118th EAAE Seminar

"Rural development: governance, policy design and delivery"

Ljubljana, 25-27 August 2010

FACTORS AFFECTING FARM PRODUCTIVITY IN BULGARIA, HUNGARY, POLAND, ROMANIA AND SLOVENIA AFTER THE EU-ACCESSION AND LIKELY STRUCTURAL IMPACTS

Monica Campos [*], Tina Jaklič [†], Luka Juvančič[† ‡],

[*] **Lund University, Department of Organic Chemistry, Box 124 SE-22100 Lund, Sweden**

[†] **University of Ljubljana, Biotechnical faculty, Zootechnical Department, Chair for Agricultural Economics, Policy and Law, Groblje 3, SI-1230 Domžale, Slovenia**

[‡]**Corresponding author: luka.juvancic@bf.uni-lj.si**

Paper prepared for presentation at the 118th seminar of the EAAE

(European Association of Agricultural Economists),

'Rural development: governance, policy design and delivery'

Ljubljana, Slovenia, August 25-27, 2010

Abstract

The paper is investigating the recent evolution of farm productivity in five EU New Member States (NMS): Bulgaria, Hungary, Romania, Poland and Slovenia. More precisely, the paper deals with determinants influencing farm productivity in a changing market and policy environment brought by their full integration to the CAP. With a combination of multivariate statistics and econometric techniques, it attempts to identify and explain the patterns of agricultural labour productivity change in the period 2003-2005. Results suggest that adjustment patterns are diverging and are region-specific, depending mainly on the initial farm structural conditions, and availability of non-farm jobs. Policy implications of the paper suggest that agricultural policy should move away from the concept of transfers to agriculture to more pro-active role in creating conditions for job creation in rural areas.

Key words: structural adjustment, farm productivity, farming types, EU-accession

JEL Classification: Q12, R11

1. Introduction

The transition from central planning to market-oriented economies in CEE and the Commonwealth of Independent States (CIS) brought along profound changes in agriculture and rural economies. Profoundness, scale and pace of structural changes are surpassing the known experience (Deininger 2002).

In view of the magnitude of the change and of the heterogeneity of initial conditions, it is hardly surprising that today, more than two decades after formal end of the socialist economic experiment, rural economies in countries undergone economic transition differ a lot, probably more than they did before transition started. Different modalities of transition, together with factors, such as different policies for land property rights, degrees of control of land rental and sale markets, procedures for restructuring former collective or state farms, contributed to the today's diversity of farm structures.

Today there is no universal model of post-transition rural economies. Rather than this, already in the CEE countries which are regarded as relatively advanced in terms of economic transformation, one can meet radical differences: from relatively large and efficient agricultural enterprises in Czech Republic to small-scale subsistence-oriented agricultural households in North-East Bulgaria, from highly specialised large-scale family farms in former Eastern Germany to diversified small-scale family farms in Slovenia.

The situation encountered opens many questions. What were the main causes that triggered so diverse paths of transition? Can we point out, which models of transition proved to be more successful in forming efficient agricultural sectors and vibrant rural communities? In addition to this, it would be beneficial to understand, what are the immediate outcomes, and future implications for agricultural structures with regard to the recent EU-accession, and adoption of the Common Agricultural Policy (CAP). Did the EU accession affect trajectories of structural adaptation? What can we expect – a unique pattern of structural adjustment in agriculture, or rather a plethora of different pathways?

This paper is addressing some of the above questions from the perspective of changing farm productivity and farming types in five CEE countries recently acceding to the EU (NMS-5): Bulgaria, Hungary, Poland, Romania and Slovenia.[1] To the best of our knowledge, no such empirical analysis

[1] The authors gratefully acknowledge the financial support of the European Community under the Sixth Framework Programme for Research, Technological Development and Demonstration Activities, for the Specific Targeted Research Project "SCARLED" SSPE-CT-2006-044201 (www.SCARLED.eu).

has been done for a group of Central and Eastern European countries (CEE). Obviously, various aspects of structural change in agricultural and rural sectors of countries undergone economic transition have been extensively covered in reports of international organisations (FAO, World Bank, OECD, European Commission), and in scientific literature (Lerman 2000, Swinnen et al. 2005, Sarris et al. 1999, just to mention some). Most of these reports are focusing on the period prior to the EU accession. Having this in mind, it is therefore tempting to explore the more recent, maybe even EU accession – induced structural developments.

