand for the factors of production. The elasticity of land supply and the elasticity of substitution of the factors of production are key determinants of land prices and rental rates. The method of policy implementation is the third determinant of capitalisation (in accordance with the 2008 OECD Policy Evaluation Model). Hence, it can be concluded that capitalisation of subsidies in the value of assets is a side effect of interventionism in agriculture, with a broader multichannel impact on the economy. Analyses on capitalisation of support were and still are varied, both in place and time. The following may be listed as representative ones:

- S.H. Lence, A.K. Mishra (2003) – USA in 1996-2000;
- M. Patton, P. Kostov, S. McErlean, J. Moss (2008) – Ireland before 2005;
- S. Kilian, J. Anton, K. Salhofer, N. Roder (2008) – Bavaria, 2005;
- G. Breustedt, H. Habermann (2011) – Germany, before 2004;
- P. Ciaian, D. Kancs (2012) – EU-12 (SAPS), after 2004;
- L. Latruffe, Ch. Le Mouël, L. Piet, P. Dupraz (2013) – France, 2008;
- K. van Herck, L. Vranken (2013) – EU-12 (SAPS), after 2004.

Most of these studies found that there was a correlation between the SPS payment model (regional, historical and hybrid) and the amount of rent and land price. Furthermore, decoupled support (decoupling) proved to be more capitalised in land prices (according to the 2008 OECD PEM model) than coupled support.

In many EU Member States (Luxembourg, Slovakia, Germany, the United Kingdom, France, the Netherlands, and Italy), large part of land is cultivated by lessees, rather than owners. In line with the OECD estimates, owners of agricultural land may receive up to 90% of area payments due to higher rents (Table 2) and a growth in price per hectare of land. Yet, producers of means of production for agriculture and landowners receive most of the support to the prices of agricultural products through organisation of their markets. This phenomenon is referred to as the outflow of agricultural subsidies to the agricultural surroundings.

Table 2

Impact of subsidies on rental rates in the light of the literature review (based on the American agricultural land market)

Authors	Support type	Capitalisation rate (%)
S.H. Lence, A.K. Mishra (2003)	coupled support	71-90
B.K. Goodwin, A.K. Mishra, F. Ortalo-Magné (2005)	coupled support	29
B. Kirwan (2009)	decoupled support	25
B. Kirwan, M.J. Roberts (2010)	decoupled support	14-24
B.K. Goodwin, T. Serra, A.M. Featherstone (2011)	decoupled support	32-164
N.P. Hendricks, J.P. Janzen, K.C. Dhuyvetter (2012)	decoupled support	20-57
J.D. Kropp, J.G. Peckham (2012)	decoupled support	32

Source: P. Ciaian, J. Swinnen, D. Kancs: The impact of the 2013 CAP reform on land capitalization. CEPS, Brussels 2014.

Capitalisation of the SAPS subsidies in the European Union countries, joining the Community in 2004, accounted for 19% of rental rate as calculated by P. Ciaian and D. Kancs (2012), and 15-32% of its value as per the estimates of K. van Herck and L. Vranken (2013). As regards the SPS[5], applied in the EU-15 and in Malta and Slovenia, these subsidies accounted for 6-10% of the

[5] There are different types of SPS: historical, regional, and hybrid static and dynamic.

rent (J. Michalek, P. Ciaian and D. Kancs, 2013). The pace of the process of capitalisation of payments in the rent depends on the length of terms for which lease contracts are concluded. The longer the terms the greater the inertia of rental rates.

Studies carried out by K. van Herck and L. Vranken (2013), based on the EU-12 data, confirmed that:

– up to EUR 25 cents for every EUR of direct payments was capitalised in rent (see Figures 1-2);
– an increase in land prices due to subsidies reduced the impact of subsidies on agricultural income (and income stabilisation is the basic aim of area subsidies);
– an increase in rents had a direct negative impact on the transfer of land and an indirect – also negative – impact on the restructuring of farms and structural changes in the agricultural sector.

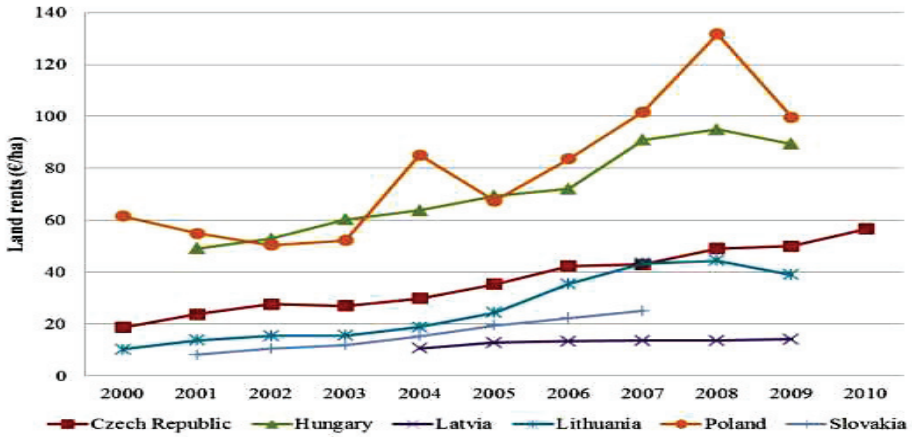


Fig. 1. Changes in land rent in selected countries (EUR/ha)

Source: K. van Herck, J. Swinnen, L. Vranken: Direct payments and land rents evidence from new Member States. Factor Markets, no. 62, August 2013.

