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

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## Abstract:

The average incomes in the agricultural sector are still much lower than the average wages in non-agricultural sectors in the most of the European MS, which is not in line with one of the CAP initial objectives of "ensuring fair standard of living for the agricultural community". The main aim of this paper is to verify, whether the membership in the EU and utilization of the CAP founds help to reduce relative income gap of farmers. The second aim is to analyse which factors influence this income gap and how. In our study we exploit EAA data from 27 EU MS for the period 1995-2015 and estimate three panel data regression models for all MS, "old" MS and "new" MS. Our results prove that the social goals of the CAP support are not being achieved in the EU-15, however they are achieved under the SAPS in the EU-12.

**Key words: agricultural labour factor, relative income gap, real productivity change, price scissors, Cochrane's treadmill theorem**

## 1. Introduction

Among the main objectives of the CAP set out in the Article No.39 of Treaty of Rome, one can find "optimum use of the factors of production, in particular labour" and "ensuring fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture" (Treaty…, 1957). Fulfilling the above mentioned objectives of the CAP should lead to a mitigation of the gap between agricultural and non-agricultural

incomes. However, since average incomes received by farmers in the EU countries are still usually lower than the average wages outside the agricultural sector, this leads to the feeling of social injustice among farmers. In social sciences we call this feeling a relative deprivation. Feeling relatively deprived, farmers demand stronger financial support and act intensively to convince policymakers to support them, which may to a certain point explain high level of agricultural support in the EU. Consequently, lower level of relative deprivation among farmers should decline their political pressure and allow to reduce financial support within 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 in shaping the level of agricultural incomes. We consider "the market" as a combination of the impact of prices and productivity changes. Since the CAP is becoming more and more decoupled and the share of subsidies to products plays relatively smaller role, the influence of prices on agricultural incomes is gaining in importance. With regard to productivity, there are however two counteracting forces driving the income gap in agriculture. Although a productivity rise in agriculture ought to mitigate the relative deprivation of farmers, it doesn't transform into proportional incomes growth as it was stated in the Cochrane's treadmill theorem[1].

Thus, our research objective is to verify, if membership in the EU and utilization of the CAP founds help to increase income of labour factor in agriculture and, what is even more important, to reduce 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 maybe productivity and price gap play the main role. To study the relation between relative income gap and policy and market factors, we exploit Eurostat Economic Accounts for Agriculture data from 27 EU Member States for the period 1995-2015 and estimate three panel data regression models for all MS, "old" MS and "new" MS.

The paper proceeds as follows. In Section 2 we provide short theoretical framework. Section 3 gives information on data used and methods of analysis. Section 4 presents the results and finally in section 5 we provide conclusions.

## 2. Theoretical Framework

Fulfilling one of the main objectives of the CAP, which is "ensuring 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

[1] For the explanation of the Cochrane's treadmill theorem see Theoretical Framework of this paper.

to decrease the difference between incomes in agricultural sector and non-agricultural sectors. Although the general economic situation of farmers in the EU has been improving[2], 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 (European Commission, 2015). We believe that decreasing income gap is even more important for "ensuring fair standard of living" than increasing incomes, because people tend to compare their incomes and economic situation not only in time, but also spatially (i.e. with people working in non-agricultural sectors). Seeing that most of the society, who work outside the agriculture, is usually richer and 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 our situation to the situation of others. The concept of relative deprivation was first soundly described by the American sociologist J. Davis (1959), but it is W. Runciman (1966), who played the most important role in disseminating this concept. The key assumption of this theory is that people judge their achievements comparing them with the achievements of other people in their environment (i.e. with the reference group), however reference group may vary depending on the aspect of life. The phenomenon of relative deprivation can be analyzed at the individual level (when a single entity believes it is in a worse position than the other entity of the reference group) or at the collective level (when a single entity believes that the group to which it belongs is in a worse situation than other groups) (Kelly, Breinlinger, 1995). The response to relative deprivation at the collective level will be participation in group activities (eg. the protests and lobbying), which aim is the redistribution of rents (economic and political) in society and changing the position of the group (Tougas, Beaton, 2002; Grant, Abrams, Robertson i Garay, 2015).