The paper is organised as follows. It starts with an observation of statistical evidence on farm productivity changes in analysed countries, and on a number of factors that are likely to affect these changes. Different pathways of structural adjustment in terms of farm labour productivity are then analysed and interpreted by a combination of multivariate statistical and econometric techniques. The paper concludes with a discussion on policy implications.

2. Farm labour productivity and its likely determinants – a review of statistical evidence

The choice of the most appropriate measure for farm labour productivity and its likely determinants has been guided by theoretical and empirical evidences obtained from the literature (Feder, 1985; Choudhry, 2009). As for dependent variable, productivity in agriculture, literature suggests using total factor productivity as the most suitable measure. Since this data is seldom available, particularly on regional level, Lerman et al. (2002) suggest that, in the absence of such data, a partial measure of productivity should be calculated as the ratio of agricultural output to agricultural labour. Secondary statistical data at the NUTS-3 level offer two alternative ways of defining labour productivity of agriculture. One is expressed in European size units (ESU[2]) per Annual working hour (AWU[3]). Economic Accounts for Agriculture (EAA) offer us another alternative. Labour productivity in agriculture can be illustrated also as gross value added (GVA) per person employed in agriculture.

Data at the regional level (NUTS3) is collected for five EU New Member States: Bulgaria, Hungary, Romania, Poland and Slovenia for the years 2003 and 2005. This is the only period for which data at NUTS3 level are available for all five analysed countries. The database has a disadvantage with respect to time discontinuity and information at farm level. It is thus not possible to conduct time series analysis which is the normal case when analysing changes in productivity. Estimates then only indicate the power of the different variables to explain differences in productivity among countries and between these two time periods, and do not contribute to our understanding of the causes of changes in productivity over time in individual countries/regions. Such estimates would

---

The views expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

This paper is an excerpt of D.5.2 “Impacts of structural change and structural policies on rural labour markets” of SCARLED, authored by Juvančič et al. (2010).

[2] For each activity ("enterprise") on a farm (for instance wheat, dairy cow or vineyard), a standard gross margin (SGM) is estimated, based on the area (or the number of heads) and a regional coefficient. The sum of such margins in a farm is its economic size, expressed in European Size Units (ESU, 1 ESU is a 1200-euro standard gross margin) (http://epp.eurostat.ec.europa.eu).

[3] The total annual working time of the persons employed in agriculture is converted into "annual work units" (AWU). One AWU is taken to be the minimum number of hours per year laid down in the national collective agreements. If the number of hours is not laid down in these agreements, 2 200 hours are taken as the basis for one AWU up to the 1987 survey. For subsequent surveys the AWU is based on 1 800 workings hours per year (http://epp.eurostat.ec.europa.eu).

require time series or panel data, which are not available. Another disadvantage of the database with regional data are limited possibilities in inclusion certain potentially important qualitative factors, which are of course not available from the Eurostat Farm Structure Survey (FSS) database e.g. farmer's managerial behaviour, risk aversion and financial assets, in the analysis. Despite this drawback, the databases can be are used at least to statistically verify the tangible factors that influence farm structural change in terms of labour productivity.

The explanatory variables are divided into three categories of indicators: economic development and other regional conditions, regional characteristics of the farm sector, and indicators of regional conditions on human capital in agriculture. In principle, economic development is applied by GDP per capita, which is an estimate of the sum of all economic activities in a region, calculated as the value added by production in all sectors. This measure is widely used to gauge economic prosperity and growth. Structure of regional economy is denoted by the share of Gross value added (GVA) from agriculture and by the share of agricultural employment in the region. Population density in a region indicates remoteness/rurality of the region, whereas natural conditions for agricultural production are partially represented in the share of Less favoured area (LFA) in a region. Furthermore, regional characteristics of the farm sector are applied in labour productivity in the region in 2003, as a starting level of labour productivity, in level of farm specialization, share of farms operating mainly for own consumption and share of farms benefiting from investment aids. Finally, explanatory variables for human capital are ratio between young farm operators and aged farmers, share of holders working full time on a farm, and share of holders with full agricultural training.

Farm productivity changes in analysed countries between 2003 and 2005 as well as factors that are likely to affect these changes are presented in the table below. The data is presented at a country level.

