Wieś i Rolnictwo 3 (176)/2017
ISSN 0137-1673
doi: 10.7366/wir032017/03

Bazyli Czyżewski,
Agnieszka Poczta-Wajda

Effects of Policy and Market on Relative Income Deprivation of Agricultural Labour*

Abstract: Average incomes in the agricultural sector are still much lower than average wages in non-agricultural sectors in the most of the EU Member States, which is contrary to one of the CAP's initial objectives of "ensuring a fair standard of living for the agricultural community". The main aim of this paper is to verify whether EU membership and the use of CAP funds helped reduce relative income gap of farmers. The second aim is to analyse which factors influence this income gap and how. Our study is based on EAA data for EU-27 for the period 1995–2015 and makes use of three panel data regression models estimated for all EU Member States, the "old" ones (EU-15) and the "new" ones (EU-12). Our results show that the social goals of the CAP support have not been achieved in the EU-15; however, they have been achieved under the SAPS in the EU-12.

Keywords: agricultural labour factor, relative income gap, real productivity change, price scissors, Cochrane's treadmill theorem.

1. Introduction

Among the main objectives of the CAP as set out in Article 39 of the Treaty of Rome one can find "ensuring the optimum use of the factors of production, in particular labour" and "ensuring a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture" (Treaty… 1957). The achievement of these objectives should have led

Bazyli Czyżewski, PhD (dr hab.), Associate Professor, Poznań University of Economics and Business, Department of Education and Personnel Development, Al. Niepodległości 10, 61-875 Poznań, b.czyzewski@ue.poznan.pl; **Agnieszka Poczta-Wajda**, PhD, Associate Professor, Poznań University of Economics and Business, Department of Macroeconomics and Agricultural Economic, Al. Niepodległości 10, 61-875 Poznań, agnieszka.poczta@ue.poznan.pl.

* This article was written under a project funded by the National Science Centre in Poland based on a decision OPUS 6 UMO-2013/11/B/HS4/00572.

to narrowing the gap between agricultural and non-agricultural incomes.[1] However, average incomes received by farmers in the EU Member States are still usually lower than those outside the agricultural sector, which leads to the feeling of social injustice among farmers. Feeling relatively deprived, farmers take well-organized actions to convince policymakers to support them, which may to a certain extent explain a high level of agricultural support in the EU. Consequently, lower levels of relative deprivation among farmers should reduce their political pressure and permit the lowering of financial support under the CAP – at least the part of support which aims at increasing farmers' incomes.

On the other hand, one cannot ignore the role of market forces in shaping the level of agricultural incomes. We consider "the market forces" as a combination of the impact of prices and productivity changes. Since the CAP is becoming more and more decoupled, with a decreasing share of product-linked subsidies, the influence of prices on agricultural incomes is gaining on importance. With regard to productivity, there are, however, two counteracting forces which drive the income gap in agriculture. Although a productivity rise in agriculture ought to reduce the relative deprivation of farmers, it does not translate into proportional income growth as suggested by Cochrane's treadmill theorem.[2]

Thus, our research objective is to verify if membership in the EU and the use of CAP funds helped increase the income of the labour factor in agriculture and, which is even more important, to reduce the relative income deprivation of farmers. The second question is what are the main factors influencing this income gap – is it just the social/income support effect of the CAP, or do productivity growth and market prices play also significant role? To study the relation between relative income gap and policy and market factors we make use of Eurostat Economic Accounts for Agriculture data from 27 EU Member States (EU-27) for the period 1995–2015 and estimate three panel data regression models for EU-27, EU-15 and EU-12.

The structure of the paper is as follows: in Section 2 we provide a short theoretical framework; Section 3 gives information on data and methods used for the analysis. Section 4 presents the results, which are followed by conclusions in Section 5.

[1] There are also other CAP objectives, such as "ensuring reasonable prices for consumers", which might to some extent be in conflict with "income" objectives.

[2] For an explanation of the Cochrane's treadmill theorem, see Theoretical Framework in this paper.

2. Theoretical Framework

Fulfilling one of the main objectives of the CAP, which is "ensuring a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture" means not only a need to increase agricultural incomes, but also a need to decrease the difference between incomes in the agricultural sector and in non-agricultural sectors. Although the general economic situation of farmers in the EU has been improving,[3] the average entrepreneurial income in agriculture per non-salaried annual work unit equals only 40% of average wage in the total economy per full-time equivalent[4] (European Commission 2015). Decreasing the income gap is even more important for "ensuring a fair standard of living" than increasing incomes, because people tend to compare their incomes and economic situation not only over time, but also spatially (i.e. with people working in non-agricultural sectors). Seeing that most of those who work outside agriculture earn more, farmers have a feeling of social injustice. This phenomenon is called relative deprivation, and is used in social theories to explain why people join social movements or advocate social change.

Relative deprivation is a concept of social sciences, referring to the subjective perception of harm arising from comparing one's situation to the situation of others. The concept of relative deprivation was first described soundly by the American sociologist J. Davis (1959), but W. Runciman (1966) played the most important role in disseminating the concept. The key assumption of this concept is that people judge their achievements by comparing them with the achievements of other people in their environment (i.e. with a reference group); however, the reference group may vary depending on the aspect of life. Collective response to relative deprivation manifests in participation in group actions (e.g. rallies and lobbying), whose aim is to redistribute rent (economic and political) in society and to change the group's position (Grant et al. 2015). This concept has found numerous applications primarily in sociology and psychology. In economics, it is mainly used in research on differences in life quality (Chen, Ravallion 2013; Jayanta, Dipti 2013) and in analyses of population migration (Hyll, Schneider 2014; Stark, Fan 2011). In agricultural economics, the relative deprivation concept is used relatively rarely, and relates mainly to the problem of uneven distribution of production factors (Bhandari 2004; Fałkowski 2013).

[3] Which partly results from the non-farm activities of farmers.

[4] This is, however, very diversified among the Member States, and in Belgium, Spain, the UK, the Czech Republic and Bulgaria it happened from time to time that agricultural incomes were higher (Baer-Nawrocka 2015).

