# Variations in Farm Performance: Evidence from the CEECs and Existing EU Member States

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# Variations in Farm Performance: Evidence from the CEECs and Existing EU Member States[2]

Abstract

This paper attempts to shed light on the recent performance of farms in the Czech Republic, Hungary and Poland and to compare the findings from the CEECs with the EU situation. Utilising farm survey data, ratios of agricultural profitability and productivity have been estimated and clusters of farms with similar characteristics have been identified. Analysis indicates that the Hungarian farms have the best prospects amongst the analysed accession countries according to their profitability. The poor profitability and structural problems of Polish agriculture are highlighted. The family farms are less productive than corporate farms in the Czech Republic and Hungary despite the expectations at the outset of the reform that better incentives will boost their productivity.

**Keywords**: CEECs, farm performance, profitability, cluster analysis.

## 1 Introduction

The 1990s witnessed widespread changes in farm structures, government policies and agricultural markets in the CEECs that are applicants for EU membership. These changes have resulted in a more differentiated set of farming systems that have to deal with the effects of international trade liberalisation and, on accession, with the competition in the single European market. In view of future EU enlargement, there has been a growing interest in competitiveness, productivity and profitability of farming in the CEECs. This interest has been stimulated by the desire to understand how the CEECs may perform in an enlarged European Union.

This paper tries, first, to investigate the private profitability and total factor productivity (TFP) of farms classified by several variables including size, legal type and agri-environmental region. Second, it identifies groups of farms with common characteristics, utilising cluster analysis, to better classify and understand variations in performance. These clusters form the basis of a discussion of the overall survivability of different groups of farms with and without direct payments (net current subsidies) and, thus, the likelihood of future restructuring.

The study is focused on the Czech Republic, Hungary and Poland. In order to compare the findings from the CEECs with the EU situation, similar studies were carried out for two contrasting regions in the EU, the region of Navarra in Spain and South-East England. They have been chosen as they reflect the diversity of agricultural regions that already exist within the EU.

## 2 Previous studies on CEEC farm performance

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Previous studies of farm performance in the CEECs have mainly focused on understanding differences in relative efficiency. Gorton and Davidova (2001) drew together several individual country studies for CEECs that are part of the enlargement process in order to present a synthesis of findings and draw out relevant cross-national patterns.

The majority of farm efficiency studies for the region have focused on size and structural matters. This is unfortunate as studies for other regions have found that farm efficiency is significantly related to human and social capital (Lockheed *et al.* 1980; Stefanou and Saxena, 1988). This is also important for the CEECs as the level of formal education and training held by small-scale farmers in the region tends to be low.

Regarding structural issues, at the beginning of the transition process the most common view was the strong belief that once the centrally planned system had been dismantled farm structures would go back to their 'normal' trajectory, namely smaller individual/family type farms (Csaki and Lerman, 1996). On economic grounds, this assumption has been based on the view that family farms are more efficient than co-operatives and other types of corporate farms (Schmitt, 1991). In addition, the predominance of the family farms in developed market economies gave an easy example to promote the idea that the chances of the associative type of production in agriculture surviving under market conditions was low (Schmitt, 1993). From a political economy perspective Christiaensen and Swinnen (1994) point out that historically the process of the development of family farms in the EU was not the one of self-organisation only, but it was strongly shaped by policy. The family farms were not considered as the best structure for organising agricultural production *per se*, but rather they became "a political goal in itself" (Christiaensen and Swinnen, 1994).

There is, thus, a lack of conclusive *a priori* arguments to claim that there is a superiority of individual over corporate type of farming or of small over larger farms. The results of previous studies on farm structures and productivity show that the evidence is far from clear cut. In Hungary, when other factors are controlled for, family farms do appear to be more efficient, based on both Tornquvist - Theil TFP indices and DEA analysis (Hughes, 2000; Mathijs and Vranken, 2000) (Table 1). For the Czech Republic, both Hughes (1998) and Mathijs and Swinnen (2000) found that individual private farms were significantly more productive than corporate farms for livestock farming but not crop production. In Curtiss' (2000) analysis of crop production in the Czech Republic she found that co-operatives performed better for wheat and rapeseed cultivation compared to individual farms but that the latter were superior with regard to sugar beet production.

For Poland Mech (1999) employing data for the whole country for 7 years concludes that there is some evidence of economies of scale with farms larger than 15 ha being more productive and profitable than the smaller ones. Small farms record only higher land productivity, evidence consistent with the inverse relationship between farm size and land productivity observed in developing countries (Verma and Bromley, 1987). Van Zyl *et al.* analysed one point in time for two regions. They conclude that there is a downward sloping curve for TFP (i.e. smaller farms were more productive). However, using Data Envelopment Analysis (DEA) they show that there were not significant differences in scale efficiency between farms below and above 15 ha. Munroe (2000) employing stochastic frontier analysis found a negative relationship between farm size and efficiency (with farms greater than 15 ha exhibiting lower efficiency), but also found that the age of the farmer and soil quality were important determinants.

