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AGRICULTURAL TOTAL FACTOR PRODUCTIVITY CHANGE AND ITS DETERMINANTS IN EUROPEAN UNION COUNTRIES

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Abstract

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The present study concerns the measurement of changes in agricultural total factor productivity in 27 European Union (EU) countries. The analysis included the years 2007--2011. The study was conducted based on Malmquist productivity index completed with decomposition on technological changes and technical efficiency changes. In addition, the determinants of total productivity were identified in the study, and econometric modeling of their effect on total factor productivity (TFP) was conducted using Tobit model. The study demonstrated a small increase in agricultural TFP for the whole sample of 27 EU countries over the examined period. The reason of this increase was mainly the changes in technical efficiency. An effect of technological changes was in turn relatively low and of negative character. The analysis of the factors determining TFP changes demonstrated that factors like: percentage of farm managers with complete agricultural education, average farm area and economy openness measured as a ratio of total export to total import are the stimulants. In turn, the variable like the share of farm managers aged above 55 years appeared to be dissimulated. It is worth to emphasize that soil quality, additional payment to investments and number of students' in agricultural and related fields of study was insignificant from the total productivity changes point of view.

Key words: agricultural productivity, Total Factor Productivity (TFP), technical progress, technicalefficiency, European Union

Introduction

Economic development of countries results in a decreasing share of agricultural production in the Gross Domestic Product (GDP) structure. On the one hand, this is conditioned by a low elasticity of agricultural products demand, on the other hand by low efficiency of production factors in the agriculture in relation to other economic sectors, whereas an improvement in agriculture productivity is a prerequisite forstable economic development (O'Donnell, 2010). An ability of effective utilization of production factors, mainly capital and human resources, is also a measure of competitiveness (Domanska, 2013). The European Commission perceives the productivity as the most reliable factor of competitiveness over a long period (European Commission, 2009).

Productivity is most often defined as an ability of production factors for manufacturing (Latruffe, 2010). In turn Prokopenko (1987) defines it, generally, as a relationship between revenues generated by the production or service system, and outlays essential for these revenues obtaining, while in more detail he determines it as "an effective application of resources – labor, capital, land, materials, energy, and information in various goods and services production". Olayide and Heady (1982) define agricultural farm productivity as "the ratio of total production to the value of total outlays applied on the farm".

An analysis of productivity is a key issue from its improvement possibility point of view. It constitutes a very useful tool of management at each economic level: micro, meso as well as macro. At the national and sector level, productivity indices allow for evaluating the results of management and quality of social and economic policy (Prokopenko 1987). Productivity may be measured using partial indices related to particular production factors or as total productivity (Nowak 2011). Partial measures are useful and informative, but their disadvantages are obvious limitations when compared to total

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measures (Headey et al., 2010). Moreover, they overvalue total productivity increase not taking into account the changes in the outlays of other production factors. The methods based on total factor productivity (TFP) are a more complex approach to the problem of productivity in agriculture. In order to estimate the TFP, an increase in total inputs (land, labor and capital) is compared to production growth (Fuglie and Wang, 2013). These methods have been gaining and increasing popularity also because scientists and decision-makers are interested not only in the level of agricultural productivity, but also in all of its growth sources. Moreover, as noticed by Newman and Matthews (2007), the main reason for the differences in the trends concerning cost competitiveness are the differences in the rate of productivity increase.

Malmquist index, based on the function of production maximization, is used inter alias for the measurement of

Table 1
Review of the research concerning agricultural productivity using Malmquist index