In this paper, we consider relative deprivation of farmers as income deprivation, and more precisely as a gap between the average income from agricultural activity and average wage in non-agricultural sectors expressed in relative terms.[5] Farmers' feeling of relative deprivation has an underestimated influence on the shape of agricultural policy in Europe,[6] and that is why it is crucial to recognize the factors which affect it. Although the literature on agricultural incomes in the EU Member States is quite broad (Hill, Bradley 2015; Zawalińska, Majewski, Wąs 2016), to the best of our knowledge the link between relative farmers' income gap and factors influencing this phenomenon is not so well documented.[7] We contribute to this literature by documenting the relative income deprivation of farmers in EU-27 and by investigating the factors affecting the income gap.

Among the factors with potential influence on the relative income gap between agriculture and non-agricultural sectors we distinguish technical productivity (output in constant prices excluding subsidies related to the intermediate consumption in constant prices), the price scissors in agriculture (which potentially reflect falling real returns on farm products, and rising farm costs) and agricultural policy.[8] The influence of productivity on incomes in agriculture is debatable. Some fifty years ago, Cochrane (1958) presented the view that farmers are on a "treadmill" which, in spite of their constant efforts to improve factor productivity, i.e. by adopting new technologies, wears away any profits that might result. It works also as follows: if a farmer decreases productivity, sells assets or is reluctant to adopt new technologies, he becomes a "laggard", i.e. his income drops more than proportionally to the productivity fall. In fact, the treadmill is caused by market imperfections, which result from a high flexibility of agricultural prices[9] in response

[5] Our approach here is different from that of Yitzhaki (1979), since we do not pay attention to the size of a reference group.

[6] For more information on farmers' lobbying affecting the CAP, see Jonsson 2007 and Mueller 2015.

[7] For example, Cai and Pandey (2015) adopt a similar idea with regard to the European agriculture. They compare productivity gap understood as difference in value added per capita in agricultural sector and nonagricultural sectors, which might be treated as approximation of incomes.

[8] Since we are aware of the potential importance of labour migration in maintaining the equality of returns to labour in different sectors or even countries, we initially decided to include a labour market factor (i.e. the unemployment rate) in our considerations and we included the unemployment rates in our models. However, this variable proved to be insignificant in all models. We explain this in terms of the low mobility of farmers for whom their place of work is also their place of residence; hence farmers have to face the problem of occupation-residential choice. Moreover, the geographical dispersion of the agricultural industry and the distance between rural and urban labour markets imply information bias, as well as high costs of moving (Tacco, Bailey, Davidova 2013). Additionally, sociological and psychological factors, such as attachment to the heritage and land, further reduce the mobility of labour in agriculture.

[9] In the neoclassical view prices are independent variables and shall not be "flexible" in terms of reacting to the changes of demand or supply. The flexibility of agricultural prices is defined as $(\Delta P/P):(\Delta Q/Q)$, where P stands for prices and Q for output (Tomek, Robinson 1981).

to productivity growth. Cochrane claimed that the agricultural sector would not automatically return to the equilibrium and lost rent would never be regained, even though economic conditions had changed to the upward swing of agricultural business cycle. In the present times, higher land prices put farmers on a new kind of "land market" treadmill, since a growing competition for land[10] drives up rents, and profits from increasing scales of production go back to zero (Levins, Cochrane 1996). Although the market treadmill seems to be an interesting theory, it was never empirically tested in Europe, as the above cited author claimed (1996). Many economists are sceptical whether this phenomenon still exists. If the treadmill effect is still the case, it should be manifested in a negative relationship between farm-level productivity and farmers' incomes (or lack of the positive relationship).

If the Cochrane's treadmill effect does not occur, entrepreneurial income in agriculture should be a positive function of factor productivity. We refer here to the aggregate productivity of the sector.[11] From the microeconomic perspective, it can be understood as the expected (in the sense of average) level of productivity. Income and productivity are theoretically combined with exponential regression function ($y = e^{\delta X}$). While the share of intermediate consumption in production decreases due to the technological progress (recalling that intermediate consumption does not cover fixed capital expenditures), income rises more than proportionally due to the increasing economies of scale.[12] On the other hand, if the treadmill effect occurs (a negative sign for δ), income is a decreasing function of productivity (though the marginal declines are getting smaller). Or there may be no positive relationship (there are not many laggards, and the majority of farmers compete on the treadmill).

Price scissors are the second factor which potentially influences the relative income gap between agriculture and non-agricultural sectors. The influence of this phenomenon on the relative income gap is quite obvious. Agricultural income should be a positive function of the price gap indicator (defined as the ratio of output prices index to the input prices index). Faster increase in producer prices than growth of input prices causes linear gains in agricultural incomes (Liefert 2005).

For agricultural policy, the influence of subsidies on agricultural incomes is also disputable. If there is a market treadmill effect, an increase in production stimulated by subsidies on products can lead to a drop in income. If the treadmill

[10] A growing competition for agricultural land results from many factors, such as i.a. absolute scarcity of land, urban pressure, new land amenities, decoupled support and speculation.

[11] While the "laggards" exit the sector, the incomes of survivors could improve but presumably not enough to offset the price scissors, over time.