Table 1: Selected FSS and relevant other statistical data by country and year

	Year	Bulgaria	Hungary	Poland	Romania	Slovenia
ESU/AWU (labour productivity)	2003	1.35	3.34	3.43	1.87	3.71
	2005	1.49	4.20	3.63	1.80	3.72
GDP p.c.	2003	2,300	7,300	5,000	2,400	12,900
	2005	2,800	8,800	6,400	3,700	14,400
GVA agriculture / GVA total	2003	0.09	0.03	0.02	0.11	0.02
	2005	0.07	0.02	0.02	0.08	0.02
Employment in agriculture (%)	2003	10.08	5.35	18.42	35.96	8.37
	2005	8.93	4.87	17.37	32.29	9.07
Share of LFA (ha)	2005	0.49	0.51	na	0.72	na
Average farm size (ha)	2003	4.36	5.63	6.64	3.11	6.31
	2005	5.11	5.97	5.96	3.27	6.29
Average economic farm size (ESU)	2003	1.62	2.27	3.46	1.14	4.60
	2005	1.74	2.72	3.34	1.10	4.59
Labour input (AWU) per farm	2003	1.19	0.68	1.01	0.61	1.24
	2005	1.17	0.65	0.92	0.62	1.23
Specialised farms (share)	2003	0.47	0.62	0.54	0.44	0.37
	2005	0.56	0.61	0.55	0.40	0.44
Benefiting from investment aid (share)[1]	2005	0.00	0.02	0.03	0.00	0.05
Farm holders engaged in agriculture full time (share)	2003	0.27	0.06	0.29	0.04	0.15
	2005	0.25	0.06	0.18	0.01	0.18
Age of farm holders: ratio35/65	2003	0.13	0.20	na	0.24	0.11
	2005	0.10	0.29	0.74	0.12	0.13
Share of farm holders with full training in agriculture	2005	0.01	0.08	0.16	0.01	0.07
Share of farm holders with basic training in agriculture	2005	0.04	0.05	0.22	0.06	0.21
Share of farm holders with only practical experience in agriculture	2005	0.95	0.87	0.61	0.93	0.72

[1] data only available since 2005

Statistical evidence shows that Hungary witnesses the highest labour productivity among the analysed countries in 2005, as well as the highest increase from 2003 level. Higher returns on labour are also observed for Poland and Slovenia, partly due to the structure of agricultural production (intensive livestock prevailing in Slovenia). Bulgaria and Romania both observe lower returns, whereas Romania in the analysed period records even a slight drop in labour productivity in the sector. This can be due a highly fragmented farm structure and a strong subsistence orientation of agricultural holdings, which lead to the situation, where agriculture is not only an economic, but also an activity that reduces rural poverty.

GDP levels are by no surprise increasing in all the countries. As in the pre-transition, the later GDP figures still reflect some major discrepancies, although slow-moving convergence within the countries and towards EU can be noted. Regarding the structure of employment in the countries, where agriculture still presents more or less significant share of the economy, GVA in primary sector gives a minor contribution to the total GVA of the economy and is, nevertheless, still declining. This is the most expressed in Romania and Poland.

Natural conditions for agricultural production could be potentially also affecting productivity in the region. Statistical evidence shows that Slovenia has the highest share of LFA, mostly due to mountain areas.

The reason for small size farms in the countries lies in skewed farm distribution, where share of small-scale holdings is disproportionately high and their contribution to total agricultural output (measured in ESU) is low. Sharply dual farm structure, with numerous small scale, subsistence-oriented holdings on one side and a strong corporate farm sector on the other, is the most explicitly expressed in Bulgaria and Hungary and less in Romania and Slovenia, although also in this case, about 70% of holdings contribute to only 25% of total output (see Figure 1, Appendix). As revealed from statistical data, the countries showed a decline in total labour input, in Bulgaria, Poland and Hungary labour input rates even clearly outscore the rates of farm number decrease. Since Hungary also records large increase of agricultural output, this suggests a large improvement in labour productivity in this country.

The level of specialisation of agricultural production in NMS-5 is relatively low. Mixed production systems are the most widespread. Crop-livestock system is the most numerous production type in Slovenia (33%), Romania (17%), Poland (19%) and Bulgaria (18%), while Hungary deviates from this pattern. Although the crop-livestock system is numerous (20%), the specialist granivore production is the most strongly represented production type (22%). The period 2003-2005 sought some significant changes in the structure of farm production types. The share of agricultural holdings engaged in specialised crop production has increased in Romania, Bulgaria and Slovenia. Contrary to this, in Poland and Hungary the share of agricultural holdings engaged in specialised plant production decreased. The share of holdings specialised in livestock production increased in Bulgaria, Slovenia and Poland. In Slovenia the increase is due to grazing livestock while in Bulgaria the livestock production raised on account of granivores[4].