Author	Period included in the study	Countries included in the study	Results of the study
Coelli and Rao (2005)	1980-2000	93 developing and developed countries	An annual growth in total factor productivity growth of 2.1 percent, with efficiency change (or catch-up) contributing 0.9 percent per year and technical change (or frontier-shift) providing the other 1.2 percent.
Rungsuriyawiboon and Lissitsa (2007)	1992-2002	EU 15; EU 10; "Transition countries"	The weighted average TFP growth in the European agriculture over the study period grew at 1.527 percent per annum which was driven by –0.027 percent in technical efficiency change, 1.496 percent in technical change and 0.054 percent in scale efficiency change.
Brümmer et al. (2002)	1991-1994	Poland, Germany and the Netherlands (the case of dairy farms)	Polish farms experienced a productivity deterioration of about 5%, mainly due to a technological regress of about 7%. In the same period the authors identify a productivity increase of about 6% for German farms and of about 3% for Dutch farms.
Latruffe et al. (2008)	1996-2000	Polish farms	Over the whole period, the average TFP change and technological change was respectively -2% and -6%.
Galonopoulos et al. (2011)	1966-2002	32 European and Mediterranean countries that formed part of the Euro-Mediterranean Free Trade Zone	There are two clubs of performers: a high productivity club including mainly EU-15 countries and CEECs, and a low productivity club that consists of Albania, Algeria, Libya, Morocco, Tunisia and Syria.
Fogarasi and Latruffe (2009)	2001-2004	France and Hungary (farms in the dairy and cereal, oilseeds and protein seeds (COP) sectors)	In both the dairy and the COP sectors, Hungarian farms' technology was the more productive, despite a technological deterioration.
Ludena et al. (2007)	1961-2001	116 countries in FAO	Average annual agricultural TFP growth increased from 0.6% to 1.29% between 1961–1980 and1981–2001.
Tong et al. (2012)	1993-2005	China	On average, TFP growth in Chinese agriculture during 1995-2003 was a robust 3.97% annually, compared with 1.73% in US agriculture during the same period.
Nin-Pratt and Yu (2012)	1961-2006	Sub-Saharan Africa (26 countries)	For a sample of 26 SSA countries annual growth in 1961-2006 was almost zero (0.18%). From the mid-1960s to the mid-1980s the productivity growth was negative (-1.08% per year). Recovery starts in 1984-1985 and extends up to 2006 (annual rate of 1.45%).

productivity changes over a period of time (Trueblood and Coggins, 2003). Unlike the conventional function of production and other indices, this index distinguishes two sources of productivity increase – changes in technical efficiency and changes in production technology. It is widely used in the studies, both with respect to agricultural farms, as well as to regions, countries or groups of countries. The results of research conducted using Malmquist index are presented in Table 1.

A significant element in the analysis of agricultural productivity changes is an assessment of the factors affecting these changes. Taking into account the fact that classical production factor outlays are considered in Malmquist index calculation, productivity changes should be explained using other variables, which may be related to the quality of production factors orto the environment. Study by Raoet al. (2004) point towards productivity determinants such as soil quality, illiteracy rate, governmental expenses (% GDP), total export and total trade (%GDP). In another earlier study, significant role of research-development activity and governmental support of agricultural sector has been emphasized (Darku et al., 2012). Headey et al. (2010) examined the determinants of an increase in agricultural total productivity and presented additional variables related to the policy towards the agriculture and institutional elements, including public expenditures on the agriculture. Isaksson (2007), based on a relatively wide literature review in micro- sector and macroeconomic aspect, identified a few variables affecting TFP increase. Some of the most important variables are education, health, infrastructure, import, institutions, economy openness, competitiveness, financial development, geographical localization and ability of absorption. Danquah et al. (2011) in turn, based on the conclusions from empirical studies, deduced that the strongest determinants affecting TFP increase are: inability to identify heterogeneity, initial GDP, sharing consumption and trade openness.

Materials and Methods

We calculate agricultural productivity changes and its components for a sample of 27 European Union (EU) countries over the period 2007-2011 using data from the EUROSTAT datasets. Our measure of aggregate output includes production value of the agricultural sector at basic price. In turn, aggregate inputs are agricultural labor, capital and land. Labor input is measured in annual work unit, which corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis. Capital input is retrieved from capital flow, which encompasses intermediate consumption, i.e. physical inputs for crop and livestock production and overall production inputs, as well as amortization. Land input denotes to stock of utilized agricultural area.

We deploy Malmquist index to calculate and decompose total factor productivity (TFP) change. As noted by Caves et al. (1982) the output-oriented Malmquist index is often defined as geometric mean of two indices. That is:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\left(\frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}\right)\left(\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^t, y^t)}\right)\right]^{\frac{1}{2}}$$

The notation $D^t(x^t, y^t)$ represents the distance from the period *t+1* observation to the period *t* technology and (x^t, y^t) is the input-output vector in the *t*-th period. A value of M_o greater than 1 indicates TFP growth from period *t* to period *t+1*, whereas a value less than one indicate TFP deterioration.