[12] We assume that farmers are rational and they follow capital-intensive path of development only when it enables productivity growth.

effect does not occur, we should expect a positive sign, unless there is an endogenous relationship of decoupled subsidies (theoretically it is possible that decoupled subsidies would fluctuate with product prices, like deficiency payments or counter-cyclical payments). The impact also depends on whether we consider the "old" EU-15 or the "new" EU-12 countries. In the EU-12, the Single Area Payment Scheme (SAPS) has operated from the very beginning of EU membership in the mid-2000s, and we expect a positive sign because these payments contribute to the growth of output (since the majority of subsidies are spent on production or investments [Czubak, Jędrzejak 2011]). In the EU-15, there is evidence that decoupled subsidies have a negative influence on production (Rizov, Pokrivcak, Ciaian 2013). We also observe a negative sign for the linear correlation coefficient for the decoupled subsidies and the productivity in our dataset (the correlation is however weak; it equals –0.2 using data after 2003 from Table 5). The impact of support on the production and productivity of farms in the EU-15 has been studied by many researchers (Hennessy 1998; Ciaian, Swinnen 2009; Rizov, Pokrivcak, Ciaian 2013; Banga 2014). These studies indicate that the subsidies before the introduction of decoupling reform (Luxembourg 2003) had a positive effect on production, but after the reform and the introduction of the SPS system the effects are ambiguous, and there is even some evidence of a negative impact (Rizov, Pokrivcak, Ciaian 2013). Firstly, this may be due to the system of "entitlements for payments". If farmers buy new land, they also have to buy new entitlements. Hence, if land purchase is the only way to enhance productivity, new land can be attributed with relatively lower direct payment. Secondly, farmers in the EU-15 can be more affected by the environmental requirements (cross-compliance) of the BPS than farmers in EU-12. The increase in productivity may often result in the loss of a portion of the environmental subsidies (now AECM agri-environment-climate-measures or AEM in RDP 2007–2013). Thirdly, it is concluded in some studies that in the Western European countries so-called 'complementary subsidies' (granted from national budgets), are counter-cyclical in nature, while in the New Member States these subsidies have a pro-cyclical impact (Czyżewski, Matuszczak 2016). However, even if the impact of decoupled subsidies on production and productivity is positive, it would also lead to a drop in income if treadmill effects occur.

3. Methodology and Data

We studied the relation between the relative income gap in agriculture and policy and market factors using an unbalanced panel of 27 EU Member States for the period 1995–2015. We used the Eurostat Economic Accounts for Agriculture

dataset as our data source (Eurostat 2016). Our dependent variable was a relative income deprivation index, which we defined as follows:

$$\frac{\text{average wage in nonagricultural sectors} - \text{average income in agritultural sector}}{\text{average wage in nonagricultural sectors}} \times 100$$

A positive value of the relative income deprivation index indicates that the average wage in non-agricultural sectors is higher than the average income in agricultural sector. If the average agricultural income is higher than the average wage in non-agricultural sectors, the relative income deprivation of farmers equals zero.[13]

Although there are many approaches to measure a farmer's income, we decided to use the value of entrepreneurial income[14] per unpaid annual work unit.[15] This is the most appropriate way to present changes in agricultural income in those countries, where individual farming and unpaid labour prevail[16] (Zawalińska, Majewski, Wąs 2016). The entrepreneurial income corresponds to the concept of current profit before distribution and income tax, as normally used in business accounting.

In order to assess the value of average wage in non-agricultural sectors,[17] we deducted the total value of wages and salaries[18] in agriculture, forestry and fishing

[13] We assume as Yitzhaki (1979) did, that there is no such thing as negative relative deprivation.

[14] The purpose of the entrepreneurial income account is to determine a balancing item corresponding to the concept of current profit before distribution and income tax, as normally used in business accounting. Entrepreneurial income is calculated as follows: net added value; minus employee compensation; plus balance of subsidies and taxes connected with production; plus property income receivable in connection with financial and other assets belonging to the enterprise (on the resources side); minus interest on debts payable by the enterprise and rent payable on land and other non-productive tangible assets leased by the enterprise (Eurostat 2017).

[15] One average working unit (AWU) corresponds to the work performed by one person who works on a farm on a full-time basis. If the national regulations do not indicate the number of hours, then 1,800 hours are taken to be the minimum annual working hours: equivalent to 225 working days of eight hours each (Eurostat 2016).

[16] However, we are aware of the fact that this measure is less appropriate for the countries featuring more diversified organizational and legal forms of farming.

[17] We took wages for comparison because they are basic indicators of the opportunity cost in a national economy as a whole. In the agricultural sector we consider only unpaid labour in AWU for which the average wage is an obvious opportunity cost since farmers can abandon agriculture and look for a job elsewhere.

[18] Wages and salaries include the values of any social contributions, income taxes, etc. payable by the employee even if they are actually withheld by the employer and paid directly to social insurance schemes, tax authorities, etc. on behalf of the employee. Wages and salaries do not include social contributions payable by the employer (OECD 2016b).

from the total value of wages and salaries from all NACE[19] activities, which we then divided by the number of average worker equivalents[20] hired in non-agricultural sectors.

The set of our independent variables includes:

- *productivity coefficient* – value of the agricultural output (real, producer[21] prices in national currencies) divided by total intermediate consumption (constant, basic prices[22] in national currencies). The coefficient sign is debatable with regard to Cochrane's treadmill theory;
- *price gap (scissors)* – index of prices received for agricultural products divided by the index of prices paid by farmers for industrial goods (means of production). We expect the coefficient sign to be negative;
- *subsidies on products ratio* – value of the subsidies on products divided by the value of agricultural output at current, basic prices including subsidies. The coefficient sign is debatable;
- *other (decoupled) subsidies ratio* – value of other subsidies on production divided by the value of agricultural output at basic prices including subsidies. The coefficient sign is debatable.

The data is a set of macro-economic panel data. We decided to estimate three panel data regression models for the following country groups: i) UE-27; ii) EU-15 ("old" EU Member States); and iii) EU-12 (New Member States). First, we tested our panel for the collinearity problem with the VIF[23] test, and, based on panel diagnostics (Breusch-Pagan and Hausman tests), we decided the panel data estimation method. In order to control for the endogenous variables affecting the relative income gap but not included in our model, we added a time trend.[24] For the two first groups of countries (EU-27 and EU-15), we estimated fixed-effect models with the following specification:

[19] Statistical Classification of Economic Activities in the European Community.

[20] We assume that the average worker (AW) works 1800 hours per year, which corresponds to the AWU idea.