Aa a rule, the age structure of farm labour input in the analysed period is worsening. In most of the countries the share of older farm holders and their spouses increased, the exception is only Hungary. The problem of ageing labour input is most vividly expressed in Romania and Bulgaria, where labour input of holders and their spouses above 65 years of age is close to 40% and is in the analysed period even increasing. Again, only Hungary records more favourable and obvious trend where the ageing labour force is superseded by younger generations.

The above data also shows that holders that work on a farm full-time, represent relatively high share in Poland, Bulgaria and Slovenia, whereas Romania and Hungary record much lower shares of such farmers. The share declined drastically in Poland and slightly also in other countries, Slovenia being an exception.

In 2005, about 5 per cent of Slovenian holdings benefited from European investment aids (rural development framework and productive investment framework), whereas the percentage in other NMS at the time was even lower. Romania and Bulgaria were at that time not eligible for such benefits yet.

Further to agricultural education in analysed countries, the majority of holders have no official education. The big majority of holders in Bulgaria and Romania have practical experience only, whereas Poland records relatively high shares of holders with full or basic agricultural training than other countries. Due to absence of data for past years it is not possible to recognise any trend in improving/worsening of agricultural educational structure.

[4] Data was extracted from the Eurostat database with Farm Structure Survey data (see http://epp.eurostat.ec.europa.eu/portal/page/portal/agriculture/data/database) and then aggregated for better clarity of presented data

3. Labour productivity change in NMS-5 in the period 2003-2005

3.1 Cluster analysis

In order to get a better overview of regional data and to classify regions by labour productivity change, we use cluster analysis. The purpose of such analysis is to group regions based on the characteristics they posses. Although this method has no statistical basis upon which to draw inferences, it presents a good exploratory technique and provides better overview of the data.

In our case the essential characteristic for partitioning data and form clusters is labour productivity change in agriculture in period 2003-2005. NUTS-3 regions were clustered based on two dimensions of productivity in the region: change in agricultural output (defined as GVA of agriculture), and change in labour input (defined as agricultural employment). With help of the methods, developed to assist in evaluating the cluster solutions (Malhotra and Birks, 2000), and our expert judgement, the regions were grouped into three clusters.[5] Based on characteristics they possess (see Table and Graph below), they are defined as follows:

- Cluster 1: Regions where labour productivity increased, especially due to increase in GVA;
- Cluster 2: Regions where labour productivity decreased, most often as a combination of a decrease in GVA, and growth (or stagnation) of agricultural employment, but;
- Cluster 3: Regions with the drastic decrease in agricultural employment and stagnating GVA.

Table 2: Definition of clusters based on their performance in terms of agricultural labour productivity change

	Δ GVA/empl.	Δ GVA	Δ agr. empl.
	Mean	Mean	Mean
productivity slightly increased; employment decreased and GVA increased	0.320	0.270	-0.020
productivity decreased; GVA decreased even though employment increased	-0.171	-0.040	0.284
drastic decrease of employment, GVA small increase or stagnating	0.848	0.012	-0.350

[5] Unfortunately, 45 Polish regions remained non-classified due to the problem of missing data.