This concept has found numerous applications primarily in sociology and psychology. Its use in economic science is not so common, which may be surprising due to the fact that eminent economists[3] have long time ago noticed that people compare themselves to others, and these social comparisons affect their decisions and behavior. Today in economics the concept of relative deprivation is mainly used in research on differences in quality of life (Chen and Ravallion, 2013; Ravallion and Chen, 2011 Jayanta and Dipti, 2013) and analyzes of population

[2] Which partly results from the non-farm activity of farmers.
[3] Already A. Smith in his groundbreaking publication " The Wealth of Nations" emphasized the relative nature of poverty.

migration (Hyll and Schneider, 2014; Stark and Fan, 2011). In agricultural economics the relative deprivation concept is used relatively rare and mainly relates to the problem of inequality in the distribution of production factors (Bhandari, 2004; Falkowski 2013).

In our paper we consider relative deprivation of farmers as an income deprivation, and more precisely, as a relative income gap between the average income from agricultural activity and the average wage in non-agricultural sectors[4]. We believe that farmers' feeling of relative deprivation has an underestimated influence on the shape of agricultural policy in Europe[5] and that is way it is crucial to recognize the factors, which affect it. Although there exists a vast literature dealing with agricultural incomes in the EU Member States (e.g. Hill, 2012; Hill, Bradley, 2015; Zawalińska, Majewski, Wąs, 2016), to the best of our knowledge the link between relative farmers' income gap and factors influencing this phenomena is less documented[6]. We contribute to this literature by documenting the relative income deprivation of farmers in the 27 EU Member States and by investigating the factors affecting the income gap.

Among the factors with the potential influence on relative income gap between agriculture and non-agricultural sectors we distinguish: production factors productivity, price scissor in agriculture, agricultural policy and labour market situation. 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 factors productivity, i.e. by adopting new technologies, wears away any profits that might result. It works also in the opposite direction: if farmer decreases productivity, sells assets or if he is reluctant to adopt new technologies, he becomes "the laggard" and is lost in the price squeeze. As a result, farmer's incomes drop more than proportionally to the productivity fall. In fact, the treadmill is caused by the market imperfections, which result from the flexible agricultural prices in response to the productivity growth. Cochrane claimed that agricultural sector would not automatically return to the equilibrium and drained rents would never be given back, even though economic conditions had changed. In the present times, higher land prices put farmers on the new kind of "land market" treadmill, since a competition for land drives up rents and profits from increasing scale of production go back to zero (Levins, Cochrane, 1996). Although

[4] Our approach here is different than the Yitzhaki (1979), since we do not pay attention to the size of reference group.
[5] For more information on farmers lobbing affecting the CAP see (Jonnson, 2007) and (Mueller, 2015).
[6] For example Cai and Pandey (2015) utilize 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.

the market treadmill seems to be an interesting theory, it was never empirically tested in Europe. Many economists are sceptical whether this phenomenon still exists. If the treadmill still occurs, it shall manifest by the negative relation between productivity and farmers' income (or lack of the positive relation).

If the Cochrane's treadmill is not present, the entrepreneurial income in agriculture should be a positive function of factor productivity. We refer here to the macroeconomic productivity of the sector. From the microeconomic perspective, it can be understood as the expected level of productivity. Income and productivity are theoretically combined with exponential regression function ($y = e^{\delta X}$). While the share of intermediate consumption in the production decreases (ceteris paribus), the income rises more than proportionally due to the increasing economies of scale. On the other hand, if the treadmill occurs (negative sign for $\delta$), the income is the decreasing function of productivity (however the marginal declines are getting smaller), or simply there is no positive relationship (there are not many laggards and the majority of farmers competes on the treadmill).

For the price scissors in agriculture, we believe that 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 a growth of input prices causes linear gains in agricultural incomes (Liefert, William 2005).

For the agricultural policy, the influence of subsidies on agricultural incomes is also disputable. If there is the market treadmill, an increase in production stimulated by subsidies on products, can lead to a drop in income. If the treadmill does not occur, we should expect positive sign, unless there is an endogenous relationship of decoupled subsidies. However the final impact depends on whether we consider the "old" EU-15 or the "new" EU-12 countries. In the EU-12, SAPS (single area payment scheme) has operated at the very beginning and we expect the positive sign because there is contribution of these payment to the growth of output. In the EU-15, there are evidences that decoupled subsidies negatively influence production. We also observe the negative sign of the linear correlation coefficient for the subsidies and the productivity in our dataset (the correlation is however weak, it equals 0.2). The impact of support on the production and productivity of farms in the EU-15 has been studied by many authors (Olley, Pakes, 1996; Hennessy, 1998; Ciaian and Swinnen, 2009; Rizov et al., 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 effects are ambiguous. There are even some evidence of the negative impact (Rizov et al., 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 the land purchase is the only way to enhance productivity, new plots can be attributed with relatively lower payment. Secondly, farmers in the EU-15 can be more affected with the environmental requirements (cross-compliance). The increase in productivity may often result in a loss of a part of the environmental subsidies. Thirdly, it is concluded in some studies that in the Western Europe 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). On the second hand, 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.