[21] The price received by the producer without the deduction of taxes or levies (except deductible VAT) and exclusive of subsidies (Eurostat 2008)

[22] The price receivable by the producers from the purchaser for a unit of goods or services produced as output minus any tax payable on that unit as a consequence of its production or sale (i.e. taxes on products), plus any subsidy receivable on that unit as a consequence of its production or sale (i.e. subsidies on products). It excludes any transport charges invoiced separately by the producer. It includes any transport margins charged by the producer on the same invoice, even when they are included as a separate item on the invoice (Eurostat 2008).

[23] All variables do not exceed VIF = 2.5 which is in line with the rule of thumb (Chatterjee, Hadi 2006).

[24] An alternative approach to solve this problem is to include time fixed effects.

$$RELATIVEDEPRIVATION_{i,t} = \beta_1 PRICEGAP_{i,t} + \beta_2 PRODUCTIVITY\ COEF_{i,t} + \beta_3 SUBS\_PRODUCT_{i,t} + \beta_4 SUBS\_OTHER_{i,t} + \beta_5 TIME\ (LINEAR\ TREND)_{i,t} + \alpha_i + \varepsilon_{i,t}$$

where α_i is the unobserved time-invariant individual effect for each observation and ε_{it} is the error term. The significance of the individual effects is assessed with the Welch test.

Since the panel testing suggests a random-effects model for the third group of countries (EU-12), this model can be denoted as:

$$RELATIVEDEPRIVATION_{i,t} = \beta_0 + \beta_1 PRICEGAP_{i,t} + \beta_2 PRODUCTIVITY\ COEF_{i,t} + \beta_3 SUBS\_PRODUCT_{i,t} + \beta_4 SUBS\_OTHER_{i,t} + \beta_5 TIME\ (LINEAR\ TREND)_{i,t} + v_{i,t}$$

where $v_{i,t}$ is a sum of between-entity error and within-entity error.

4. Results

Table 4 in the Appendix presents the index values of relative income deprivation in EU-27. It is interesting that in most of the "old" Member States there still exist substantial discrepancies between wages in the non-agricultural sector and incomes of non-salaried labour in the agricultural sector. In most of these countries, this index was stable over the analysed period, but in some countries (Belgium, Ireland, Greece, Italy and UK) one can see some considerable increases at the beginning of the new millennium. This phenomenon could be explained by the CAP reforms in 2000 and 2003. However, although support estimates provided by OECD (2016a) suggest that support for the European Union agricultural producers in the analysed period was declining, our indicator of support presented in Table 5 in Appendix offers an alternative view. In most of the EU-15, the 2003 CAP reform led to an increase in the ratio of agricultural support to the value of agricultural output. Moreover, the correlation between the support ratio and relative income deprivation index is positive in all the EU-15 except Germany and Austria. This puts into question the common view than the CAP has primarily a social dimension.

The situation looks completely different in the New Member States. In most of them, accession to the EU resulted in a substantial decline in relative income deprivation, which can be associated with the participation of farmers in CAP mechanisms and an increase in the share of the subsidies in the value of agricultural output.

Results of this preliminary data analysis suggest that the influence of the CAP on the relative income gap in agriculture is unclear, and varies in different groups

of Member States. This creates the need for further analysis, including taking into consideration market factors such as prices and productivity, as well as analysing countries in groups.

Table 1 displays the results of fixed-effects regression for EU-27. The estimated values of coefficients of all variables are statistically significant,[25] which suggests that the relative income gap in agriculture results from a combination of policy and market factors. We can see that all marginal effects reduce (*ceteris paribus*) relative income deprivation. It gives grounds for assuming that the Cochrane treadmill effect does not exist as the "productivity vs incomes" relation seems to be positive. The "price gap" has a negative sign, as expected. Both "product" and "decoupled subsidies" also have negative signs. However, this result may be biased by the set of the EU-12 countries included in the panel. The standardized coefficient indicates the strongest influence of other (decoupled) subsidies, but this result may also be distorted by the influence of the New Member States. Additionally, low within R-squared values also encourage further analysis.

Table 1. Results of panel data estimation for EU-27 (1995–2015)

Model 1: Country-fixed effects using 502 observations
Included: 27 cross-sectional units
Time-series length: minimum 5, maximum 21
Dependent variable: RELATIVEDEPRIVATION
Beck-Katz robust standard errors

Variable	Coefficient	Standardized coefficient	Standard error	t-ratio	p-value	Statistical significance
CONST	132.98	0.00	19.25	6.91	0.00	***
PRICEGAP	−0.50	−0.10	0.21	−2.37	0.03	**
PRODUCTIVITY COEF.	−12.21	−0.15	5.13	−2.38	0.03	**
SUBS_PRODUCT	−1.12	−0.18	0.29	−3.83	0.00	***
SUBS_OTHER	−0.88	−0.28	0.28	−3.14	0.00	***
Mean dependent var.		48.27	S.D. dependent var.			30.17
LSDV R-squared		0.58	Within R-squared			0.09
rho		0.44	Durbin-Watson			0.87
Test F		8.61 (p < 0.00)	Welch test			83.21 (p < 0.00)
Breusch-Pagan test		789.85 (p < 0.00)	Hausman test			8.96 (p = 0.06)

Source: own calculations.

[25] Except for the time trend; since the coefficients for time proved to be insignificant, in Table 1 we present the already reduced model.

In the next step, we estimate a country-fixed regression for EU-15. The results are presented in Table 2. Coefficients of all variables are significant, but we observe puzzling positive signs for the subsidies. This confirms the inverse relation of subsidies and incomes in the Basic Payment Scheme (BPS) as it was stated in the *Theoretical Framework* Section. Meanwhile, the market treadmill effects do not occur. It supports the thesis that the social goals of CAP support are not achieved under the scheme of decoupled subsidies in the EU-15, as they enhance the relative income deprivation of farmers rather than reduce it.

The time effect (linear trend) reinforces the following conclusion: the relative income deprivation index was increasing by 0.96 (approximately 1%) per year over the period 1995–2015. What is also important, the standardized estimation results indicate that for this group of countries it is the subsidies which play the most important role in shaping relative agricultural income gap.