The R line in Figure 3 presents, in a simplified manner, the Ricardian land rent, for different soil valuation classes from the baseline model which referred to the Cobb-Douglas production function. The land rent was marked on the vertical axis, and the land resources of specified quality (A) – the horizontal axis. The baseline model R is understood as the land rent dependent only on the soil valuation class (excluding subsidies). The available quantity (supply) of land (A^{max}) is marked on the horizontal axis and its quality deteriorates from left to right. The R line may be also perceived as demand curve illustrating the readiness to pay the rent for land of a specified quality in a given year. In case of area payments, the rent (Ricardian land rent) increases by the same amount for all

acreages, regardless of their quality. The R function (line) was moved up, parallel to the $R^{area/regional\ payments}$ level. For price support policy, which favours better quality lands of higher productivity, the case is opposite. The correlations in the historical model are expected to be similar as for the price support.

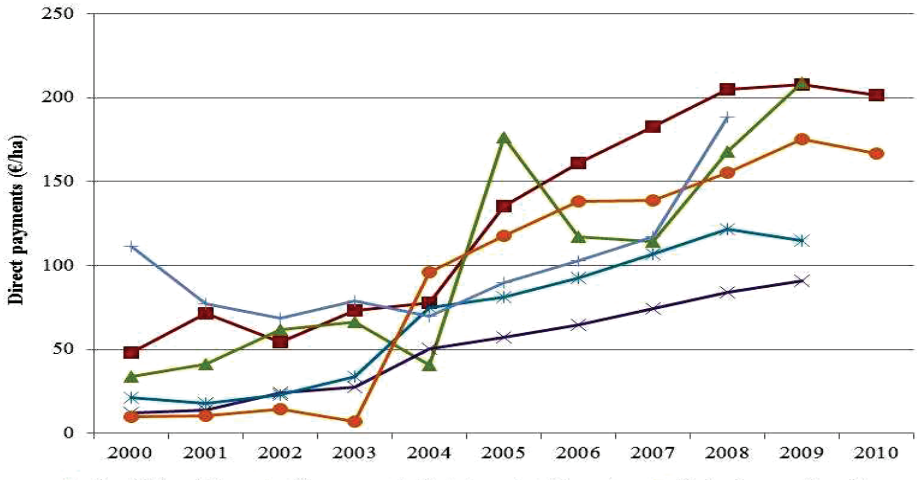


Fig. 2. Changes in direct payments in selected countries (EUR/ha)

Source: as for Fig. 1.

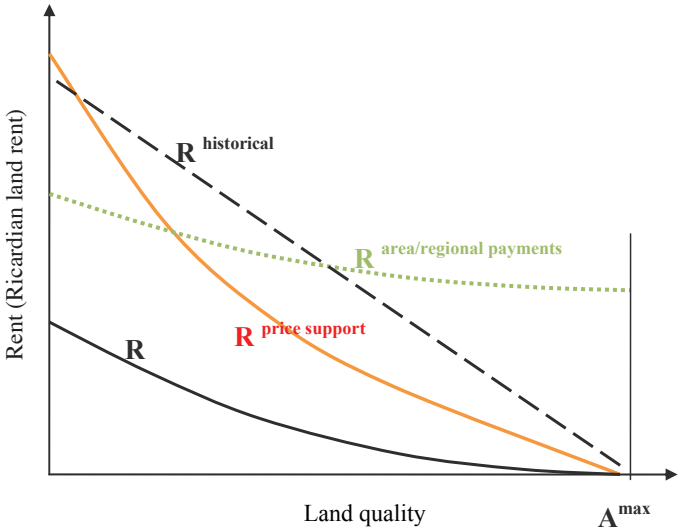


Fig. 3. Rent by different support policies

Source: J. Swinnen, L. Knops: Land, labour and capital markets in European Agriculture. CEPS, Brussels, 2013.

B.K. Goodwin and F.N. Ortalo-Magne (1992), analysing the effect of public support on agricultural land prices, concluded its positive impact – in case of wheat producers – on agricultural land prices in different regions of the United States, Canada and France in 1979-1989. Also, the research of J. Cavailhès and S. Degoud (1995), basing on the NPV (Net Present Value) method, showed capitalisation of support from CAP after the 1992 reform in the agricultural land prices in France. Research on the issue was held by other teams of researchers as well (J. Dewbre, J. Antón, W. Thompson, F. Courleux, H. Guyomard, F. Levert, L. Piet, S. Kilian, N. Röder, K. Salhofer, B.E. Kirwan). Different CAP subsidies contribute, in varying degrees, to the rise in agricultural land prices because of their variable objectives and functions, and because of how they implement and execute the assumptions of aid schemes. These are the conclusions from the research of the teams in a nutshell.