Since we are aware of the potential importance of the labour migration in maintaining the equality of returns to labour in different sectors or even countries, we decided to include labour market factor (i.e. unemployment rate) in our considerations. For the agricultural sector we expect however that this factor plays less significant role in shaping the level of agricultural incomes[7]. We explain it with 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, geographical dispersion of the agricultural industry and the distance between rural and urban 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.

## 3. Methodology and Data

We study the relation between relative income gap in agriculture and policy and market factors in an unbalanced panel of 27 countries for the period 1995-2015. As our data source we use Eurostat Economic Account for Agriculture dataset (Eurostat, 2016). As our dependent variable we use relative income deprivation index, which we define as follows:

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

Higher values of relative income deprivation index indicate that average earnings in non-

[7] Initially we included unemployment rate in our models, however, as expected this variable proved to be insignificant in all models.

agricultural sectors are higher than average incomes in agricultural sector. Negative values indicate that average agricultural incomes are higher than average earnings in non-agricultural sectors, hence relative income deprivation of farmers equals zero.

Although there are many approaches to measure farmer's income, we decide to use value of entrepreneurial income per unpaid annual work unit[8]. It is the most appropriate way to present changes in income in these countries, where prevail individual farming and unpaid labour[9] (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 value of average wage in non-agricultural sectors we deducte the total value of wages and salaries[10] in agriculture, forestry and fishing from the total value of wages and salaries in all NACE activities, which we then divide by the number of average worker equivalents[11] hired in non-agricultural sectors.

Set of our independent variables includes:

- *productivity coefficient* – value of the agricultural output (constant, producer[12] prices in national currencies) divided by the total intermediate consumption (constant, basic prices[13] in national currencies). Coefficient sign is debatable with regard to the Cochrane's treadmill theorem;
- *price gap (scissors)* – index of prices received for the agricultural products divided by the index of prices paid by farmers for the industrial goods (means of production). We expect 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

[8] One average working unit (AWU) corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis. If the national provisions 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).

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

[10] 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).

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

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

[13] The price receivable by the producers from the purchaser for a unit of a good or service 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)

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 above described data is a set of macro-economic panel data. In our paper we decide to estimate three panel data regression models for the following country groups: i) 27 EU Member States; ii) 15 "old" EU Member States; and iii) 12 "new" EU Member States. First we test our panel for the collinearity problem with the VIF[14] test and based on panel diagnostics (Breusch-Pagan test and Hausman test) we decide about the proper panel data estimation method. In order to control for the endogenous variables affecting the relative income gap but not included in our model we add time trend[15]. For the two first groups of countries (all 27 EU MS and 15 old EU MS) we estimate fixed-effects models with the following specification:

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

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

Since the panel diagnostic suggests random-effects model for the third group of countries (12 new EU MS), 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 $v_{it}$ is a sum of between-entity error and within-entity error.

## 4. Results

Table 5 in Appendix present index of relative income deprivation in all 27 EU Member States. Interesting thing is that in most of the "old" EU MS there still exist substantial discrepancy between earnings in non-agricultural sector and incomes of non-salaried labour in agricultural

[14] All variables do not exceed VIF=2,5 which is in the line with the rules of thumb (Chatterjee, Hadi 2006).
[15] An alternative approach to solve this problem is to include time fixed effects.

sector. In most countries this index has been stable over the analysed period, but in some countries (Belgium, Ireland, Greece, Italy and UK) one could even notice some essential increase at the beginning of the new millennium. This phenomenon could be explained by the CAP reforms and resulting decline in agricultural support. However, although support estimates provided by OECD (2016a) and World Bank (Anderson, Nelgen, 2013) suggest that support for the European agricultural producers in the analysed period has been declining, our indicator of support offer an alternative view. Table 6 in the appendix presents ratio of the subsidies (on products and on production) for agriculture to the value of agricultural output including subsidies. In most of the "old" MS CAP reform in 2013 has led to an increase in the share of agricultural support in agricultural output. What is more, correlation between support index and relative income deprivation index is positive in all "old" MS except Germany and Austria. This puts into question the common view than the CAP has primarily a social dimension.