Table 2. Results of panel data estimation for EU-15 (1995–2015)

Model 2: Country- and time-fixed effects using 306 observations
Included: 15 cross-sectional units
Time-series length: minimum 16, maximum 21
Dependent variable: RELATIVEDEPRIVATION
Beck-Katz robust standard errors

Variable	Coefficient	Standardized coefficient	Standard error	t-ratio	p-value	Significance
CONST	113.36	–0.01	23.09	4.99	0.00	***
PRICEGAP	–0.82	–0.16	0.18	–4.63	0.00	***
PRODUCTIVITY COEF.	–12.94	–0.20	7.79	–1.66	0.10	*
SUBS_PRODUCT	1.78	0.38	0.40	4.45	0.00	***
SUBS_OTHER	1.01	0.41	0.22	4.53	0.00	***
TIME	0.96	0.22	0.24	4.10	0.00	***
Mean dependent var.		45.52	S.D. dependent var.			26.31
LSDV R-squared		0.71	Within R-squared			0.17
rho		0.55	Durbin-Watson			0.84
Test F		13.08 (p < 0.00)	Welch test			40.94 (p < 0.00)
Breusch-Pagan test		808.22 (p < 0.00)	Hausman test			12.19 (p = 0.03)

Source: own calculations

As expected, the results for the EU-12 differ significantly from the results for the EU-15. In Table 3, we present the estimated random-effects regression for the EU-12. In random-effects models, the individual effects are constant over time,

but they cannot be attributed to single countries; hence they are presented as a part of residual variance (between variance). The higher value of "within" variance than "between" variance indicates that income gap differentiation within the Member States is explained better by the model than the income gap among them. In this model, the time-invariant and unobservable conditions in the EU-12 account only for 48.35%[26] of the total random error, and the remaining part of this variability is random. This means that agricultural policy (as well as other individual conditions) is quite homogenous in this group of countries, and the independent variables are of crucial importance for agricultural incomes.

Table 3. Results of panel data estimation for EU-12 (1995–2015)

Model 3: Random effects using 200 observations
Included: 12 cross-sectional units
Time-series length: minimum 5, maximum 21
Dependent variable: RELATIVEDEPRIVATION
Beck-Katz robust standard errors

Variable	Coefficient	Standardized coefficient	Standard error	t-ratio	p-value	Significance
CONST	88.68	–0.08	16.15	5.69	0.00	***
PRODUCTIVITY COEF.	–14.15	–0.12	9.24	–1.53	0.13	
SUBS_OTHER	–1.55	–0.36	0.26	–5.93	0.00	***
Mean dependent var.		53.22	S.D. dependent var.			35.78
Between variance		656.00	Within variance			678.83
Mean theta		0.75	Corr (y.yhat)^2			0.09
Breusch-Pagan test		231.47 (p < 0.00)	Hausman test			1.14 (p = 0.57)

Source: own calculations.

Since price gap, linear time trend and product subsidies proved to be insignificant, we provide only the reduced model. We decided to leave "productivity" in the model although it is on the threshold of statistical significance (assuming $\alpha = 0.1$). In the case of the EU-12, other subsidies[27] proved to be the only strongly significant variable with the biggest standardized coefficient. This implies that for these countries the CAP has still a strong social dimension. On the other hand, it is "productivity" that stimulates income growth. It is worthwhile to note that its marginal effect on the relative deprivation is 10% stronger than in the EU-15. The

[26] Rho = square of between variance/sum of the squares of between and within variance.

[27] This is of course due to the fact that after the CAP reform in 2003 subsidies on production are barely available.

lack of "price gap" in the set of significant variables belies the claim that global prices have a stronger impact on farmers' income in the EU-12 than in the EU-15.

5. Conclusions

The main aim of this study was to verify whether membership in the EU and the use of CAP funds helped increase income of labour factor in agriculture, and, which is even more important, reduce the relative income deprivation of farmers. The second objective was to analyse the main factors influencing the income gap between farmers and the rest of society. Theoretical considerations and empirical analysis have led to the following conclusions.

The social goals of CAP support have not been achieved by decoupled subsidies in the EU-15 as they enhance the relative income deprivation of farmers instead of reducing it. Social goals of the CAP have, however, been achieved under the SAPS in the EU-12, where the agricultural subsidies play the major role in reducing the income gap between agricultural and non-agricultural sectors.

Cochrane's market treadmill theorem, manifested by a negative relation between farm productivity and incomes, did not occur in the European agriculture in the period analysed. However, the influence of productivity on reducing the income gap between agricultural and non-agricultural sectors is rather weak.

Farmers in the EU-15 operate under a bigger pressure of global prices than in the EU-12, although the effect of productivity on incomes is stronger in the New Member States.

On the basis of the macroeconomic analysis performed, we can formulate only some very general recommendations with regard to the future direction of the CAP.

If policy designers want to mitigate the problem of relative income deprivation of farmers, they should look for new CAP solutions and reconsider the role of decoupled payments in the EU. Should they have a social dimension, a compensatory meaning, or maybe their role should be limited to payments for providing public goods only?

One of the possible solutions for fulfilling the CAP objective of "ensuring fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture", might be a gradual substitution of the payment scheme operating in the "old" Member States by a scheme resembling SAPS.

The negative correlation found between agricultural subsidies and agricultural incomes in the EU-15 should be subject to deeper analysis.

Bibliography

Banga R. (2014). *Impact of Green Box Subsidies on Agricultural Productivity, Production and International Trade*. Unit of Economic Cooperation and Integration Amongst Developing Countries (ECIDC). Background Paper NO. RVC-11, 15–21.

Baer-Nawrocka A. (2015). Kwestia parytetu dochodów rolniczych w krajach Unii Europejskiej. In: A. Czyżewski, B. Klepacki (eds). *Problemy rozwoju rolnictwa i gospodarki żywnościowej w pierwszej dekadzie członkostwa Polski w UE*. Warsaw: Wydawnictwo Naukowe PWN.