On the basis of conducted research, L. Latruffe and Ch. Le Mouël (2009) stated that in France, in 2003-2007, the impact of different forms of public support on agricultural land prices differed (starting from a weak positive impact of direct payments to neutral – no impact, in case of payments for rural areas, including environmental and LFA payments). The researchers especially highlighted the effect of the governmental support on the agricultural land prices, simultaneously, taking into account the land use planning law and regional policies (e.g. certain entities are not allowed to own land, regulated prices, etc.). The regulations governing the land market and land use planning in France are among the toughest in Europe. L. Latruffe and Ch. Le Mouël demonstrated a positive impact of subsidies on the agricultural land prices broken down by zones under the provisions of the nitrate directive. All variables were analysed at the level of NUTS 3 regions in 1994-2011. Six types of subsides were recognised as significant and likely to have a multichannel impact on the operation of agricultural holdings (coupled payments, premiums for land set-aside, decoupled area payments, LFA payments, agri-environmental payments and overall payments). As for regional estimates, the findings were somewhat surprising in the opinion of the researchers. Payments to land set-aside and coupled direct payments to crops and animals had a significant impact on capitalisation of land prices. But from another perspective, in NUTS 2 region only decoupled payments (single farm payment – SFP) and agri-environmental payments to free grazing of livestock (extensive grazing livestock – EGL) proved to have a significant impact on capitalisation of land prices. In another NUTS 3 region, in turn, only EGL deposited in higher land prices. In this case in was a positive impact, in others – negative. As follows from the discussed research, the scale of capitalisation depends on several factors. One of the more important ones was the region of the farm's location. Another factor differentiating between the effects of support capitalisation was the type of subsidy (as mentioned before, the authors isolated 6 variables to capture them). Consequently, the research produced contrasting, omnidirectional and inconsistent findings on the impact of aid instruments and subsequent CAP reforms. As highlighted

by L. Latruffe and Ch. Le Mouël, state's intervention may influence the transfer of lands for a given user, which follows from land use planning and that, in turn, may be contrary to another objective of the government, namely support to farmers' income. In the aforementioned paper, it turned out that regulations on land use planning and the nitrate directive may increase the degree of capitalisation of subsidies in the agricultural land prices thus implying a potential outflow of support from subsidies to non-agricultural entities, and difficulties as regards inheritance of farms in France.

During presentations and discussions at the symposium entitled *Productivity and its Impacts on Global Trade*, held in 2013 in Spain, Latruffe, Piet, Dupraz and Le Mouël delivered an interesting paper: *The influence of agricultural support on sale prices of French farmland: A comparison of different subsidies, accounting for the role of environmental and land regulations* which continued the aforementioned research. Therein the researchers defined the determinants of agricultural land prices in some French regions in 1994-2011, with the use of individual data on the purchase-sale transactions, and putting special emphasis on agricultural subsidies. It turned out that it is possible to identify a positive, but relatively minor, effect of capitalisation of all subsidies in land prices. It should be emphasised that the effects of capitalisation were clearly different by regions. Only subsidies to land set-aside strongly affected plot prices, while individual payments had a vital positive impact on the capitalisation effect only in the case of plots situated in some zones. J. Karlsson and P. Nilsson (2014) reached similar conclusions for Sweden.

Figure 4 presents variables determining the value of land that were considered in the aforementioned research of most of the researchers. These variables were then used in the meta-regression analysis which was to facilitate an answer to the question on the degree of support capitalisation. Meta-regression was used for the purpose, for instance, by: C.H. Barnard, G. Whittaker, D. Westenbarger, M. Ahearn (1997); A. Weersink, S. Clark, C.G. Turvey, R. Sarker (1999); J.G. Carlberg (2002); S. Devadoss, V. Manchu (2007); L. Latruffe, T. Doucha, Ch. Le Mouël, T. Medonos, V. Voltr (2008); J. Weerahewa, K.D. Meilke, R.J. Vyn, Z. Haq (2008) and S. Kilian (2010).

Area subsidies lead to higher capitalisation rate in the value of agricultural lands than other types of subsidies. G. Breustedt and H. Habermann (2011) estimated the marginal capitalisation rate for area payments at 0.38 in German region of Lower Saxony. Research on capitalisation of other (than area) subsidies resulted in setting the capitalisation rate also in the range of 0.2-1.0. This was illustrated in Figure 5 (for SAPS) where the horizontal axis depicts land supply, and the vertical axis – rent and subsidies.

Initial demand for land was determined by L line. Supply of land is represented by line S. Payments under SAPS cause an upward movement in demand for land from L to L_s. Equilibrium depends on elasticity of land supply. Apart from a relative elasticity of land supply and demand, the SAPS capitalisation rate depends also on a number of other factors.