Situation looks completely different in the "new" MS. In most countries, accession to the EU resulted in substantial decline in relative income deprivation, which can be associated with the participation of farmers in the CAP mechanisms and increase in the share of the subsidies in the value of agricultural output.

Results of this preliminary data analysis suggest that influence of the CAP on the relative income gap in agriculture is unclear and vary in different groups of countries. This creates need for further analysis and including into considerations also market factors like prices and productivity, as well as analysing countries in groups.

Table 1 displays the results of fixed-effects regression for the all 27 EU Member States. Coefficients of all variables are significant[16], which suggests that relative income gap in agriculture results from combination of policy and market factors. We can see that all marginal effects reduce (*ceteris paribus*) the relative income deprivation. It gives premises to assume that the Cochrane treadmill doesn't exist since the relation "productivity vs incomes" seems to be positive. The "price gap" has negative sign as expected. Both "product" and "decoupled subsidies" have also negative signs. However this result can be biased by the set of the EU-12 countries included in the panel. Standardized coefficient indicates the strongest influence of other (decoupled) subsidies, however this result may be also distorted by the influence of the "new" MS. Additionally low within R-squared also encourages for further analysis.

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

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

| Model 1: Country fixed-effects. using 502 observations<br>Included 27 cross-sectional units<br>Time-series length: minimum 5. maximum 21<br>Dependent variable: RELATIVEDEPRIVATION<br>Beck-Katz robust standard errors | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Coefficient | Standardized coefficient | Standard error | t-ratio | p-value | 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.

Additionally, in table 2 we present the ranking of EU-27 countries (with reference to Belgium) based on the increasing fixed effects on the relative deprivation index. The best time in-variant conditions for reducing relative deprivation of farmers' incomes occur in Bulgaria, Netherlands, Malta and Spain, the worst in Ireland, Denmark, Slovenia, Slovakia and Finland. However the more detailed analysis of this observation goes beyond the objectives of the paper.

In the next step we estimate country-fixed regression for the 15 "old" MS. Results are presented in table 3. Coefficients of all variables are significant, however we observe puzzling, positive signs for the subsidies. This confirms the inverse relation of subsidies and incomes in Basic Payment Scheme (BPS) as it was stated in the Theoretical Framework part. Meanwhile the market treadmill effects do not occur. It supports thesis that social goals of the CAP support are not being achieved under the scheme of decoupled subsidies in EU-15 since they enhance relative income deprivation of farmers instead of reducing it.

Table 2. Countries' fixed effects (ref. Belgium, model 1 for 27 EU Member States) (1995-2015).

| Country | Coefficient | Standard error | t-ratio | p-value | Significance |
|---|---|---|---|---|---|
| Bulgaria | −27.72 | 6.83 | −4.06 | 0.00 | *** |
| Netherlands | −23.27 | 6.60 | −3.53 | 0.00 | *** |
| Malta | −22.71 | 10.51 | −2.16 | 0.03 | ** |
| Spain | −21.84 | 9.48 | −2.30 | 0.02 | ** |
| Estonia | −14.43 | 7.07 | −2.04 | 0.04 | ** |
| United Kingdom | −8.89 | 6.54 | −1.36 | 0.17 | |
| Greece | 1.51 | 9.15 | 0.16 | 0.87 | |
| France | 2.59 | 6.64 | 0.39 | 0.70 | |
| Cyprus | 6.60 | 9.60 | 0.69 | 0.49 | |
| Italy | 8.21 | 8.92 | 0.92 | 0.36 | |
| Romania | 9.16 | 7.55 | 1.21 | 0.23 | |
| Czech Republic | 11.66 | 6.91 | 1.69 | 0.09 | * |
| Lithuania | 15.88 | 6.57 | 2.42 | 0.02 | ** |
| Hungary | 17.60 | 6.64 | 2.65 | 0.01 | *** |
| Germany | 21.39 | 6.41 | 3.34 | 0.00 | *** |
| Portugal | 22.62 | 6.91 | 3.27 | 0.00 | *** |
| Sweden | 23.39 | 6.78 | 3.45 | 0.00 | *** |
| Poland | 25.44 | 6.99 | 3.64 | 0.00 | *** |
| Latvia | 27.65 | 7.01 | 3.94 | 0.00 | *** |
| Luxemburg | 33.24 | 7.10 | 4.68 | 0.00 | *** |
| Austria | 36.32 | 7.41 | 4.90 | 0.00 | *** |
| Ireland | 41.43 | 7.44 | 5.57 | 0.00 | *** |
| Denmark | 41.62 | 6.31 | 6.60 | 0.00 | *** |
| Slovenia | 46.98 | 6.56 | 7.16 | 0.00 | *** |
| Slovakia | 49.37 | 6.57 | 7.52 | 0.00 | *** |
| Finland | 54.99 | 11.10 | 4.95 | 0.00 | *** |