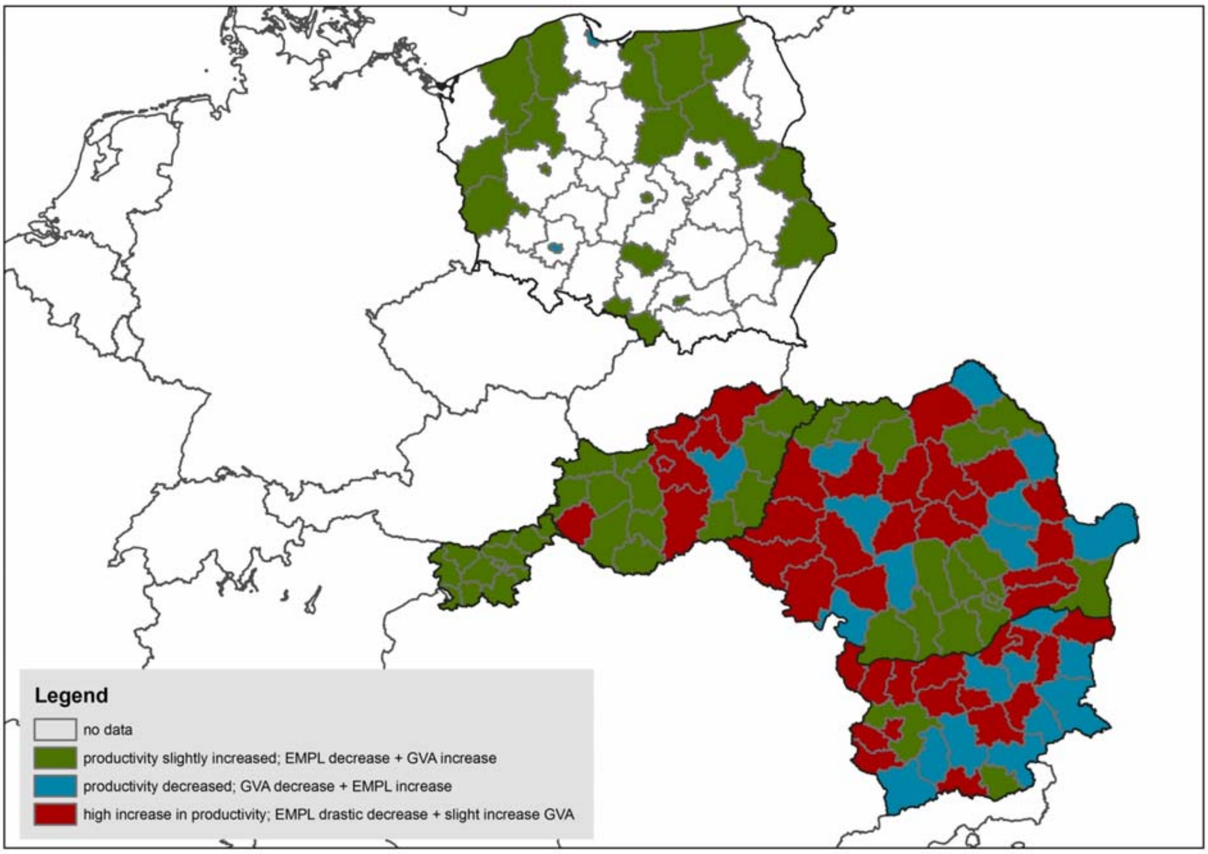

Figure 1: Cartographical presentation of clusters

Further insight in the clusters reveals that first cluster consists of all Slovenian regions and most of the Polish regions, where data was available. Regions in Hungary are also predominantly represented in this cluster, however, the rest of the regions fall into third cluster, together with major share of Bulgarian and Romanian regions. Regions where productivity in the analysed time period actually decreased are mainly Bulgarian and Romanian. Due to mixed cluster representation of Hungarian, Romanian and partly Bulgarian regions, map below, does not reveal any clear spatial clusters.

Although cluster analysis does not provide us sufficient empirical evidence, descriptive statistics of regions that belong to each cluster, offers additional overview of group characteristics as well as directions for further empirical research. From the data below (see Table 3) one can recognise additional differences between groups of regions. Regions from the second cluster, where productivity even decreased, were lagging behind already in 2003. Labour productivity in agriculture in those regions was on average significantly lower than in regions from other two clusters. Not surprisingly, other economic factors show similar picture. Based on these average figures, regions from the second cluster are less developed, with lower productivity, higher share of agriculture in regional economy and lower population density, both indicating a high level of rurality. On the other hand, regions classified in the first cluster seem to reflect just opposite characteristics. Economic significance of agriculture (reflected in agricultural employment, or share of agriculture in GVA) is far below the NMS-5 average. Regions grouped in the first cluster also demonstrate the highest level of agricultural pluriactivity.

Moreover, in terms of farm characteristics, the average farm size (in ha as well as ESU) is on average the highest in first cluster regions. In addition, specialisation figures show that regions from first cluster group have higher share of specialised farms, especially in crop production, whereas the differences in livestock specialisation are not very significant. On the other hand, regions in the second and third cluster appear to have above-average share of subsistence farming. It appears that agriculture still plays an important role of a social buffer in these regions.