The above productivity index may be rearranged in the following way:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \left(\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}\right)\left[\left(\frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})}\right)\left(\frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)}\right)\right]^{\frac{1}{2}}$$

The first bracket measures the change in relative efficiency, i.e. the change in the distance of observed production from maximum potential production, between years *t* and *t+1*. The square bracket indicates technical change, i.e. the shift in technology between two periods.

Although there are a number of possible decompositions of these efficiency change and technical change (Coelli et al., 2005), we use a decomposition proposed by Fare et al. (1994). This decomposition is widely used in empirical studies, despite its shortcomings (Balk, 2003).

According to Fare et al. (1994), the decomposition becomes:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = TECHCHxPEFFCHxSCH$$

The notion TECHCH denotes to technical change, PEFFCH relates to pure efficiency change and SCH represents scale change. The pure efficiency change and the scale change are decomposition of efficiency change measured relative to constant returns to scale (CRS) frontier. The pure efficiency change is efficiency change calculated under variable returns to scale (VRS). The scale efficiency change component is actually constructed as the distance function satisfying CRS to the distance function satisfying VRS.

Following Fare et al. (1994), we calculate the TFP change and its components using non-parametric method, i.e. Data Envelopment Analysis (DEA). For each unit/country we have to solve four different linear-programming problems: $D_o^t(x^t, y^t)$, $D_o^{t+1}(x^{t+1}, y^{t+1})$, $D_o^{t+1}(x^t, y^t)$ and $D_o^{t+1}(x^{t+1}, y^{t+1})$ to calculate TFP change between period *t* and *t+1* relative to CRS technology. To derive the full decomposition, we calculate additional two programming problems, i. e. $D_o^t(x^t, y^t)$ and $D_o^{t+1}(x^{t+1}, y^{t+1})$, relative to VRS technology. Linear programming equations can be written as follows:

$$[D_o^{t+1}(x^{t+1}, y^{t+1})]^{-1} = max_{\phi,\lambda}\phi,$$
$$st \quad -\phi y_{i,t+1} + Y_{t+1}\lambda \geq 0$$
$$x_{i,t+1} - X_{t+1}\lambda \geq 0$$
$$\lambda \geq 0$$
$$[D_o^{t}(x^{t}, y^{t})]^{-1} = max_{\phi,\lambda}\phi,$$
$$st \quad -\phi y_{it} + Y_{t}\lambda \geq 0$$
$$x_{it} - X_{t}\lambda \geq 0$$
$$\lambda \geq 0$$
$$[D_o^{t+1}(x^{t}, y^{t+1})]^{-1} = max_{\phi,\lambda}\phi,$$
$$st \quad -\phi y_{it} + Y_{t+1}\lambda \geq 0$$
$$x_{it} - X_{t+1}\lambda \geq 0$$
$$\lambda \geq 0$$

and

$$[D_o^{t}(x^{t+1}, y^{t+1})]^{-1} = max_{\phi,\lambda}\phi,$$
$$st \quad -\phi y_{i,t+1} + Y_{t}\lambda \geq 0$$
$$x_{i,t+1} - X_{t}\lambda \geq 0$$
$$\lambda \geq 0$$

Once TFP change is computed, the next step is to investigate its drivers. To identify the determinants of TFP change, we use a Tobit model. We deploy this approach due to the properties of dependent variable, i.e. TFP change, which is censored. The model is specified as follows (Greene 2006):

$$y_i^* = x_i'\beta + \varepsilon_i$$
$$y_i = a \;\; if \;\; y_i^* \leq a$$
$$y_i = y_i^* \;\; if \;\; y_i^* > a,$$

where a is certain threshold, y_i^* is a latent variable implying the TFP change rate related to the ith country in the year 2010, x_i' is a vector of regressors described below and ε_i is the error term that is assumed to be normally distributed. In the model we introduce seven independent variables that are considered to be highly relevant for TFP change. These variables are as follows:

x_1 - average farm size in ha,

x_2 - soil productivity indexexpressed in relative terms where the score 1 represents the poorest and 8 the highest productivity soil,

x_3- percentage of farms managers with full agricultural training,

x_4- percentage of farms managed by holders over 55 years,

x_5-number of tertiary students in the field of agriculture, forestry and fishery,

x_6-value of investments grants per ha in euro,

x_7- ratio of total export to total import.