Source: own calculations.

Time effect (linear trend) reinforce this conclusion: the relative income deprivation index was increasing by 0,96 (approximately 1%) per year in the period 1995-2015. What is

also important, standardized results of estimation indicate that for this group of countries it is the subsidies which play the most important in shaping relative agricultural income gap.

Table 3. Results of panel data estimation for 15 "old" EU Member States (1995-2015).

| Model 2: Country and time fixed-effects using 306 observations<br>Included 15 cross-sectional units<br>Time-series length: minimum 16. maximum 21<br>Dependent variable: RELATIVEDEPRIVATION<br>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, results for 12 "new" MS differ essentially form the results for "old" MS. In table 4 we present estimated random-effects regression for the "new" MS. In random-effects models 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 the model explains better the income gap differentiation within the country than between countries. In this case, the time-invariant and unobservable conditions in the EU 12 countries accounts only for 48.35%[17] of the total

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

random error, and the remaining part of this variability is random. This means that the agricultural policy (as well as other individual conditions) is quite homogenous in this group of countries and the independent variables are of the crucial importance for the agricultural incomes.

Table 4. Results of panel data estimation for 12 "new" EU Member States (1995-2015).

| Model 3: Random-effects using 200 observations<br>Included 12 cross-sectional units<br>Time-series length: minimum 5, maximum 21<br>Dependent variable: RELATIVEDEPRIVATION<br>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 trend and subsidies on product proved to be insignificant, we provide only reduced model. We decided to leave the "productivity" in the model although it is on the threshold of significance level (assuming $\alpha = 0,1$) In case of the "new" MS other subsidies[18] proved to be only strongly significant variable with the biggest standardized coefficient. It implies that for these countries the CAP has still strong social dimension. On the second place it is the "productivity" which stimulates income growth. It is worth to notice that its marginal effect on the relative deprivation is 10% stronger than in the EU-15. The lack of "price gap" in the set of significant variables belies the claim that global prices have stronger impact on the farmers' income in the EU-12 than in the EU-15.

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

## 5. Conclusions

The main aim of this paper was to verify, if membership in the EU and utilization of CAP founds help to increase income of labour factor in agriculture and, what is even more important, to reduce relative income deprivation of farmers. The second objective was to analyse main factors influencing the income gap between farmers and rest of the society. Theoretical considerations and empirical analysis have led to the following conclusions:

- Social goals of the CAP support have not been achieved under the scheme of decoupled subsidies in EU-15 since they enhance 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 agricultural subsidies play the major role in reducing the income gap between agricultural and non-agricultural sectors;
- Cochrane's market treadmill theorem, which manifests with the negative relation between the productivity and incomes did not occur in the European agriculture in the analysed period, 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 the bigger pressure of global prices then in the EU-12, although the effect of productivity on incomes is stronger in the "new member countries".

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

- In order to fulfil one of the main objectives of the CAP, which is "ensuring fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture", the BPS should be gradually substituted by the system recalling SAPS;
- Policy designers should look for the new CAP solutions which will mitigate the problem of relative deprivation of agricultural incomes. They should also reconsider a role of decoupled payments in the EU. Shall they have a social dimension, a compensatory meaning, or maybe their role shall be limited to the payments for providing public goods only?
- Negative correlation between agricultural subsidies and agricultural incomes in the EU-15 should be subjected of deeper analysis.

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## Appendix

Table 5. Relative income deprivation index in 27 EU Member States (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 6. Ratio of subsidies for agriculture to the value of agricultural output in 27 EU Member Countries (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.