Comparatively analysing these results, it appears that arguments that co-operatives or other forms of corporate farming are inherently less efficient for all types of farming compared to family farms is misplaced. It appears that at least some corporate farms can solve the governance problems alluded to in the literature or that there are some types of farming for which such problems are less severe.

**Table 1: Empirical Studies of Farm Efficiency in the Czech Republic, Hungary and Poland**

| Country | Author(s) | Dataset | Methodology | Comments |
|---|---|---|---|---|
| Czech Republic | Hughes (1998) | VUZE panel. 1996 | Tornquvist - Theil TFP Index | |
| Czech Republic | Mathijs and Swinnen (2000) | Agrocensus and VUZE panel data for 1996 | Data envelopment analysis (DEA). | |
| Czech Republic | Curtiss (2000) | VUZE FADN 1996-1998 | Stochastic Frontier Analysis (SFA). | |
| Hungary | Hughes (2000) | AKII 1996-1997 | Tornquvist - Theil TFP Index | |
| Hungary | Mathijs and Vranken (2000) | 1998 ACE survey | Data envelopment analysis (DEA). | Crop and dairy farms |
| Poland | Munroe (2001) | IERiGZ farm survey (1996) | Cobb-Douglas stochastic frontier | |
| Poland | Mech (1999) | 1988-1994 IERiGZ farm survey | - Partial productivities-labour, land, capital.<br>- TFP-Tornquist index.<br>- Gross margin index by farm sizes in relation to the country average. | Individual farms only |
| Poland | van Zyl et al. (1996) | 1993 IERiGZ data | TFP and Data envelopment analysis (DEA). | Regionally specific; individual farms only |

These productivity studies present some interesting findings but it is argued that further work is required on three counts. First, it is important to see if the trends identified for the early and mid-1990s reflect short-term characteristics of restructuring or are more long-lasting phenomena. Second, from the efficiency studies it is possible to identify farms which are *relatively* more efficient (e.g. on the production frontier or with a higher TFP index score) in a particular sample. However, this says nothing about profitability and returns on resources employed in agriculture which will guide further restructuring in the sector. With the exception of Mech (1999), the other studies did not cover the issue of farm profitability. Finally, previous studies have focused principally on the farm size, structure and efficiency debate. The performance of farms is shaped by many other factors than just size and ownership type, such as agri-environmental region, financial and managerial characteristics. These points guided the profitability, productivity and cluster analyses conducted in this paper.

## 3 Methodology

Farm profitability is analysed through the estimation of ratios between the costs and revenues for each farm. Farm profitability is mainly analysed with reference to a private cost benefit ratio (P_CB). For the *i'th* farm, the P_CB is taken to be:

$$(1) \qquad P\_CB_i = \frac{\left(C_i^t + C_i^f\right)}{R_i}$$

where $C^t_i$ is the cost of tradable inputs, $C^f_i$ is the cost of non-tradable factors of production (based on private prices or estimates for non-paid land and labour input) and $R_i$ is revenue excluding current subsidies net of taxes. The initial data did not include a notional rent for owned land and wages for non-paid labour input. As all factors should bring returns at opportunity costs, for non-paid land and labour input a set of shadow prices were estimated using regional averages. Family labour was valued using the average regional farm unit labour costs. As far as land was concerned, if a farm had a mix of rented and owned land, the rent paid was imputed to the owned land, as it was assumed that rented and own land were in close proximity and, thus, were of a compatible quality. If a farm did not rent land, then the average regional rent was applied to the owned land.

Two other profitability ratios were also calculated. The first, cost-revenue plus subsidies (C_Rs), exactly matches the entries in the EU's Farm Accountancy Data Network (FADN) and, therefore, $C^f_I$ does not include estimates for non-paid labour and land and $R_i$ includes the budgetary transfers. The second one, cost-revenue without subsidies (C_R), does not include estimates for non-paid labour and land and also excludes direct budgetary transfers. The rationale for calculating these three different ratios is to give an insight into the effect of the direct budgetary transfers and the valuation of all factors at opportunity costs on different farm types and farms located in different agri-environmental regions. As the approach is a static one, little however can be said about future adjustments to policy changes that might involve a removal of production related budgetary transfers.

Productivity differences were estimated by the construction of a Tornquist-Theil TFP index for all farms in the sample relative to a base case 'average farm' with results interpreted relative to the sample mean, showing cohorts as having above or below average TFP scores. The Tornquist-Theil TFP index is recognised as a measure of technical efficiency and to be an acceptable alternative to econometric estimation in cases where the data does not permit an underlying production function to be estimated (Capalbo and Antle, 1988).