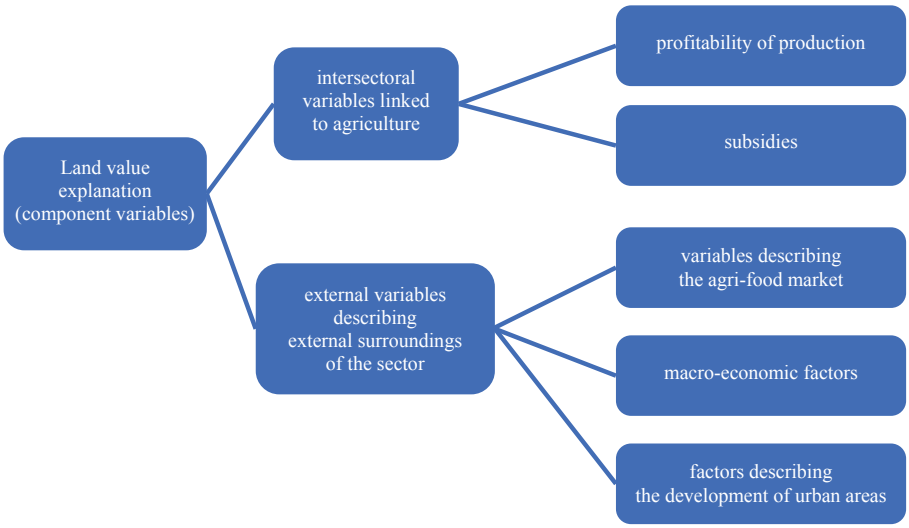


Fig. 4. General formulation of variables applied to empirical research concerning the agricultural land market

Source: as in Figure 3.

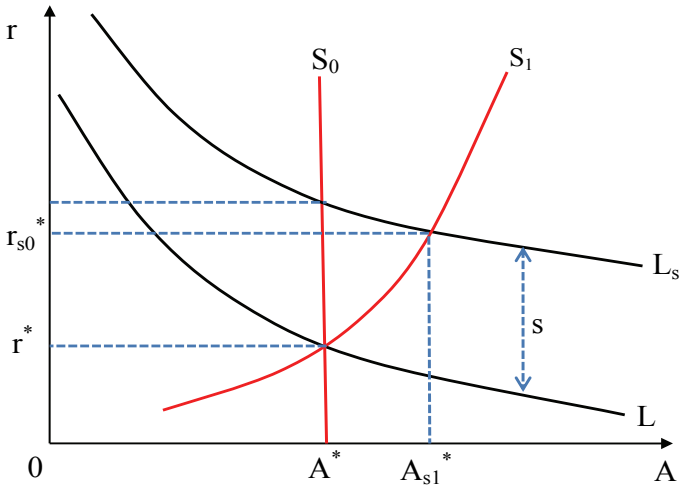


Fig. 5. SAPS vs agricultural land market

Source: P. Ciaian, d'Artis Kancs, J. Pokrivčák: Empirical Evidence of the Distributional Effects of the CAP in the New EU Member States. Factor Markets Working Paper no. 58/August 2013.

J.M. Alston, B.E. Kirwan, P. Ciaian, D. Kancs and J. Michalek (2011) demonstrated that the share of subsidies, which were capitalised in the land value,

depends, *inter alia*, on details of CAP implementation, expectations concerning changes in the future CAP programmes[6], market failures, and formal and informal land governing organisations and institutions. In some new Member States the agricultural sector is dominated by large-size farms (e.g. the Czech Republic and Slovakia, where such farms cultivate more than 70% of agricultural lands). The prevalence of corporate farms may enable them to use their market power to influence the land market and set the level of prices of rent.

Research on the Polish land market was carried out by E. Laskowska (2011). It aimed at identifying the specificity of agricultural land market and characterising the key determinants of investment decision-making process in the market. The research findings showed a lower level of return rate – as measured by the quotient of annual income from rents to the land price – in the agricultural land market than in other segments of property market (Table 3).

In this case the capitalisation rate was understood as the rate of return. In the light of the above-findings, it was not satisfactory (rent increments were not relevant to the increase in land prices). Lease in Poland is still relatively inexpensive. It is confirmed also by the research of A.M. Sikorska (2013).

Table 3

Investment capitalisation rate in the agricultural land market in Poland in 2005-2010 (as a ratio of average annual rent to the price per 1 ha of agricultural land)

Specification	Annual values (%):					
	2005	2006	2007	2008	2009	2010
Capitalisation rate (private trade)	3.01	3.27	3.03	2.95	2.50	2,41
Capitalisation rate (state-owned land)	2.49	2.43	4.85	3.53	1.87	3,02

Source: E. Laskowska: Inwestycje na rynku gruntów rolnych w Polsce. Roczniki Nauk Rolniczych, series G, vol. 98, issue 3, 2011.