All independent variable used in the analysis are derived from Eurostat datasets and they refer to the year 2010 except for the soli productivity index, which due to the data availability denotes to the year 2006.

Results and Discussion

Table 2 presents geometric mean of total factor productivity (TFP) index for particular EU countries from the years 2007-2011 with decomposition on technological changes and technical-efficiency changes.

Analysis of the indices established for 27 EU member countries points towards small (2.4%) increase in total agricultural productivity during the investigated period. It may be noticed that this increase was mainly affected by the technical efficiency (index was 1.035), which in turn was positively affected by the scale efficiency changes. The index of technology changes was in turn at the level of 0.990. This may be explained by the fact that an improvement in production technique seems to be easier on macroeconomic level than new technologies implementation. Technological changes, in general, concern the progress in the state of knowledge and are composed of three related forces: research and development, acceptance and diffusion, institutional factor (OECD, 1995). Moreover, an important feature of the changes in technology is the necessity of existing process adaptation via new means acquisition (usually those of mechanical character), which requires an engagement of additional financial means. In order to be effective, some technologies require additionally a suitable production scale, which impedes their implementation in many entities, especially in the countries of considerable agrarian disintegration.

The results of the study demonstrate that an increase in total productivity was noted in 15 EU member countries. In two countries (Bulgaria and Lithuania), the productivity did not change (TFP index was 1.000), while a decrease in the analyzed factor was observed in ten countries. However, the differences in the level of Malmquist index between the countries where an increase in total productivity index was noted are relatively small. The highest productivity increase during the examined period may be observed in agriculture in Ireland, where the examined index reached 1.146 and was an effect of both production technology changes and technical efficiency.

An increase in total productivity level was higher than the average level estimated for all 27 European Union countries only in the case of five countries such as Czech Republic, Denmark, Germany, Ireland and Cyprus. Ireland, where TFP index was the highest, obtained a result higher of 11.9% compared to EU-27, while the result for Cyprus and Denmark was higher of 4.3 and 2.8%, respectively. In Czech and Germany in turn, an increase in total productivity level was only slightly higher than the level obtained in the whole EU during the examined period, of 0.3 and 0.6%, respectively. It should be noticed that a productivity increase in the mentioned countries was affected to a great degree by technology changes, not by technical efficiency dynamics.

Productivity decrease in the analyzed period was most often an effect of unprofitable changes in technology and more rarely a decrease in technical efficiency. Total productivity in agricultural sector was subject to the highest decrease in Greece (4.8%), where the agriculture is characterized by considerable agrarian disintegration. It is concurrently one of the countries that, to the highest degree, were affected by the global economic crisis which started in 2007. Ireland, where total productivity dynamics was the highest in the examined period, had an advantage in relation to Greece in terms of an absolute value, reaching 19.4 percentage points, and 20.4% in relative value.

In so-called "old 15" countries, the highest increase in agricultural productivity, except Ireland, was noted in Denmark

Table 2
The changes in total productivity (TFP) of EU countries agriculture in the years 2007-2011 with decomposition on technological changes and technical-efficiency changes

No.	EU member country	Technical-efficiency change	Technical change	Pure efficiency change	Scale-efficiency change	TFP change
1	UE-27	1.035	0.990	1.000	1.035	1.024
2	Belgium	0.988	0.992	0.989	0.999	0.980
3	Bulgaria	1.000	1.000	1.000	1.000	1.000
4	Czech Republic	0.992	1.035	0.985	1.007	1.027
5	Denmark	1.000	1.053	1.000	1.000	1.053
6	Germany	1.008	1.022	1.000	1.008	1.030
7	Estonia	1.000	1.003	1.000	1.000	1.003
8	Ireland	1.062	1.079	1.062	1.000	1.146
9	Greece	0.978	0.973	0.986	0.992	0.952
10	Spain	1.000	0.995	1.000	1.000	0.995
11	France	1.002	1.017	1.000	1.002	1.019
12	Italy	1.011	0.985	1.006	1.005	0.996
13	Cyprus	1.000	1.068	1.000	1.000	1.068
14	Latvia	1.000	0.989	1.000	1.000	0.989
15	Lithuania	1.000	1.000	1.000	1.000	1.000
16	Luxemburg	0.962	1.007	1.000	0.962	0.968
17	Hungary	1.005	0.992	0.990	1.015	0.997
18	Malta	1.006	0.997	1.000	1.006	1.003
19	Netherlands	1.000	1.005	1.000	1.000	1.005
20	Austria	1.013	0.995	1.013	1.000	1.007
21	Poland	1.000	0.988	1.000	1.000	0.988
22	Portugal	1.007	0.981	1.005	1.002	0.988
23	Romania	1.007	0.981	1.000	1.007	0.988
24	Slovenia	1.033	0.971	1.032	1.001	1.003
25	Slovakia	1.000	1.008	1.000	1.000	1.008
26	Finland	1.016	1.002	1.016	1.000	1.018
27	Sweden	1.004	1.012	1.008	0.997	1.016
28	United Kingdom	1.000	1.008	1.000	1.000	1.008