Bhandari P. (2004). Relative deprivation and migration in an agricultural setting of Nepal. *Population and Environment*, *5* (25), 475–499.

Cai W., Pandey M. (2015). The agricultural productivity gap in Europe. *Economic Inquiry*, *53* (4), 1807–1817.

Chatterjee S., Hadi A. (2006). *Regression Analysis by Example*. Hoboken, N.J.: Wiley-Interscience.

Chen S., Ravallion M. (2013). More relatively-poor people in a less absolutely-poor World. *The Review of Income and Wealth*, *1* (59), 1–28.

Ciaian P., Swinnen J. (2009). Credit market imperfections and the distribution of policy rents. *American Journal of Agricultural Economics*, *91* (4), 1124–1139.

Cochrane W. (1958). *Farm Prices: Myth and Reality.* Minneapolis: University of Minnesota Press.

Czubak W., Jędrzejak P. (2011). Wykorzystanie dopłat bezpośrednich w gospodarstwach rolnych. *Roczniki Naukowe SERiA*, *13* (2), 75–79.

Czyżewski B., Matuszczak A. (2016). Political rents in the EU-27. Comparative analysis in political rents of European farmers. In: B. Czyżewski (ed.). *The Sustainable Development Paradigm. International, National and Regional Perspective*. Warsaw: Wydawnictwo Naukowe PWN.

Davis J. (1959). A formal interpretation of the theory of relative deprivation. *Sociometry*, 4, 280–296.

European Commission (2015). *EU agriculture spending – focused on results*. Brussels: DG Agri Fact-Sheet.

Eurostat (2008). Handbook for EU Agricultural Price Statistics. http://ec.europa.eu/eurostat/ramon/statmanuals/files/Handbook%20for%20EU%20Agricultural%20Price%20Statistics%202008.pdf [accessed: 10.01.2017].

Eurostat (2016). Economic Accounts for Agriculture Database, http://ec.europa.eu/eurostat/web/agriculture/data/database [accessed: 10.01.2017].

Eurostat (2017). Economy and finance glossary. http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Entrepreneurial_income_account [accessed: 10.01.2017].

Fałkowski J. (2013). *Does it matter how much land your neighbour owns? The functioning of land markets in Poland from a social comparison perspective*. IDEAS Working Paper Series from RePEc, 1–20.

Grant P., Abrams D., Robertson D., Garay J. (2015). Predicting protests by disadvantaged skilled immigrants: A test of an integrated Social Identity, Relative Deprivation, Collective Efficacy (SIRDE) Model. *Social Justice Research*, *1* (28), 1–6.

Hennessy D. (1998). The production effects of agricultural income support polices under uncertainty. *American Journal of Agricultural Economics*, 80, 46–55.

Hill B., Bradley D. (2015). *Comparison of Farmers' Incomes In The EU Member States*. Study for the European Parliament's Committee on Agriculture and Rural Development.

Hyll W., Schneider L. (2014). Relative deprivation and migration preferences. *Economics Letters*, *2* (122), 334–337.

Jayanta S., Dipti P. (2013). Changes in reative deprivation and social well-being. *International Journal of Social Economics*, *6* (40), 528–536.

Jonsson T. (2007). Collective action and Common Agricultural Policy lobbying: Evidence of Euro-Group influence, 1986–2003. *Umeå Economic Studies*, 713. Umeå University.

Levins R., Cochrane W. (1996). The treadmill revisited. *Land Economics*, *72* (4), 550–553.

Liefert W. (2005). *Decomposing Changes in Agricultural Price Gaps*. International Agricultural Trade Research Consortium, Working papers No. 14592.

Mueller D. (2015). Profit seeking and rent-seeking in the United States and Europe. In: R. Congleton, A. Hillman (eds). *Companion to the Political Economy of Rent Seeking*. Cheltenham, UK: Elgar.

OECD (2016a). Agricultural support estimates. OECD Agricultural Statistics. http://dx.doi.org/10.1787/data-00737-en [accessed: 10.01.2017].

OECD (2016b). Glossary of statistical terms. https://stats.oecd.org/glossary/detail.asp?-ID=2890 [accessed: 10.01.2017].

Rizov M., Pokrivcak J., Ciaian P. (2013). CAP subsidies and productivity of the EU farms. *Journal of Agricultural Economics*, *64* (3), 537–557.

Runciman W. (1966). *Relative Deprivation and Social Injustice.* Berkeley: University of California Press.

Stark O., Fan S. (2011). Migration for degrading work as an escape from humiliation. *Journal of Economic Behavior and Organization*, *3* (77), 241–247.

Tacco B., Bailey A., Davidova S. (2013), *The Reallocation of Agricultural Labour across Sectors: An Empirical Strategy for Micro Data*. Factor Markets Project Working Paper No. 45.

Tomek W.G., Robinson K.L. (1981). *Agricultural Product Prices*. Ithaca–London: Cornell University Press.

Treaty Establishing the European Economic Community (1957). 25 March 1957, 298 U.N.T.S. 3, 4 Eur. Y.B. 412.

Yitzhaki S. (1979). Relative deprivation and the Gini coefficient. *Quarterly Journal of Economics*, *2* (93), 321–324.

Zawalińska K., Majewski E., Wąs A. (2016). Long-term changes in the incomes of the Polish agriculture compared to the European Union countries. *Annals of Polish Association of Agricultural Economists*, *17* (6), 346–354.