Despite this, demand for agricultural land and upward trend in their prices have continued recently, which has not been noted in the markets of other types of property. It proves the existence of other factors influencing investment decision-making in the market, apart from income from property lease. The factors include benefits from agricultural land value appreciation in the long term. Prosperity in the market may result in especially high rate of return in a short-term perspective, but such actions may be considered speculations. Moreover, in case of agricultural property market there are additional specific reasons which, on the one hand, stimulate demand and, on the other, limit supply. These may include, e.g., benefits following from the EU subsidies and other forms of agriculture support, entitlements to insurance in Agricultural Social Insurance Fund [*Polish: Kasa Rolniczego Ubezpieczenia Społecznego, KRUS*], extension of the area of agricultural holdings to rise the productivity of agricultural production or others, for instance, recreational use of agricultural property of special natural and/or landscape values.

[6] Capturing the expectations regarding the future CAP budget in modelling the present capitalisation of support caused considerable difficulties to researchers.

Present rent vs future payments

Expected future rents are the key component of land value today (definition by D. Ricardo still applies). Agricultural land prices may be adequately approximated by the sum of the discounted future rates of rent. The NPV (Net Present Value) method is helpful in explaining about 40% of land price value. Based on the NPV approach, the following calculation formula is used:

$$L_t = \sum_{i=0}^{\infty} \frac{E(R_{t+i})}{(1+r_{t+1})(1+r_{t+2})...(1+r_{t+i})} .$$

This equation may be shortened as follows:

$$L_t = \frac{1}{1+r} \sum_{i=0}^{\infty} \frac{E(R_{t+i})}{(1+r)^i}$$

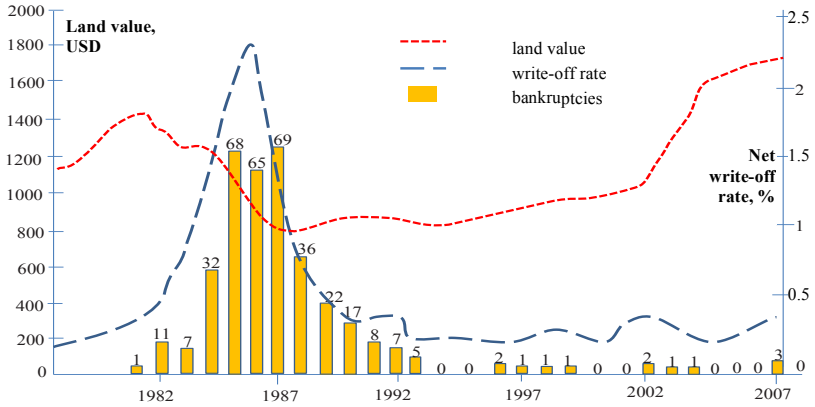
or:

$$L_t = \frac{R^*}{r}$$

where:
Lt – equation for asset prices over time *t*,
E(Rt+1) – expected value of future net returns (profitability) from land,
*R** – real net returns from agricultural land,
r – discount rate.

However, estimating the value of rent based on the above-formulae involves some risk. It is linked to uncertainty of the future discount rates and thus their potential abrupt changes due to new economic crises. Such a case, briefed below, was described by French researchers.

The aforementioned review of research on the US agriculture, by L. Latruffe and Ch. Le Mouël (2009), allowed to conclude that direct payments cause higher capitalisation effect, in an increase of agricultural land values, than subsidies to production and prices of agricultural products. Capitalised direct payments were calculated by dividing their annual amounts, paid for a reference area in a given region, by the value of the discount rate, which determines the time value of money. As a result, it was found that the possibility of using direct support determines the value of a hectare of land in 12-40%. The reduction or elimination of direct payments may significantly decrease agricultural land prices thus causing a rapid fall in the value of fixed assets and the creditworthiness of farmers. This could even be described as a speculative bubble burst in the market. Figure 6 shows a situation where a drop in land prices was followed, with some delay (about 5 years), by an increase in the number of bank failures (yellow bars).



Explanation:

$$\textit{Net write-off rate} = \frac{\textit{annual loan write-offs} - \textit{recovered loan losses}}{\textit{total loans before write-offs}}$$

Normally, the rate is 0.5-1%.

Fig. 6. Real land values (prices as of 2000), net write-off rate and agricultural bank failures in the US in 1977-2008

Source: own elaboration based on: C.B. Briggeman, A.M. Gunnderson, A.B. Gloy: The Financial Health of Agricultural Lenders. American Journal of Agricultural Economics, vol. 91, no. 5, 2009.

Due to the drop in land prices and thus the fall in the value of fixed assets, banks faced problems associated with non-performing loans. This, in turn, affected the entire US economy, including the state budget. The given situation is comparable to the problem of subprime[7] loans from 2008.