Cluster analysis has been chosen due to its strengths to define groups of objects, or farms in our case, with the maximum homogeneity within the groups while having maximum heterogeneity between the groups (Hair *et al.,* 1998). First, factor analysis was applied. Important variables considered in the factor analysis included measures of size: total labour (AWU), total output including the net current subsidies (OUTTOT), total assets (TOTASSET), and the utilised agricultural area (UAA). A variable to account for specialisation of the farm in arable farming (PROCRO) was included. Also two measures of the degree of intensification were included. The first one is the amount of land per annual work unit (LANDAWU): with larger scores indicating lower levels of intensification. The second one is the quantity of depreciation per annual work unit (DEPAWU), in which case higher values are used as proxies that there is more capital per worker employed. Two variables to account for the degree of dependence on direct subsidies

were also considered: total net current subsidies (SUBNET) and the percentage of revenue derived from direct subsidies (SUBOUTP). Two variables to account for the use of paid primary factors, the percentage of rented land (PORREUAA) and the percentage of paid labour (PORPALAB), were included alongside standard financial ratios (DEBTOAS, LEVERAGE).

The method of principal component analysis with varimax rotation has been adopted. The cut-off applied for interpretation purposes were factor loadings greater or equal to 0.5 on at least one factor. Two tests have been applied to assess the validity of each factor analysis. The Kaiser-Meyer-Olkim measure of sampling adequacy and Bartlett's test of sphericity. The factors formed the basis of the cluster analysis, following a two-stage approach. First, a hierarchical technique was used to identify outliers, the number of clusters and profile the cluster centres. Then, the observations were clustered by a non-hierarchical method with the cluster centres from the hierarchical results as the initial seed points. This combined procedure allows one to benefit from the advantages associated with hierarchical and non-hierarchical methods, while at the same time minimising the drawbacks (Punj and Stewart, 1983). The algorithm used in the hierarchical technique was Ward's method based on squared Euclidean distances. To decide how many clusters exist, criteria suggested by Fiegenbaum and Thomas (1993) were applied.

## 4 Data sets

Data was extracted from FADN surveys, which are implemented in all EU Member-States and some of the EU candidate countries. FADN is biased towards larger commercial holdings. Studying larger farms and excluding the purely subsistence ones is adequate for the present research as the very smallest 'farms' are likely to continue to produce for self-consumption and to be less integrated into the market even after EU accession (Kostov and Lingard, 2002). Poland has to date not introduced the FADN system. The Polish Institute of Agricultural and Food Economics (IERiGZ)[3] carries out an annual farm survey that has been used as the main source of data. Table 2 sets out the main characteristics of the datasets used in the analysis.

**Table 2: Characteristics of the Data Sets used in the Analysis**

| Country | Year(s) analysed* | Type | Useable number of records | No. of records used in cluster analysis (outliers excluded) | Comments |
|---|---|---|---|---|---|
| Czech Republic | 1998-9 | FADN | 823 | 812 | |
| Hungary | 2000 | FADN | 1,121 | 1,112 | |
| Poland | 1999 | IERiGZ | 1,001 | 979 | Only individual farms |
| Spain | 1996-9 | FADN | 369 | 369 | |
| S.E. England | 1999 | FBS | 183 | 183 | FBS consistent with FADN. |

* For comparative purposes the presentation of Czech and Spanish results in this paper concentrates on data from 1999.

Finally, regarding the data available, one should note some caveats. The cross-national comparisons face the problem of differences in data collection procedures between countries. While most associated countries are harmonising their own surveys with the EU's FADN, this is still an on-going process. It is, therefore, difficult to exactly compare farm performance amongst the CEECs and against current EU member states. Rather cross-national comparisons give a flavour of the main characteristics of commercial agriculture in three CEECs and how this differs from two contrasting EU regions.

[3] Instytut Ekonomiki Rolnictwa i Gospodarki Zywnosciowej.

## 5 Basic farm characteristics: a comparative picture

Table 3 presents an overview of the sample farms.[4] The table shows that according to the four size measures (average UAA per farm, average output, total assets and labour input) the countries fall into three groups. These three groups are: the largest farms (the Czech Republic), medium size farms (Hungary and S.E. England, although measured by assets, the S.E. English farms are the largest) and small farms (Poland and Navarra).

**Table 3: Background Sample Characteristics, 1999[1]**

| | Czech R | Hungary | Poland | Navarra Spain | S.E. England |
|---|---|---|---|---|---|
| Average UAA per farm (ha) | 658 | 202 | 25 | 50 | 141 |
| Average output[2] (EUR) | 532,665 | 224,073 | 18,000 | 97,000 | 399,753 |
| Average total assets (EUR) | 870,542 | 204,484 | 86,000 | 292,000 | 1,345,154 |
| Average total assets per ha (EUR) | 1,450 | 1,977 | 3,440 | 5,840 | 9,540 |
| Land rented (%) | 76 | 42 | 17 | 45 | 34 |
| Hired labour input (%) | 50 | 31 | 6 | 10 | 53 |
| Land per AWU (ha) | 38 | 53 | 13 | 36 | 41 |
| DEPAWU (EUR) | 2,421 | 2,427 | 1,294 | 6,281 | 7,810 |
| Average AWU per farm | 32 | 7.45 | 1.85 | 1.49 | 6.35 |
| Average paid wage (EUR per paid AWU) | 3,552 | 3,490 | 2,308 | 12,312 | 18,790 |

[1] For Hungary 2000.
[2] Output includes net current subsidies.