Table 3: Comparison of clusters with regard to agricultural structures and socio-economic conditions

	productivity slightly increased (GVA increase)	productivity decreased (GVA decrease)	drastic decrease in employment, GVA stagnating/decreasing	All regions
	Mean	Mean	Mean	Mean
change GVA/employee	0.32	-0.17	0.85	0.408
change ESU/AWU	0.075	0.010	0.125	0.077
GDP per capita (1000 €)	5.48	2.58	3.12	4.49
share agriculture in GVA, 2003	0.09	0.19	0.16	0.129
share agriculture in empl., 2003	0.21	0.31	0.30	0.26
population density	93.43	64.14	92.71	88.03
share of unemployment	17.53	15.93	10.63	15.08
avg. share of net migration (%)	-0.08	-1.45	-1.29	-0.59
avg. farm size 2003, ha	6.44	4.76	4.51	5.92
avg. econ. farm size 2003, ESU	3.15	1.77	1.53	2.76
farms specialised in crops	0.33	0.23	0.18	0.31
farms specialised in livestock	0.21	0.21	0.24	0.20
mixed farms	0.47	0.55	0.57	0.49
share of fubsistence production	0.60	0.71	0.78	0.59
share of other gainful activities	0.39	0.23	0.25	0.31
holders working on farm 0-50%	0.65	0.63	0.64	0.61
holders working on farm 50-100%	0.20	0.24	0.21	0.21
holders working on farm 100%	0.14	0.13	0.15	0.18
holders without formal agric training	0.75	0.91	0.93	0.77
ratio of farm holders above 65 yrs.	0.33	0.42	0.41	0.36

Differences between clusters can also be seen when looking at human capital characteristics. As for other gainful activities, the highest share of holders with such activities is on average in regions from cluster one, where productivity increased due to significant increase of GVA. On average, those regions also have more favourable better age structure as well as higher share of educated farm holders. On the other hand, differences in share of farm holders that work on a farm full time or part time are not that noticeable.

3.2 Econometric specifications and results

In order to test change in agricultural labour productivity econometrically, three categories of indicators for changes in productivity were tested. The selection of explanatory variables is in line with the literature and data retrieval. The functional form is then defined as:

$$Y = \alpha_0 + \alpha_1 \mathbf{x}_1 + \alpha_2 \mathbf{x}_2 + \alpha_3 \mathbf{x}_3 + \varepsilon$$
$$z = \beta_0 + \beta_1 \mathbf{i}_1 + \nu \qquad (1)$$

where in the first equation the subscripts 1, 2 and 3 are the three categories of explanatory variables shown in Table 1, α_0 and β_0 are intercepts, while ε and ν are vectors of error terms in each of the functions, respectively. Regional productivity and economic development, $\mathbf{x}_1$, is explained by labour productivity *labr05* and GDP per capita for 2005, *Gdpr*. Initial farm labour productivity and specialisation at the farm, $\mathbf{x}_2$, is elucidated by labour productivity for 2003, *lab03* and livestock specialisation *animal05* for 2005. Human capital, $\mathbf{x}_3$, is a vector including information on age ratio, *ratio35vs65* and working on the farm, *fulltimeshare* for 2005. The second equation denotes small-farm size z and instrumental variables $\mathbf{i}_1$ as farm size *size03*, *UAA03*, *AWU03* and *ESU03* assumed to be high correlated with endogenous variables in the first equation.

The model comprises also the use of instrumental variables since the number of holdings is assumed to be an endogenous variable. Small farm size up to 5 hectares is the most observed farm size among countries and it is explained by instruments at regional level. See Table 1 for a list of dependent and explanatory variables and abbreviations.

Table 4: Abbreviations and descriptions of variables

Dependent variable	
Lab05	Agricultural labour productivity 2005, holding level
Independent variables	
Lab03	Agricultural labour productivity 2003, holding level
GDPr05	GDP per capita 2005 (economic development - regional level)
Labr05	Labour productivity 2005 regional level
Animal05	Specialisation livestock production 2005 holding level
Ratio3565	Age ratio of farm holders (holders<35 yrs. / holders>65 yrs.)
FTShare	Share of farm holders employed on farm on full-time basis
Endogenous variable	
shold05	Share of small-scale holdings (below 5 hectares)
Instrumental variables	
Size03	Average farm size 2003
UAA03	Utilised agricultural area 2003
AWU03	Annual Work Units 2003
ESU03	Economic size of farms 2003