Capitalisation vs sustainability of agriculture

The concept of a hedonic pricing model, which is based on the premise that heterogeneous goods can be represented as the aggregate of their features (characteristics), is another way to estimate rental rates. More technically, hedonic models take the form of econometric models (usually, single-equation models nonlinear in their variables), in which price is the dependent variable, and product characteristics – believed to have a significant impact on product price – are the explanatory (independent) variables. Therefore, the price of a heterogeneous good is the sum of the valuations of its individual characteristics described by the explanatory variables and the factors reflected in a random component[8].

[7] Mortgage loans in the US with the lowest rating.

[8] F. Waugh, who examined the impact of the size, shape, colour and ripeness of vegetables on their prices in 1928-1929, and A. Court, author of a work published in 1939 about the dependence of the car prices on such features as engine type, car weight and glazed area, are considered as pioneers of the hedonic analysis of prices of goods (Berndt, 1991). Whereas, dynamic development of the theory of price indices and econometric theory of hedonic models is reflected in the rich empirical literature. Malpezzi presents an overview of the application of hedonic models and the newest directions of their development (2002).

Environmental values affect agricultural land prices, as confirmed by research held by J.R. Wasson, D.M. McLeod, Ch.T. Bastian, B.S. Rashford (2013), on the example of the state of Wyoming, and basing on the following hedonic model:

$$y_i = \sum_{k=1}^{K} \beta_k^{ag} X_{k,i}^{ag} + \sum_{j=1}^{J} \beta_j^{amenity} X_{j,i}^{amenity} + U_i$$

where:
yi – price of the plot concerned i,
β_k^{ag}, K – parameters related to production variables for the entire sector (national statistics),
$X_{k,i}^{ag}$, J – parameters characterising production variables for the plot concerned i,
amenity – facilities,
other symbols relate to amenities (special properties) at the plot concerned i.

Remote agricultural areas in Wyoming, which include wildlife habitats, picturesque views and angling opportunities, have higher prices per hectare than those whose landscape is dominated by agricultural production. Geographic Information System (GIS) data are used to measure recreational advantages and amenities associated with scenic views of rural areas (Tables 4 and 5). Proximity to forests, parks, lakes, rivers, hills and clean air not polluted by industry, are the variables contained in different classes of attributes of a given plot for the purposes of its valuation (using a hedonic model). The sampled land prices are explained by the level of both environmental advantages and productive attributes. "Recreational" variables (scenic view, angling opportunities and distance to urban areas) proved to be statistically significant. This analysis allows to better estimate the environmental amenities when determining the price of a plot. Wyoming can be considered as a state of large and very diverse rural areas, where the agricultural land market can be accurately analysed. It is a typically agricultural state engaged in animal fodder production and holding a considerable share of sugar beet cultivation in crop structure. Agricultural land values are dependent on such features as: productivity, distance to markets and amenities, such as irrigation, infrastructure, etc.

Table 4

Disadvantages due to a lack of environmental amenities – dollar/acre (hedonic model)

Region	Land cover	Location	Wildlife
West	–58.06	–43.77	–28.92
Central	–38.09	–56.90	–13.06
East	–20.80	–114.58	–4.84
Country	–38.09	–71.75	–15.16

Source: J.R. Wasson, D.M. McLeod, Ch.T. Bastian, B.S. Rashford: The effects of environmental amenities on agricultural land values. Land Economic, 89(3), August 2013.

Table 5

Share of selected amenities in the total estimated land value

Region	Environmental amenities (%)
West	56.20
Central	8.20
East	5.57
Country	30.94

Source: as in Table 4.

The conducted research revealed that environmental amenities accounted for 5-60% of plot value.

Agricultural land price in Poland at the backdrop of Europe

In Europe there are, in general, great disparities as it comes to the agricultural land prices. Definitely the highest prices are recorded in the Netherlands, the lowest – in former republics of the Soviet Union and Slovakia (Zadura A. 2010, 2013). After 22 years of price growths, Poland is in the middle of the European rankings. Figure 7 presents the 2011 land prices for Europe.

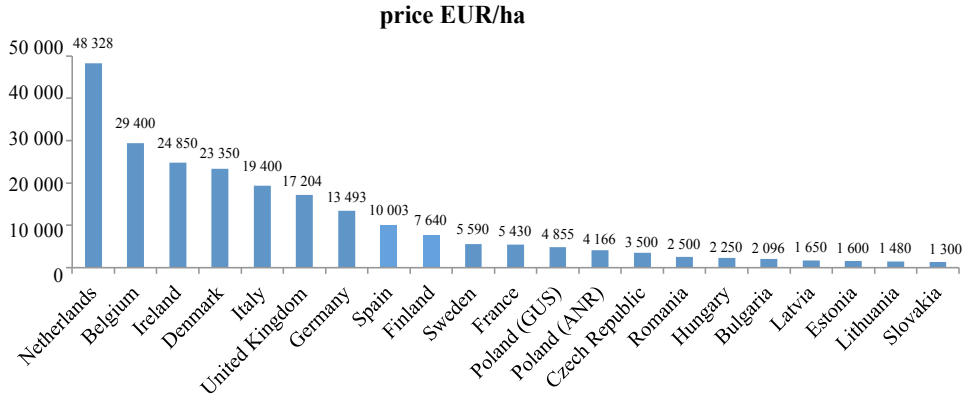


Fig. 7. Agricultural land prices in Europe in 2011

Source: Ziemia rolna – czy warto w nią inwestować?, http://independenttrader.pl.