The main differences amongst the CEECs in farm size stem from the existence, or the lack of, corporate farms. Although corporate farms are widespread in both the Czech Republic and Hungary, there is a considerable difference between the two countries. The land area available to successor farms in Hungary decreased substantially during transition as a result of the adopted procedures of land reform and farm restructuring, especially because a large area of land had to be set aside for compensation purposes under the Compensation Act. Thus, although in the Hungarian FADN sample there were 235 corporate farms, 55 per cent of them were below 300 ha. In the Czech Republic the FADN sample included 310 corporate farms split up according to the legal form into limited liability companies, joint-stock companies and co-operatives. The average size of each of these legal forms was above 1,000 ha. In addition, in comparison to Hungary, corporate farms use a much higher share of UAA in the Czech Republic. These differences are reflected in the larger average area, output and assets per farm in the Czech Republic than in Hungary.

The Polish farms are the smallest by all size measures. However, according to size they appear closer to farms in the EU (Navarra, Spain) than their counterparts in the Czech Republic. When assets are measured per ha, then the Polish farmers seem to be much better capitalised than farms in the Czech Republic or Hungary. This results from their longer history of independent farming. Not surprisingly, S.E. England has the most capitalised farms, having assets per ha more than 60 per cent higher than in Navarra and nearly three times that of Poland.

The differences amongst the countries in using the land rental and labour markets are striking. The Polish farms rely almost entirely on their own resources. Only 6 per cent of labour input is

[4] It has to be noted that these averages include the usable records only. As during the cluster analysis some outliers were removed, there might be slight differences between the averages in the table below and the means shown in the cluster tables in the country sections.

accounted for by hired labour and only 17 per cent of total land is rented. Thus, they are dependent on the initial family endowment of resources and familial human capital. This lack of integration into factor markets is one of the clear signs of the peasant character of the Polish agriculture. Farms in Navarra, most of which are located in marginal areas (LFAs or objective 5b), also rely on own labour but they do rent land in order to achieve a reasonable size, which can provide an acceptable income. Poland however appears to present a clear structural problem: there are too many people farming on too small land areas. Family farms in Navarra have three times as much land per AWU than in Poland. The Czech Republic and Hungary, due to their corporate farms which depend almost fully on rented land and hired labour, are nearer to the English case of large family farms in terms of the extensive use of land rental and labour markets.

Another striking difference is the pay of hired labour. In this case the clear divide is between the EU member states and the accession countries. Although theoretically accession may accelerate the equalisation of product and factor prices, the order of magnitude of the differences in agricultural wages is such that most probably a large gap will persist for a long time post-accession. This may continue to induce incentives for agricultural labour from the CEECs to move to work, at least seasonally, in West European farms, a phenomenon that is currently in place.

## 6 Farm profitability

The differences in farm structural characteristics bring about important consequences for the profitability of farming. Table 4 presents the average farm profitability for the sample farms in each of the analysed countries according to the three profitability ratios.

**Table 4: Profitability Ratios**

| | Czech R | Hungary | Poland | Navarra Spain | S.E. England |
|---|---|---|---|---|---|
| Average P_CB score | 1.224 | 1.03 | 3.83 | 1.098 | 1.374 |
| % of sample profitable on P_CB | 20 | 60.9 | 8.7 | 45.0 | 14.8 |
| Average C_R score | 1.086 | 0.81 | 1.01 | 0.714 | 1.095 |
| % of sample profitable on C_R | 38 | 81.5 | 60.4 | 85.4 | 42.6 |
| Average C_Rs score | 1.003 | 0.76 | 1.01 | 0.604 | 0.922 |
| % of sample profitable on C_Rs | 48 | 85.4 | 60.4 | 92.7 | 74.9 |

The P_CB ratio is sensitive to the shadow prices applied to non-paid labour and own land. This is particularly important for individual farms that mainly rely on own resources. However, as shown in Table 69, even in regions where farming uses mainly own resources, as in Navarra, if the resources are effectively used, farms can be near the break-even point according to the P_CB ratio.

The most profitable farms are in Navarra and Hungary. The fact that in this group there is one EU member state and one transition country tends to undermine any easy generalisations. The profitability of farms in Navarra cannot be solely attributed to CAP headage and acreage payments and transfers received because of their location in LFAs or objective 5b areas. It is true that direct payments account for 13.6 per cent of the gross output of Navarra's farms and that almost all sample farms receive direct payments (Table 5). However, the importance of direct payments in S. E. England is not substantially different but the English farms are unprofitable on both P_CB and C_R ratios.

The Hungarian farms have the best prospects amongst analysed accession countries according to their profitability. They are near the break-even point on the P_CB ratio and are profitable according to the other two ratios (Table 4). They achieve this profitability with more modest direct payments than the EU members. The net current subsidies account for slightly above 5 per cent of the gross output (Table 5).