(5.3%), while in countries such as Belgium, Italy, Luxemburg, Spain, Portugal and Greece, a decrease in TFP was observed.

Among the countries newly affiliated to the EU, the highest productivity increase during the analyzed period was noted for Cyprus and Czech Republic. The source of this improvement in both cases was production technology changes. Small improvement in total productivity was also observed in Estonia, Slovenia, Slovakia and Malta. A decrease in production efficiency being an effect of unprofitable changes in technology was noted for countries like Poland, Latvia, Hungary and Romania. This may be explained by the fact that an implementation of technological progress in these countries not only requires structural transformations including optimization of work resources, but also the quality changes, and especially an improvement in farmers' knowledge and qualifications. These transformations are a difficult and long-lasting process, which are further limited due to financial crisis.

Table 3 presents the results of Tobit model parameters estimations, demonstrating the relationships between selected factors and the changes in total productivity in EU countries in the year 2010. The method of backward elimination was applied in order to remove insignificant variables from the model.

The conducted study shows that productivity changes in EU countries were positively affected by the factors like: percentage of farm managers with complete agricultural education, average farm area and ratio of total export to total import. The last of variables mentioned above, reflecting the degree of economy openness, had the highest influence compared to other ones. Similar relationship between this factor and TFP was observed in the study of Rao et al. (2004). It is assumed that the more open is the economy; the highest is the probability of an adaptation of new technologies derived from abroad. Despite this, economies of high degree of openness are characterized by efficient labor force and commodity markets, which lead to more reasonable resource allocation and higher productivity. Open economy also favors scale economies achievement due to sale in foreign markets. An increase in production scale allows for cost reduction, and thus leading to productivity increase (Suphannachart and Warr, 2012).

According to the expectations, the level of agricultural education of farm managers also affects total productivity. The education is the basic index of quality of human capital, and this in turn constitutes a significant factor of innovations creation in production. Human capital plays a special role in managing result improvement, especially in the aspect of efficient management and organization of other production factors, i.e. land and capital. The confirmation of this thesis may be found in the study conducted by Makki et al. (1999). The authors reason that the competences acquired during the course of education process increase the ability of the farmers for information processing and allow proper choice and utilization of new technologies. Thus, people with complete agricultural education have usually better knowledge concerning new technologies and more reasonable ways of combining available resource, and therefore are able to improve their agricultural productivity.

Third of the factors positively affecting TFP is the average farm size – its effect on productivity was the lowest among determinants mentioned above. Production scale increases along with the farm size increase, which is reflected in more reasonable utilization of available resources resulting in an increased productivity. Relatively low significance of farm size in TFP growth may point "depletion" of returns to scale compared to the farms in the EU countries. It is also noteworthy that farm size is still a predominant growth determinant in developing countries (Rahman and Salim, 2013). Attention should be however paid to the fact that predominance of small-area farms small is a desirable feature from sustainable agriculture development point of view of, which is cur-

Table 3
Parameters and test values of Tobit regression

Variable	Coeff.	Z - value
Constant	1.0845***	14.89
X_1 percentage of farms managers with full agricultural training	0.00227**	2.013
X_2 percentage of farms managed by holders over 55 years	-0.00225**	-2.244
X_3 number of tertiary students in the field of agriculture, forestry and fishery	x	-
X_4 soil productivity index	x	-
X_5 average farm size in ha	0.0007***	2.650
X_6 value of investments grants per ha in euro	x	
X_7 ratio of total export to total import	0.0927***	3.042
Log-likelihood=47,27 Chi-square(4)=26,50***		

Notes: x – eliminated variable, ** and *** indicate significance at the 5% and 1% level rently considered as a priority in EU policy (Europe 2020). Extensive production methods used such kind of farms favor and rational management of natural resources and biodiversity maintenance. Such approach causes the need of taking into account not only economic aspects (e.g. productivity improvement), but also social and environmental ones.