Wpływ polityki i rynku na relatywną deprywację dochodową czynnika pracy w rolnictwie

Streszczenie: W większości krajów członkowskich UE przeciętne dochody w sektorze rolnym są ciągle dużo niższe niż przeciętne wynagrodzenia w sektorach nierolniczych, co stoi w sprzeczności z jednym z pierwotnych celów WPR, jakim jest „zapewnienie odpowiedniego poziomu życia ludności rolniczej". Głównym celem tego artykułu jest sprawdzenie, czy członkostwo w UE i korzystanie ze środków WPR pomagają zredukować relatywną lukę dochodową w rolnictwie. Drugim z celów jest zbadanie, które czynniki wpływają na tę lukę i w jaki sposób. W badaniach wykorzystano dane EAA z 27 krajów członkowskich z lat 1995–2015 i oszacowano trzy modele regresji panelowej: dla wszystkich, „starych" i „nowych" krajów członkowskich. Wyniki badań wskazują, że w krajach UE-15 cele socjalne WPR nie są realizowane, ale są osiągane w ramach systemu SAPS w krajach UE-12.

Słowa kluczowe: czynnik pracy w rolnictwie, relatywna luka dochodowa, zmiana realnej produktywności, nożyce cenowe, teoria kieratu technologicznego Cochrane'a.

Appendix

Table 4. Relative income deprivation index in EU-27 (1995–2015)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Belgium	43.4	33.7	31.3	35.8	45.6	35.3	43.3	55.0	48.3	47.0	54.1	36.6	27.2	53.3	59.7	37.2	52.7	35.0	56.4	66.7	61.4
Bulgaria						0.0	0.0	7.4	22.4	15.5	18.2	12.6	27.2	0.0	30.8	31.7	21.7	19.0	4.2	0.0	11.6
Czech Rep.			175.7	255.0	128.2	35.6	152.7	147.5	0.0	0.0	4.9	0.0	0.0	63.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Denmark	46.4	48.7	55.4	87.1	91.8	74.1	58.7	94.9	100.5	90.1	85.3	80.5	90.8	184.7	150.8	96.6	76.3	23.6	70.8	59.6	88.1
Germany	83.3	71.5	71.5	80.0	80.8	65.1	51.2	78.4	84.6	53.8	63.3	57.2	35.6	31.7	67.1	51.2	11.6	45.6	12.4	45.8	78.0
Estonia						54.7	38.4	47.2	49.4	0.0	0.0	10.8	0.0	32.5	48.0	0.0	0.0	0.0	0.0	0.0	0.0
Ireland				58.9	63.2	55.0	51.0	63.6	66.4	65.2	58.0	67.3	65.4	73.4	83.7	79.7	69.0	72.3	69.8	67.9	65.5
Greece	0.0	0.0	0.0	0.0	0.0	3.1	4.2	14.6	24.7	27.8	29.7	35.8	29.6	29.3	20.1	24.1	32.5	28.2	31.4	25.4	14.8
Spain	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
France	29.3	28.4	26.1	22.9	28.3	33.2	36.7	39.4	42.0	41.9	50.0	43.1	30.7	49.0	66.8	32.4	29.1	30.1	50.1	40.0	30.2
Italy	33.8	29.2	29.3	27.4	22.4	28.0	25.7	28.0	29.2	27.3	45.5	49.0	50.8	48.4	51.0	61.8	54.0	48.5	31.9	42.1	
Cyprus						100.0	100.0	100.0	99.8	43.7	40.4	47.2	47.1	46.9	43.7	43.7	42.3	40.3	35.0	33.6	37.3
Latvia				75.7	76.7	75.0	68.5	69.2	71.9	51.1	58.1	50.9	55.1	65.0	67.7	49.8	49.2	40.6	54.9	60.8	33.7
Lithuania			36.6	40.8	59.1	63.9	69.7	76.7	78.8	58.1	56.0	69.7	55.0	60.7	70.7	60.1	40.1	21.5	37.7	47.3	53.2
Luxembourg					53.4	56.2	31.0	62.0	48.7	65.8	61.2	49.5	68.4	85.0	86.5	77.1	58.4	80.2	78.0	85.0	45.8
Hungary			53.4	46.7	66.3	70.3	69.7	81.8	83.2	63.9	65.5	62.6	61.4	40.7	70.2	61.3	28.9	41.5	30.9	22.0	85.0
Malta													0.0	3.9	0.0	1.4					32.4
Netherlands	0.0	0.0	0.0	0.0	11.7	8.5	6.5	28.1	22.0	35.6	29.6	0.0	10.9	35.4	64.1	23.4	52.5	39.4	17.5	30.8	24.8
Austria	55.3	56.9	62.9	65.5	66.0	63.5	55.2	59.9	60.6	57.5	58.8	53.8	47.7	49.8	64.2	55.8	48.1	52.3	59.5	63.0	33.2
Poland						81.7	79.6	82.5	84.5	63.2	66.9	63.2	54.6	64.7	58.7	50.4	40.9	45.8	41.0	47.3	64.8
Portugal	34.6	41.0	46.9	51.0	43.9	56.5	54.4	59.3	60.6	51.7	60.0	59.6	64.8	59.9	67.9	58.0	69.9	60.9	50.9	51.8	54.0
Romania				33.9	43.4	64.2	43.9	45.2	37.9	4.8	60.8	62.6	76.4	65.2	73.2	70.7	18.5	45.9	35.5	30.1	47.5
Slovenia	83.2	87.3	84.2	84.5	85.4	83.6	86.9	80.6	86.3	76.7	78.1	79.8	77.1	80.7	81.3	80.8	77.0	83.2	82.1	77.9	45.3
Slovakia	119.3	100.8	97.4	116.8	100.9	90.1	80.0	78.4	110.8	70.7	92.2	75.6	70.8	60.6	105.4	108.5	63.0	41.0	78.0	54.7	76.5
Finland	43.0	57.3	56.9	69.0	56.8	49.2	50.0	51.6	54.8	58.2	57.7	62.4	54.1	61.1	54.6	49.4	45.6	43.5	64.3	80.4	89.9
Sweden	56.4	59.9	54.8	61.7	69.7	64.4	60.8	61.1	63.7	69.4	60.0	50.8	37.8	48.1	68.4	46.1	52.5	55.9	66.2	56.2	87.0
UK	0.0	0.0	23.4	47.3	50.1	60.4	58.1	48.5	34.7	42.5	42.1	43.7	40.9	8.4	4.6	13.6	0.0	0.0	0.0	0.0	54.4

Source: own calculations based on EAA Database.