Poland may expect further acceleration of the pace of price growth, due to abrogation of the last administrative barriers faced by foreigners from the Community area purchasing agricultural land (in 2016). Thus, the Agricultural Property Agency [*Agencja Nieruchomości Rolnych, ANR*][9] sold nearly 148 thousand hectares of state-owned agricultural lands in 2013. It is almost 20% more

[9] The resources of the Agency include 1.6 million ha of lands, out of which over 1.25 million ha under lease. The greatest areas of land for sale are in the following voivodeships: Zachodniopomorskie, Wielkopolskie, Dolnośląskie and Warmińsko-Mazurskie.

than provided in the last-year's plans and, at the same time, the best sales result since 2003. In 2013, farmers had the best ever conditions to purchase state-owned lands. They could purchase them on preferential conditions, repaying instalments at 2% interest per year. In 2013, the State aid was used by over 4 600 people who purchased under preferential conditions as much as 88 thousand hectares. As evident, the Agency limited the lease of state-owned lands by favouring their sales. Moreover, fees for land use have been increasing gradually (Figures 8 and 9).

Agricultural land in Poland goes up *de facto* from the beginning of political changes. In the 1990s, because of market downturn in agriculture, nobody was interested in its purchase (agricultural production profitability is one of the determinants of land prices). In 1992, ca. PLN 500 was paid per 1 hectare. But in 1992 the prices have started to grow. Since Poland's accession to the EU, in 2004, the prices have grown abruptly. In the last year, 2014, the agricultural land prices have increased by 28.3%. The average price of land sold by the Agency in the 1st quarter of 2014 amounted to PLN 24 166 per ha and was by PLN 5 331 higher than in the 1st quarter of 2013. Figure 8 presents the average land prices sold by the Agency and the amount of rent for newly concluded contracts (by the Agency).

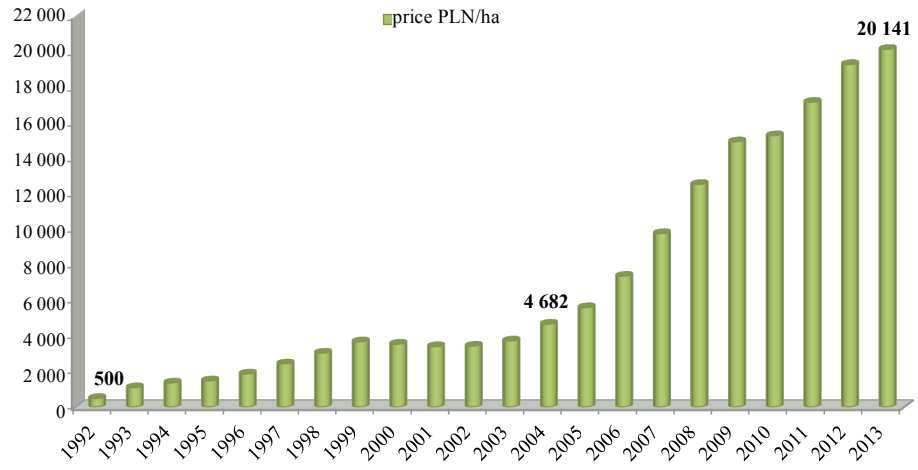


Fig. 8. Average sale prices for agricultural land obtained by the Agency
Source: www.anr.gov.pl.

This faster privatisation of land is dictated by the provisions of the Act on management of agricultural property of the State Treasury, which are in force as of December 2011. Thus, the Agency extends lease contracts and leases land only to a limited degree. At present, lease contracts are concluded for no more than 6 years, and in some cases, e.g. when the lessee plans to take part in the EU programmes – up to 10 years.

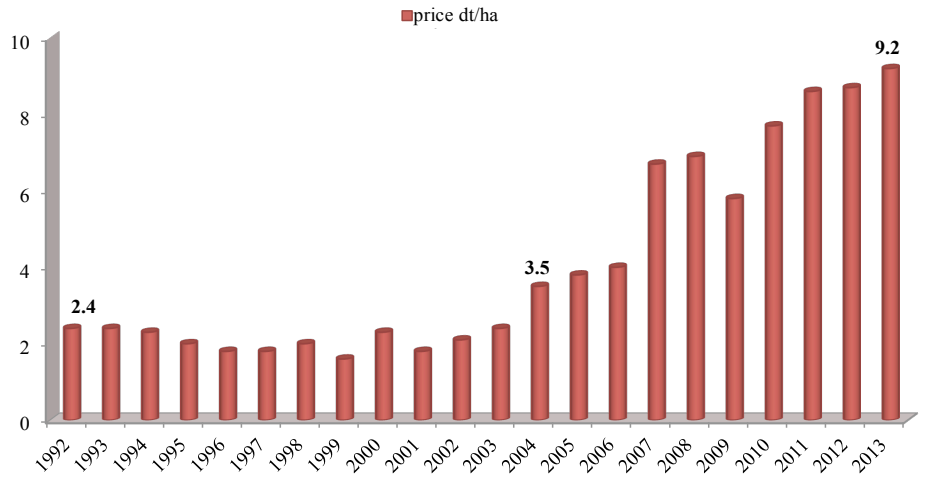


Fig. 9. Average rent obtained by the Agency expressed in dt of wheat
Source: as for Figure 8.