**Table 5: Direct Payments**

| | Czech R | Hungary | Poland | Spain | S.E. England |
|---|---|---|---|---|---|
| Direct payments as % of gross output | 6.4 | 5.2 | 0.0003 | 13.6 | 14.0 |
| % of sample which receive direct payments | 80 | 82 | 1.9 | 99.2 | 72.1 |

For the Czech Republic and Poland profitability is a big problem is agriculture. The average scores according to the three ratios are above 1. Even without accounting for the opportunity costs of own resources and adding up the direct payments, 52 per cent of the sample farms in the Czech Republic and 40 per cent in Poland are unprofitable. Whilst Polish farmers do not benefit from direct payments, the Czech farms receive more net current subsidies in relative terms than the Hungarian farmers, but nevertheless their private profitability is low. The comparison of the average profitability scores by legal form for the Czech Republic and Hungary (Table 6) reveals that the Czech farms are uniformly loss making with the exception of individual farms on the C_Rs ratio. Exactly the opposite is true for Hungary with only one ratio above 1, the P_CB measure for individual farms. Production co-operatives appear to be the most profitable management form in Hungary.

**Table 6: Profitability Ratios for Czech and Hungarian Samples according to Management Type**

| | Individual farmers | Ltd Companies | Production Co-ops | Other corporate farms | Individual farmers | Ltd Companies | Joint Stock | Production Coops |
|---|---|---|---|---|---|---|---|---|
| | Hungary | | | | Czech Republic | | | |
| P_CB average | 1.0889 | 0.8637 | 0.7840 | 0.9316 | 1.2623 | 1.2035 | 1.1944 | 1.1372 |
| C_R average | 0.8212 | 0.8559 | 0.7826 | 0.7933 | 1.0467 | 1.1932 | 1.1879 | 1.1297 |
| C_Rs average | 0.7686 | 0.7686 | 0.7455 | 0.7365 | 0.9544 | 1.0981 | 1.1302 | 1.0658 |

The lack of profitability makes the long-term viability of a large number of Czech and Polish farms questionable unless they manage to restructure. The issue is even more serious in the Czech Republic due to the high level of farm indebtedness (Table 7). Czech farms are funded by debt and average debts are higher than the net worth of the farms (leverage above 1). However, their financial stress (RENGO and RENGM) is not as high as would have been expected by the indebtedness figures, in fact it is less than in the two EU case study regions. The poor financial situation of the Czech farms is mainly due to the non-bank liabilities of the successor farms either to individual owners of the assets for producer co-operatives or to the state for the limited liability companies. As a result of the adopted reform legislation these farms did not need to repay these debts for several years after their establishment.[5] For this reason the financial stress is lower than it would have been under similar situations in the EU.

[5] Limited liability companies are to a large extent successors of the former state farms. Their assets had to be purchased and the farmers had to pay an initial instalment while the rest was recorded as long-term liabilities to the state. Co-operatives carry liabilities to former, currently non-farming, owners of assets.

**Table 7: Financial Ratios for the Sample Farms**

| | Czech R | Hungary | Poland | Spain | S.E. England |
|---|---|---|---|---|---|
| Debt to assets | 0.331 | 0.16 | 0.03 | 0.079 | 0.152 |
| Leverage | 1.525 | 0.39 | 0.04 | 0.110 | 0.252 |
| RENGO | 0.038 | 0.03 | 0.02 | 0.050 | 0.094 |
| RENGM | 0.085 | 0.04 | 0.04 | 0.121 | 0.355 |

Polish farmers do not rely on external financing either due to external constraints (access to credit) or internal choice (not applying for loans). Similarly to land and labour, they rely on internal resources and this is one of the main reasons for the slow rate of farm restructuring and the persistence of small-scale, semi-subsistence agriculture.

## 7 Total factor productivity

TFP scores are expressed in relation to the sample mean that has been normalised to unity. While one is able to identify farms which are *relatively* more efficient with a higher TFP index score in a particular sample for one country, this might bear little relationship to what might be considered to be internationally productive. Therefore, what it is possible to compare internationally is the share of farms that have high TFP scores in the sample and whether they produce the predominant portion of output and to what extent they depend on net current subsidies. The ranking of productivity scores between the different management types can also be compared. Table 8 presents the country results according to TFP with estimated costs for own resources.

**Table 8: Farm Productivity (TFP scores)**

| | Czech R | Hungary | Poland | Spain | S-E England |
|---|---|---|---|---|---|
| No of high productivity farms (TFP>1) | 381 | 488 | 346 | 106 | 86 |
| % of high productivity farms | 46 | 44 | 35 | 29 | 47 |
| % of sample UAA in TFP>1farms | 53 | 64 | 63 | 29 | 38 |
| % of sample output in TFP>1 farms[1] | 60 | 85 | 56 | 37 | 69 |
| % of sample subsidies to TFP>1 farms | 46 | 49 | 52 | 33 | 26 |

1 Output includes net current subsidies.

Overall, in all countries farms with TFP scores above 1 are a minority and at the extreme in Navarra constitute only 29 per cent of the sample farms. Two important features stem from the productivity analysis. With the exception of Spain, the minority of productive farms (between two-thirds and four-fifths) produces a majority of the total output. From this point of view once again Hungary has the best performance with 85 per cent of the output produced in farms having technically efficient input-output combinations. The other important conclusion, brought about by the S.E England farms, is that the productive farms might not rely heavily on net direct subsidies. In S.E. England 47 per cent of productive farms absorb only 26 per cent of total net current subsidies.