Negative influence on total productivity was only noted for one of the examined variables, i.e. contribution of farm managers aged above 55 years. It may be supposed that the individuals above this age are less prone to risk and introduction to changes, including various kinds of innovations, which does not favor productivity improvement. Taking into account positive effect of complete agricultural education, it should be concluded that education is of a higher significance for TFP growth that long-term experience.

Such variables like soil quality, additional payments to investments and number of students in agricultural and related fields of study appeared to be insignificant from the point of view of total productivity changes. Lack of soil quality effect on TFP may be explained by the fact, that due to suitable fertilization or plants selection, high production results may be obtained even on poorer quality soils. Insignificance of additional payments for investments for total productivity changes may in turn result from two reasons. Firstly, the effects of obtaining these payments may be delayed in time due to the long-term aspect of investments. Secondly, an increase in resources being an effect of an application of additional payments for investments may lead to an excessive increase in production capacity, which in numerous farms may not be fully utilized. In case of an increased number of the students on agricultural and related fields of study, the reason for the lack of significance for TFP changes may be due to the fact that not all these people find an employment in agriculture. Parts of them are employed in other branches of widely perceived agribusiness, e.g. institutions related to agriculture, agricultural and food industry, industry of production means for agriculture, etc.

Conclusions

In this study, the measurement of agricultural total productivity for 27 EU countries in the years 2007--2011 was performed. Malmquist productivity index with decomposition on technological changes and the changes in technical efficiency was used for this purpose. Moreover, the factors determining the changes in total productivity were identified, and econometric modeling of their effect on TFP was conducted using Tobit model. The study undertaken by us constitutes a significant contribution in the literature from the range of agricultural productivity for three reasons. Firstly, the range of the study included a community of 27 EU countries. According to our knowledge, no study in such a scope has been conducted so far. Secondly, this study concerns the changes in total productivity level. This measure allows taking into account an effect of all main production factors in the agriculture, i.e. labor, soil and capital. Thirdly, determinants of TFP changes identified and used in econometric analysis involve a relatively wide set of variables approximating the quality of production factors and external conditions of EU agricultural farms functioning.

The results of the study point that small increase in total agricultural productivity was noted in the whole community of 27 EU member countries during the examined period. This increase resulted from the changes in technical efficiency. In turn, an influence of technological changes was relatively low and of destimulating character. Taking into account the factors determining TFP changes, it should be noticed that the stimulants were factors like: percentage of managers with full agricultural education, average farm size and ratio of total export to total import. The share of farm managers older than 55 years may be in turn considered as a destimulant. It is worth to emphasize that the variables such as: soil quality, additional payments to investment and number of students on agricultural and related fields of study appeared to have the insignificant impact on total productivity changes.

The results obtained allow formulating a few recommendations for community policy towards agriculture. Firstly, there is a need of public support for the investments in research and development (R&D) to help enhance the technical progress in agriculture. According to the study of Makki et al. (1999), R&D financed from public means has a crucial effect on agricultural productivity changes. This is mainly a result of an occurrence of positive external effects related to new technologies diffusion (Kijek and Kijek, 2010). Secondly, education policy should be focused on improving farmer’s agricultural qualifications. The investments in human capital directly contribute to agricultural productivity increase by an improvement of utilization of available production factors and higher ability of new technologies absorption. Thirdly, the problem of an excessive fragmentation of agrarian structure in some EU member countries should be taken into account in the process of common agricultural policy programming, since an increase in farms size allows obtaining scale and ranging profits. The activities in this range should be however coherent with idea of sustainable development. Finally, a formation of open economy conditions via trade barriers limitation constitutes the prerequisite of agricultural improvement in EU countries. On the one hand, economy openness allows for new technology transfer, and on the other hand it forces higher effectiveness in agricultural production.

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