It should be, however, mentioned that the ANR prices are by an average of 15-20% lower than the average transaction prices in the market (in private trade). This is linked to preferential buy-out of land by its former lessees. According to the Agency's data, the smallest plots (1-2 ha) are the most expensive ones, which probably results from the area limit required to be covered by KRUS and with their relatively easy "deagriculturalisation". The prices of lands of more than 200 ha are way above the average, which points to a significant share of large investors in the market.

Figure 10 presents the rates of area subsidies which significantly determined the above-analysed land prices and rents. Because of the too short time series (2004-2014) the authors did not conduct further statistical research of the issue.

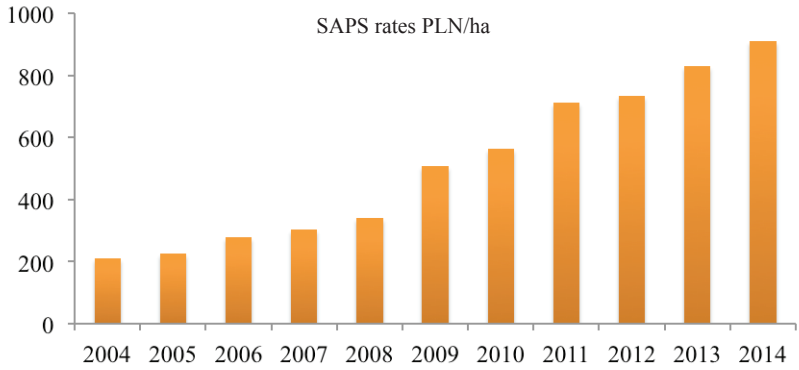


Fig. 10. Rate of Single Area Payment Scheme (SAPS) in Poland
Source: www.arimr.gov.pl.

At present, a very strong correlation (0.92) between the rates of rent and the level of SAPS was found at the initial stage of the research. From own research, it follows that an increase in SAPS by PLN 1 caused rent increase by 0.013 dt of wheat per hectare (assuming *ceteris paribus*) in case of contracts newly concluded by the ANR. Over time and as the time series extend, further research will be carried out on the issue.

Conclusions

Capitalisation of direct payments and other subsidies is the process of their deposition in rental rates, and in the value and prices of fixed assets, especially arable land. In general, it is assessed as a negative phenomenon which may be in conflict with the improvement of competitiveness that assumes, e.g., an increase in the financial potential of farms. Capitalisation of support in the prices of assets is the main source of inefficiency of direct transfers to agriculture, especially those that are to improve the income situation of farmers.

The empirical research held to date differs, however, as regards the level of capitalisation, its mechanisms, dynamics and conditions. Moreover, not many analyses refer to the SAPS as the determinant of capitalisation. Summing up the findings of former research, it should be stated that capitalisation of subsidies in agriculture is a fact. Its sources, character, intensity and consequences are conditioned in many ways.

The phenomenon of capitalisation of direct payments has varied intensity depending on the applied support model. The highest degree of capitalisation is typical of the EU regional model. It is the result of failure to differentiate between the unit value of entitlements to payments at the regional level. Thereby, one knows beforehand what stream of revenue in the form of payment can be generated by a land area unit situated in a given region. Decoupled support is also characterised by a higher degree of capitalisation. The higher the capitalisation, the lower the efficiency of direct payments as an instrument supporting the income of agricultural land users.

Former research on the channels of subsidy impact on the operation of an agricultural holding dealt with seeking for individual relations. So far none of the papers addressed the effects of many channels simultaneously. There are several reasons for this. Firstly, the channels of impact may interact in opposite directions and addressing them together requires taking into consideration that these relationships may be mutually exclusive. Furthermore, analysing annual data and estimating panel models may give different conclusions. Sometimes, capitalisation of support is visible only after aggregation of indices characterising regions. It should be stressed that subsidies influence the market of factors of agricultural production but they must also be analysed in the context of changes in the value of agricultural assets.

The model of sustainability and multifunctionality of agriculture, based mainly on subsidies, may strengthen the existing logic and consequences of their capitalisation. With no methodological progress in internalisation of externalities and allo-

cation of public goods produced in agriculture, and with no integrated and sustainable instruments of agri-environmental policy and its allocative and redistributive objectives, no change in correlation between subsidies and their capitalisation in land values and tangible fixed assets, and in the rental rates, should be expected.

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