According to management type, the corporate farms have higher TFP scores than the individual farms (Table 9).

**Table 9: Farm Productivity by Legal Form (TFP scores)**

| Hungary | | Czech Republic | |
|---|---|---|---|
| Legal type | Average score | Legal type | Average score |
| Family farms | 0.96 | Family farms | 0.987 |
| Limited liability companies | 1.16 | Limited liability companies | 0.971 |

| | | | |
|---|---|---|---|
| Co-operatives | 1.19 | Co-operatives | 1.033 |
| Joint ventures | 1.42 | Joint Stock companies | 1.035 |
| Other | 0.96 | Other | N/A |

Family farms are less productive despite the high expectations at the outset of the reform process that better incentives involved in individual farming would boost their efficiency. The reasons for this result are complex, including the long-standing tradition of farming in association in these countries, a high share of hired labour in corporate farms allowing them to recruit labour with necessary skills for technical agricultural and management positions. In some cases, former collective farm managers were able to siphon off the most attractive parts of the business into new corporate farms that yield good returns. The argument that corporate farms benefit solely from economies of size does not seem to hold, at least for Hungary. Even when size is controlled for, individual farms still appear as less productive than their corporate counterparts.

The profitability and productivity comparisons identify the broad differences between countries, but there are also considerable variations in farm performance within countries. To capture these variations, factor and cluster analysis have been employed and discussed in detail in the country sections. Here for each country the best and the worst performing clusters are presented in an attempt to draw some more general conclusions.

## 8 Cluster analysis

In order to describe whether there are common characteristics, the most and the least profitable farm clusters in different countries are compared. Consequently, farms are characterised according to their size, specialisation, reliance on own or external resources, and dependence on subsidies.

According to size, farms are classified as small or large in relation to the sample averages. When these farms are the largest or smallest in the sample this is clearly indicated. The qualifications ‘very small’ or ‘very large’ are used in cases when the size of the farms in the particular cluster differ several fold from the sample average. By the same token, when the variation is only slightly above or below the average this is also explicitly indicated. The same logic has been followed for other farm characteristics, such as specialisation, intensification, dependence on rented resources and net current subsidies, and financial situation. To the extent that for Poland, Navarra and S.E. England individual farms predominate or are solely present, management form is only indicated for the Czech Republic and Hungary. The net current subsidies for Poland have been ignored, as they are negligible.

**Table 10: Comparison of the Most Profitable Cluster from Each Country by C_Rs Ratio**

| | Czech R | Hungary | Poland | Navarra | S.E.England |
|---|---|---|---|---|---|
| N FARMS | 229 | 319 | 19 | 80 | 61 |
| UAA | 164 | 35 | 66 | 74 | 126 |
| AWU | 4.74 | 1.26 | 3.05 | 1.77 | 3.19 |
| OUTTOT | 115,789 | 30,991 | 38,598 | 18,204 | 160,764 |
| TOTASSET | 213,955 | 39,889 | 160,505 | 55,546 | 1,594,295 |
| PROCRO | 0.762 | 0.59 | 0.38 | 0.902 | 0.245 |
| DEBTOAS | 0.192 | 0.11 | 0.06 | 0.046 | 0.085 |
| LEVERAGE | 0.5 | 0.17 | 0.07 | 0.053 | 0.107 |
| LANDAWU | 51 | 31 | 17 | 43 | 47 |
| DEPAWU | 3,499 | 1,629 | 1,775 | 756 | 8,461 |

| | | | | | |
|---|---|---|---|---|---|
| PORREUAA | 0.68 | 0.29 | 0.11 | 0.32 | 0.16 |
| PORPALAB | 0.28 | 0.02 | 0.15 | 0.29 | 0.44 |
| SUBSOUTP | 0.032 | 0.06 | 0.0076 | 0.147 | 0.154 |
| SUBSNET | 415 | 2,050 | 196 | 2,214 | 27,380 |
| | | | | | |
| VADAWU | 8,323 | | 3,215 | 7,524 | 21,795 |
| TFP | 1.026 | 1.02 | 1.16 | 1.370 | 0.954 |
| PC_B | 1.157 | 1.02 | 2.35 | 0.924 | 1.423 |
| C_R | 0.992 | 0.70 | 0.94 | 0.523 | 1.054 |
| C_Rs | 0.958 | 0.65 | 0.93 | 0.429 | 0.876 |

**Table 10a: Comparison of the Most Profitable Cluster from Each Country by C_Rs Ratio**

| | Czech R | Hungary | Poland | Navarra | S.E.England |
|---|---|---|---|---|---|
| UAA | Small | Very small | Large | Large | Small |
| AWU | Small | Very small | Large | Large | Small |
| Assets | Small | Very small | Large | Large | Large |
| Management form | Individual | Individual | Na | Na | Na |
| Specialisation | Crops | Mixed | Livestock | Crop | Livestock |
| Land per AWU | Large | Small | Large | Large | Large |
| Capital per AWU | Large | Small | Large | Small | Large |
| Rented land | Small | Small | High | Small | Small |
| Hired labour | Small | Negligible | High | Large | Small |
| External debts (DEBTOAS) | Small | Small | High | Small | Small |
| Reliance on subsidies | Low | Slightly above average | Na | Slightly above average | Slightly above average |