Table 5. Ratio of subsidies for agriculture to the value of agricultural output in EU-27 (1995–2015)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Belgium	4.63	5.32	4.62	4.57	6.91	4.97	6.10	7.18	7.58	8.07	7.38	9.50	9.95	10.24	11.79	10.38	10.01	8.45	8.05	8.61	9.48
Bulgaria	0.00	0.00	0.25	0.22	0.45	0.18	1.03	1.58	2.47	2.21	2.88	1.82	10.19	13.46	14.91	15.64	13.66	17.72	23.91	23.28	20.15
Czech Rep.				4.53	6.20	5.98	5.14	7.20	8.67	10.81	19.97	24.04	19.83	23.82	32.05	27.93	24.81	24.98	22.24	25.20	25.14
Denmark	9.3	9.0	8.9	9.8	9.9	9.5	9.7	10.8	11.0	11.2	12.5	12.8	11.3	11.9	12.5	10.6	9.7	8.7	9.4	9.5	10.0
Germany	13.1	12.8	12.7	12.3	12.6	13.1	12.1	13.1	13.7	13.6	15.8	15.9	14.0	13.9	15.9	15.6	13.7	13.4	12.8	13.3	14.5
Estonia	1.0	1.8	2.1	11.1	9.2	6.4	5.0	6.6	6.1	17.5	18.2	21.6	19.3	24.3	25.9	27.6	23.7	22.5	22.4	20.3	19.5
Ireland	15.6	18.6	20.5	22.2	20.2	21.5	22.1	27.3	26.6	25.8	39.0	35.3	32.3	32.5	38.4	29.6	28.8	26.2	21.4	22.3	21.7
Greece	18.2	19.5	17.9	20.4	20.8	20.6	20.5	22.8	21.8	23.9	20.9	28.6	31.6	31.7	32.4	30.2	29.8	28.5	27.2	27.3	24.9
Spain	15.0	13.2	13.1	13.0	13.5	13.9	16.3	16.5	15.5	16.4	17.0	18.4	17.6	16.9	18.7	17.3	16.7	16.2	14.9	15.4	15.3
France	13.5	13.5	13.2	12.6	13.3	13.1	13.9	14.7	16.4	14.8	15.5	16.7	14.9	14.7	15.6	14.7	13.8	12.7	12.7	12.4	13.5
Italy	7.7	8.8	9.5	8.7	9.5	10.1	10.9	11.9	10.9	9.8	9.7	10.4	9.2	8.8	14.3	10.6	11.1	9.4	9.4	12.1	10.7
Cyprus				2.2	0.5				0.6	6.8	7.3	6.3	6.3	6.7	6.4	6.1	6.1	6.5	6.0	10.3	11.6
Latvia				6.3	2.8	3.4	3.8	6.6	9.2	24.4	26.1	34.2	26.1	26.2	32.9	29.8	26.1	22.0	23.8	27.0	25.7
Lithuania	2.7	3.4	3.5	4.0	5.5	1.6	2.7	3.2	2.9	13.0	14.6	18.4	13.3	14.4	18.7	17.9	14.6	13.3	15.3	16.7	17.0
Luxembourg	13.1	18.1	20.0	17.0	17.2	19.4	22.0	16.9	20.6	18.0	22.7	23.6	19.0	18.4	21.1	21.4	23.2	16.6	15.7	15.9	20.6
Hungary			2.5	4.6	3.5	3.6	4.1	5.2	6.7	13.6	18.2	18.0	17.5	16.7	20.7	22.7	21.0	21.9	21.9	22.3	23.3
Malta				0.8	0.8	0.8	0.9	2.0	8.5	12.4	16.9	16.7	19.4	13.4	14.6	24.4	16.4	16.6	15.6	17.6	16.3
Netherlands	3.1	3.7	2.6	2.7	3.7	2.7	3.3	3.1	3.8	4.0	4.3	5.6	4.3	4.6	5.1	4.2	4.7	4.5	4.4	4.2	4.3
Austria	35.0	32.5	29.6	28.1	26.7	27.1	29.8	31.5	31.8	31.8	34.5	33.8	27.6	26.4	29.6	27.8	23.9	23.4	24.2	23.1	22.0
Poland				1.7	1.7	1.8	1.6	1.8	1.6	12.1	14.2	17.4	15.9	16.5	21.9	22.0	20.7	17.0	19.0	19.1	16.8
Portugal	14.4	13.2	14.4	15.3	13.1	11.1	12.4	12.5	13.5	14.9	17.0	13.1	15.0	16.2	13.4	15.4	14.2	16.0	13.8	13.4	12.1
Romania				2.2	2.1	2.8	2.9	1.8	2.6	3.7	4.6	5.3	6.1	5.4	8.7	7.6	7.1	10.3	9.0	12.1	
Slovenia	2.4	2.3	2.5	2.6	5.0	9.6	11.5	11.2	16.3	18.3	21.8	24.6	23.5	22.6	24.4	22.8	20.4	22.1	22.4	20.1	19.9
Slovakia	11.4	10.1	10.5	11.1	12.2	18.2	12.3	10.5	12.5	13.4	14.9	16.5	19.8	23.3	30.9	28.1	22.1	21.5	20.6	21.7	24.5
Finland	60.1	49.9	48.3	53.6	53.2	55.4	55.1	55.4	57.9	56.9	58.0	66.7	58.7	57.5	61.2	57.5	49.0	47.8	46.5	50.3	51.0
Sweden	16.3	17.0	17.4	18.2	18.5	18.8	20.8	21.6	20.8	21.5	25.0	25.5	21.5	21.9	24.0	21.0	20.2	18.2	18.4	17.7	17.8
UK	12.6	15.8	16.1	16.9	17.5	17.4	16.9	18.0	18.0	18.6	22.1	22.7	20.1	17.4	19.8	18.1	15.7	14.3	13.7	12.2	12.7

Source: own calculations based in EAA Database.