Weaknesses in the data always imply complications in the estimation of the model. It is clearly that our indicators at the farm level, productivity, specialisation and human capital – regional measures divided by the number of holdings in each region – may violate one of the most important OLS assumptions about uncorrelated error terms with explanatory variables because of endogeneity (see for instance Kennedy 2008). There are two commonly approach in order to avoid endogeneity. The first is to lag the endogenous variable for one or more time periods which is not feasible in this study due to data properties. This approach however is easy to apply but also offers a more difficult interpretation of the indicators. The other approach is to use instrumental variables that are highly correlated with the endogenous variable and estimate a two-stage regression model, 2SLS assuming endogeneity. The instrumental variable approach is widely used when explanatory variables are correlated with the error term. That can be when relevant explanatory variables are omitted from the model or, as in our case, when the independent variables are subject to measurement errors. In that case, ordinary least square computes biased and inconsistent estimates. On the other hand, instrumental variables estimates may be inconsistent if there is a correlation with the error term in the equation of interest. Another difficulty with instrument variables is to select the right exogenous variables being highly correlated with the endogenous variables but not with the rest of the explanatory variables. The strength of the instruments can be directly assessed since both the endogenous variables and the instruments are observable, however restricted by available data. In our model we use small-farm size, up to 5 hectares, *shold05*, which is the most frequent type of farm in the database for 2005, and explain it by regional measures for 2003. Generally, the limited information method 2SLS, bis used to calculate instrumental variable estimates, where in a first stage the endogenous variables in the equation of interest are regressed on all exogenous variables in the model, including the instruments. In a second stage, the equation of interest is estimated by replacing endogenous estimates with the predicted values from the first stage. Another method is the three-stage least square method, 3SLS. This is a full information method based on the 2SLS but goes one stage further, improving asymptotically the efficiency of the error terms of the structural equations. However, if the equations in a system are not simultaneous, the seemingly unrelated regression, SUR can be used to estimate a set of independent equations with correlated errors. The estimation procedure of SUR is similar as in the 2SLS, where at the first stage the equations are independently estimated and then by being re-estimated improving the efficiency of the error terms, if necessary. The advantage of using the SUR instead of 2SLS to calculate instrumental variables estimates is that there is no need of unnecessary assumptions on the model as simultaneous interdependency between equations in the system. Hence, we assume partial endogeneity since there is a systematic error correlation, depending on each of the variables calculated at the farm level, and not because of the relationship between variables. The model is then estimated by SUR, instead of 2SLS. The Hausman test is conducted to test the null hypothesis whether indicators at the farm level are exogenous. That is if SUR with instrumental variables or and ordinary least square regression model, OLS, may be used. A low value of the test statistic suggests the rejection of the alternative hypothesis but if the test rejects the null hypothesis at a higher statistic significant than 10 % level then there are severe endogeneity problems. The results of the tests indicate however that there are endogeneity problems but not severe, p-value 0,706. Hence the model is estimated by SUR. Moreover, heteroskedasticity which also is a common problem due to cross-country data violating one of the classical assumptions of OLS is tested by the White test revealing no heteroskedasticity for all specifications.

Different specifications were tested, considering all information in the database. However, most of the indicators were missing values implying more econometrical misspecifications. Others variables did not contribute to a higher explanatory power of the model. Hence the final model presented in Table 3 is selected due to previous studies and to inference on the available data. The results of the final model are presented in Table below.

Table 5: Estimated results, OLS and SUR

	OLS			SUR	
	Estimate	**t-value**	**VIF**	**Estimate**	**t-value**
Labour productivity					
Intercept	-0.31836	-3.86	0	-0.31112	-3.77
lab03	0.24833	4.69	1.91	0.24525	4.64
GDPr	0.00004	3.67	1.86	0.00004	3.72
labr05	0.40857	4.52	1.68	0.40535	4.48
animal05	0.10976	7.95	1.68	0.10841	7.86
ratio35vs65	-0.13530	-2.55	2.56	-0.14573	-2.74
fulltimeshare	0.69238	3.35	2.17	0.69242	3.35
R-square	71.75			71.73	
White				141.5	
Instrumental variables					
Intercept				0.97252	46.62
size03				-0.0141800	-5.72
UAA03				0.0000004	3.34
AWU03				0.0000017	3.28
ESU03				-0.0000024	-8.78
R-square				64.69	
White				87.15	
Hausman				8.97	

In general, the explanatory powers, described by the R^2 measures in Table 5, are satisfactory. Variables in the models are statistically significant, at least at the 5% significance level.

On the other hand, the model results do not provide us with much additional inferences. The largest part of variability can be explained by the impact of initial conditions and 'standard' explanatory variables, especially those referring to farm characteristics and individual characteristics of farm holders. Impact of general economic development (denoted by regional GDP) is also significant, albeit the model coefficients suggest that this impact is rather weak.

The country dummies were not significant and were thus removed from the model. In contrast to the initial expectations, we can therefore say that country-specific patterns can not be identified. Rather, these pattern are region-specific and may be explained by structural and socio-economic characteristics, discussed in the section with results of the cluster analysis.