**Table 11: Comparison of the Most Profitable Cluster from Each Country by P_CB Ratio**

| | Czech R | Hungary | Poland | Navarra (same as above | S.E. England |
|---|---|---|---|---|---|
| N FARMS | 111 | 47 | 67 | 80 | 11 |
| UAA | 1,510.52 | 2,154 | 53 | 74 | 173 |
| AWU | 78 | 97 | 1.36 | 1.77 | 26.91 |
| OUTTOT | 1,312,198 | 2,998,619 | 26,555 | 18,204 | 874,177 |
| TOTASSET | 2,079,612 | 2,449,415 | 147,745 | 55,546 | 2,493,648 |
| PROCRO | 0.502 | 0.63 | 0.91 | 0.902 | 0.731 |
| DEBTOAS | 0.632 | 0.40 | 0.04 | 0.046 | 0.151 |
| LEVERAGE | -0.118 | 1.11 | 0.05 | 0.053 | 0.221 |
| LANDAWU | 23 | 24 | 36 | 43 | 13 |
| DEPAWU | 1,966 | 1,303 | 3,465 | 756 | 3,821 |
| PORREUAA | 0.97 | 0.95 | 0.14 | 0.32 | 0.57 |
| PORPALAB | 1.00 | 1.00 | 0.13 | 0.29 | 0.93 |
| SUBSOUTP | 0.051 | 0.05 | 0 | 0.147 | 0.021 |
| SUBSNET | 5,484 | 119,433 | 0 | 2,214 | 15,768 |
| | | | | | |
| VADAWU | 5,856 | | 3,402 | 7,524 | 22,802 |

| | | | | | |
|---|---|---|---|---|---|
| TFP | 1.039 | 1.35 | 2.15 | 1.370 | 1.287 |
| PC_B | 1.119 | 0.73 | 1.11 | 0.924 | 1.033 |
| C_R | 1.11 | 0.72 | 1.18 | 0.523 | 0.994 |
| C_Rs | 1.048 | 0.69 | 1.18 | 0.429 | 0.969 |

**Table 11a: Comparison of the Most Profitable Cluster from Each Country by P_CB Ratio**

| | Czech R | Hungary | Poland | Navarra | S.E. England |
|---|---|---|---|---|---|
| UAA | Very large | Largest | Large | Large | Large |
| AWU | Very large | Largest | Small | Large | Largest |
| Assets | Very large | Largest | Large | Large | The largest |
| Management form | Co-operatives | Corporate | Na | Na | Na |
| Specialisation | Mixed | Mixed | Crop | Crop | Crop |
| Land per AWU | Small | Small | Large | Large | Small |
| Capital per AWU | Small | Small | Large | Small | Small |
| Rented land | Almost all | Almost all | Small | Small | Large |
| Hired labour | Almost all | All | Large | Large | Almost all |
| External debts (DEBTOAS) | Large | Large | Above average | Small | At average |
| Reliance on subsidies | Slightly below average | At average | Na | Slightly above average | Very small |

From Tables 10 and 10a it is can be seen that the individual farms are the most profitable in relation to C_Rs. This is true also for the Czech Republic and Hungary where there is a mix between individual and corporate farms. In countries where the sample average of farms size is large (the Czech Republic, Hungary and S.E.England), the most profitable are the relatively small farms and in fact in Hungary the smallest one. This is in contrast to countries with a small mean farm size (Poland and Navarra). The profitable farms have a large land area per unit of labour and rely predominantly on own resources. The exception to this is Poland, but as in Poland on average the sample farms rely almost solely on own resources, farms that have some higher than the average involvement in land, labour or credit markets appear with a high reliance on external resources.

**Table 12: Comparison of the Least Profitable Cluster from Each Country by P_CB ratio**

| | Czech R | Hungary | Poland | Navarra | S.E. England |
|---|---|---|---|---|---|
| N FARMS | 40 | 56 | 79 | 40 | 35 |
| UAA | 553 | 558 | 17 | 67 | 136 |
| AWU | 22.19 | 6.92 | 1.72 | 1.23 | 2.97 |
| OUTTOT | 317,571 | 218,843 | 8,646 | 10,677 | 142,468 |
| TOTASSET | 640,917 | 251,218 | 56,673 | 35,695 | 635,614 |
| PROCRO | 0.357 | 0.83 | 0.4 | 0.449 | 0.155 |
| DEBTOAS | 0.386 | 0.34 | 0.01 | 0.083 | 0.171 |
| LEVERAGE | -3.242 | 1.30 | 0.01 | 0.100 | 0.235 |
| LANDAWU | 43 | 184 | 9 | 54 | 52 |
| DEPAWU | 2,300 | 6,814 | 889 | 1,143 | 7,008 |
| PORREUAA | 0.839 | 0.81 | 0.14 | 0.73 | 0.80 |
| PORPALAB | 0.47 | 0.52 | 0.03 | 0.009 | 0.35 |
| SUBSOUTP | 0.248 | 0.10 | 0 | 0.255 | 0.205 |
| SUBSNET | 5,024 | 16,651 | 0 | 2,564 | 37,859 |

| | | | | | |
|---|---|---|---|---|---|
| VADAWU | 5,585 | | | 3,078 | 22,794 |
| TFP | 0.764 | 0.82 | 0.63 | 0.636 | 0.87 |
| RC_B | 1.563 | 1.24 | 5.94 | 1.528 | 1.541 |
| C_R | 1.363 | 1.13 | 1.14 | 1.025 | 1.212 |
| C_Rs | 0.966 | 1.00 | 1.14 | 0.751 | 0.946 |

**Table 12a: Comparison of the Least Profitable Cluster from Each Country by P_CB ratio**

| | Czech R | Hungary | Poland | Navarra | S.E. England |
|---|---|---|---|---|---|
| UAA | Smaller than average | Large | Small | Large | At average |
| AWU | Smaller than average | Small | Small | Smallest | Small |
| Assets | Smaller than average | Large | Smallest | Smallest | Small |
| Management form | All types | All types | Na | Na | Na |
| Specialisation | Livestock | Crop | Mixed | Mixed | Livestock |
| Land per AWU | Large | Very large | Small | Large | Large |
| Capital per AWU | At average | Very large | Small | Above average | At average |
| Rented land | Large | Large | Below average | Large | Large |
| Hired labour | Near the average | Large | Negligible | Negligible | Small |
| External debts (DEBTOAS) | Higher than average | Above average | Small | Above average | Above average |
| Reliance on subsidies | Very large | Very large | Na | Very large | Large |
| Comments | Farms situated in the worst agri-env region | | | | |

The picture alters dramatically when the P_CB ratio is applied. In order to receive returns on own resources at opportunity costs and to survive without direct payments, farms have to be large. On two occasions these are the largest in the country (Tables 11 and 11a). The best performing farms rely heavily on external resources, including loans. Thus, the development of land rental, labour and credit markets is an important precondition for farms to be profitable without direct payments. In Poland, Navarra and S.E.England where farms are family run, specialisation in crop production helps profitability. In Hungary and the Czech Republic the best performing farms are the corporate farms as the valuation of own resources does not affect their costs. In these cases the specialisation does not appear to be important.

The least profitable farms according to P_CB ratio are small, predominantly livestock or mixed units (Tables 12 and 12a). The main feature of these farms is their high dependence on subsidies. These are farms that potentially cannot survive under a liberal CAP.

## 9 Conclusions

Research on farm restructuring in the CEECs in the early 1990s largely analysed farm performance through recourse to a dichotomy of collectivised and individual farming. The 1990s have witnessed extensive restructuring that has created a more complex pattern of farming. This suggests that the assessment of farm fortunes in CEECs cannot be reduced to merely a discussion of legal forms. The analysis of farm level profitability and productivity in three CEECs provides results supporting the view that by the end of 1990s there is no strong evidence that family farms perform better than the corporate type of farming. The small family farms are successful if they account for zero opportunity costs of their own resources and receive direct current subsidies

(C_Rs ratio). However, when the opportunity costs for own labour and land are accounted for and farms operate without current subsidies (P_CB ratio) the most profitable are large farms. In countries where there are corporate farms, as in the Czech Republic and Hungary, the best performers are either producer co-operatives or a mix of co-operatives and other farming companies. The most profitable according to the P_CB ratio are farms that do not heavily rely on subsidies. They create a core of farms that are not strongly dependent on policy protection and potentially could survive without direct payments.

One striking feature of the analysis is the current poor state of Polish agriculture. Just less than 40 per cent of farms are loss making when only paid inputs are considered. The returns on own labour and lands are exceptionally low and the majority of individual farms persist through a lack of other employment options and a degree of self-exploitation. These figures on poor private profitability mirror the findings of research on the international competitiveness of Polish agriculture. Gorton *et al.* (2001) found that for eight main commodity groups (wheat, rye, sugar beet, rapeseed, potatoes, milk, beef and pork), small farms in Poland (defined as between 3 and 10 hectares) were international competitive only for potatoes and this was very marginal. For farms above 10 hectares, the situation was slightly better (rapeseed and potato production were estimated as being profitable at international prices) but for all livestock and most crop output, production was deeply uncompetitive. The low private profitability of agriculture in Poland is therefore not the result of the sector being effectively taxed by the state, as in some other CEECs e.g. Bulgaria in the early 1990s (Ivanova *et al.* 1995) and in fact relative protection is high by CEEC standards (OECD, 2000). Rather the low private profitability and international competitiveness is the result of structural problems. Whilst direct payments could improve the private profitability of Polish agriculture, they might impede even more the process of restructuring.

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