Further empirical work is thus needed to formally test, which determinants have the most significant impacts on different pathways of farm labour productivity in NMS-5. However, in order to do so, improvements will be needed especially in terms of quality and availability of FSS data at the regional level. This should entail improved sampling methods enabling data availability at NUTS-3 level, more clearly defined variables in order to improve comparability of data, and alignment of surveying periods.

4. Concluding remarks

Results of the analysis of recent structural developments in NMS-5 reveal that, despite the fact that agriculture has started to operate in a single economic and policy environment, the pathways of restructuring remain mixed. In terms of labour productivity of agriculture, we identified three main trajectories of structural adjustment, which are region-specific.

It appears that the most stable conditions for a sustained growth in agricultural productivity can be seen in regions with relatively favourable structural conditions for agriculture. In addition to this, these regions are usually relatively affluent, located in proximity of markets and/or transport corridors, with above-average availability of non-farm jobs. These regions have recorded a moderate growth of agricultural productivity, mainly on the account of increased economic output.

Les favourable trends can be monitored in other regions. Some of them have recorded a decrease of agricultural labour productivity. More than a decrease of agricultural output, such trends occurred because of increasing number of agricultural employment, mostly on the account of absorbtion of non-farm unemployment. We are dealing with areas locked into a 'poverty trap', a combination of unfavourable initial conditions and economic collapse (both in agriculture and in non-farm sector). Often, smallholder (subsistence-oriented) plots prevail, characterised by low productivity, lack of capital (inputs, investments) and a poorly developed market infrastructure.

Another group of regions is faced with a drastic decrease of agricultural employment, occurring usually in combination with decreasing agricultural output. Relative growth of agricultural productivity is thus only superficial and hides unfavourable economic and demographic trends, such as ageing of agricultural population, or permanent migration. More favourably, in regions with sharply dual agricultural structure, efficient (corporate) agricultural sector, redundant agricultural labour may have been absorbed by regional non-agricultural labour market.

Policy implications of the above results seem to be quite straightforward. Positive, but slow agricultural productivity growth in regions with relatively favourable agricultural structural and general economic can be put into context of EU-accession, which brought stable economic conditions, and with adoption of the CAP, increased transfers to agriculture. It has to be however pointed out that CAP transfers are mainly absorbed by large-scale, efficient producers. CAP therefore largely fails to address rural poor (Gorton et al., 2009). From the perspective of economic and social cohesion, CAP is therefore rather part of the problem than solution to the problem?

Convergence with structural conditions of established member states is limited to a small number of regions in EU new member states! It is therefore fair to say that CAP, including a large part of its Rural Development component, misses the right address(es). Increasingly, key policy challenges are being linked to rural (non-farm) jobs and incomes. This challenge needs to be addressed by increased policy effort in favour of actions generating new rural jobs, not necessarily linked to agriculture. In terms of the main EU policies, this should entail both, rebalancing of the CAP expenditure, and Increasing synergies with Cohesion policy.

Bibliography

Choudhry, M.T. (2009). Determinants of Labor Productivity: An Empirical Investigation of Productivity Divergence. Working Paper. University of Groningen, Department of Economics and Econometrics, 21 pp.

Deininger, K. (2002). Agrarian reforms in Eastern European countries: lessons from international experience. Journal of International Development 14: 987-1003.

Feder, G. (1985). The relation between farm size and farm productivity: The role of family labor, supervision and credit constraints Journal of Development Economics, 18(2-3):297-313.

Gorton, M., Hubbard, C., Hubbard, L. (2009). The Folly of European Union Policy Transfer: Why the Common Agricultural Policy (CAP) Does Not Fit Central And Eastern Europe. Regional Studies, 43(10):1305-1317.

Kennedy, P. (2008). A Guide to Econometrics. 6th edition, Blackwell Publishing, UK.

Lerman, Z. (2000). Agriculture in transition economies: from common heritage to divergence. Agricultural Economics 1481:1-20.

Malhotra, N.B., Birks, D.B. (2000). Marketing research: an applied approach. Pearson Education, London, p. 599-618.

Sarris, A. H., Doucha, T., and E. Mathijs (1999). Agricultural restructuring in central and eastern Europe: implications for competitiveness and rural development, European Review of Agriculture Economics 26 (3): 305-329.

Swinnen, J. F. M., Dries, L., and K. Macours (2005). Transition and agricultural labor. Agricultural Economics 32: 15-34.