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# EU farms' technical efficiency and productivity change in 1990 – 2006


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## Abstract

In this paper we analyse and compare various efficiency indicators for a number of European Union (EU) countries: Belgium, Estonia, France, Germany, Hungary, Italy, The Netherlands and Sweden. The availability of long period datasets between 1990 and 2006, allow us to concentrate on the long time trends in technical efficiency especially in Old Member States. This study is the first which may provide a comprehensive overview on the development in farm level efficiency across eight European countries. Our main results are the following. Generally, all countries have relatively high levels of mean technical efficiency ranging from 0.72 to 0.92 for both field crops and dairy farms. Interestingly the majority of countries have better performance in dairy sectors in terms of higher levels of mean efficiency than in field crop production. A slightly decreasing trend however may be observed for all countries. Technical Efficiency estimates are largely in line with those obtained by previous studies. Stability analysis revealed that in average 60% of farms maintain their efficiency ranking in two consecutive years, whilst 20% improve and 20% worsen their positions for all countries. However, these ratios slightly fluctuate around these values for one year to next year. Mobility analysis ranks countries according to the mobility of SFA scores within the distribution. Farms in New Member States are more mobile than those in EU15. Total productivity changes are analysed in two steps. First, we do not find a definite trend in total factor productivity changes. Second, we address the question whether total factor productivity changes converge or diverge over time. Using panel unit root tests our estimations reveal a convergence of productivity across old EU member countries during analysed period. Finally, we decompose the total factor productivity changes into its main elements. Field crop farm indicators generally present significantly higher volatility than dairy farms. Random effect panel regression of Total Factor Productivity Change on its components shows Technological Change as being the significant positive driver for crop farms, whilst Technical Efficiency Change followed by Technological Change are the most important for dairy farms. In addition we do not find significant impacts of CAP reforms in 1992 and 2000 on total productivity changes.

## I. Introduction

Most existing empirical studies focus on a single country's agricultural sector, thus the comparative analysis of the technical efficiency is rather scarce. We take into account the relative importance of specific subsectors and the rationale of compiling more homogeneous sample, separately focusing on the field crops (TF1) and dairy (TF41) sectors. The abundant research in farm efficiency is mostly due to the appearance of software packages- some freely available- and the increased availability of detailed farm survey data. Table 1 presents a brief overlook of some of the recent efficiency and productivity papers. We focused on field crop and dairy sectors of countries included in this research, presenting the main methodology, data source and time-span, and estimated mean technical efficiency.

Table 1. Overview of empirical studies of technical efficiency in field crop and dairy sectors of FACEPA countries

| Paper | Sector | Period | Methodology | Data | Mean TE |
|---|---|---|---|---|---|
| | | | Germany | | |
| Kleinhanß et al. (2007) | Live-stock | 1999-2000 | non-parametric, DEA | - FADN | - |
| Brümmer et al.(2002) | Dairy | 1991-1994 | parametric (output distance fct.), translog | specialised dairy farms in Schleswig-Holstein | 0.95 |
| Zhu and Oude Lansink (2010) | Crop | 1995-2004 | parametric (output distance fct.), Translog | FADN | 0.64 |
| | | | Netherlands | | |
| Brümmer et al. (2002) | Dairy | 1991 - 1994 | parametric (output distance fct.), translog | FADN (highly specialised dairy farms) | 0.89 |
| Zhu and Oude Lansink (2010) | Crop | 1995-2004 | parametric (output distance fct.), translog | FADN | 0.76 |
| | | | Sweden | | |
| Hansson, H. (2007) | Dairy | 1998-2002 | non-parametric, DEA, input (output) oriented | Farm Economic Survey, Agriwise, Swedish Dairy Association database | 0.84 (0.82) |
| Larsen, K. (2010) | Crop | 2001-2004 | non-parametric, DEA, CRS (VRS) | FADN | 0.52 (0.58) |
| Larsen, K. (2010) | Dairy | 2001-2004 | non-parametric, DEA, CRS (VRS) | FADN | 0.65 (0.70) |
| Zhu and Oude | Crop | 1995- | parametric | FADN | 0.71 |

| | | | | | |
|---|---|---|---|---|---|
| Lansink (2010) | | 2004 | (output distance fct.), Translog | | |
| | | | France | | |
| Latruffe and Fogarasi (2009) | Crop | 2001-2004 | non-parametric, DEA | FADN | 0.47 |
| Latruffe and Fogarasi (2009) | Dairy | 2001-2004 | non-parametric, DEA | FADN | 0.76 |
| | | | Italy | | |
| Barnes et al. (2010) | Crop | | SFA | FADN | 0.76 |
| | | | Belgium | | |
| Coelli et al. (2006) | Crop | 1987-2002 | non-parametric, DEA, Malmquist TFP | FADN | TFPC of 1% p.a. |
| | | | Hungary | | |
| Bakucs et al. (2010) | All farms | 2001-2005 | parametric, SFA, translog | FADN | 0.73 |
| Latruffe and Fogarasi (2009) | Crop | 2001-2004 | non-parametric, DEA | FADN | 0.42 |
| Latruffe and Fogarasi (2009) | Dairy | 2001-2004 | non-parametric, DEA | FADN | 0.85 |
| | | | Estonia | | |
| Vasiliev et al. (2008) | Crop | 2000-2004 | non-parametric, DEA | FADN | 0.74 |

Note: TE = technical efficiency; fct = function
Source: authors' compilation

With the exception of few studies (e.g. Barnes et al. 2010, that also estimates a metafrontier for several countries), most of the research done in Europe, focuses on a single country – one or several agricultural sectors. Besides estimating various efficiency indicators, most of these papers focus on determining the drivers of efficiency, i.e. socio-economic variables that influence farms' relative position towards the efficient frontier. The analysis of determinants of efficiency is not an objective of this study. Therefore, besides presenting a number of efficiency indicator estimations for each country and sector in the annex, here we analyse the general evolution of technical efficiency and total factor productivity change estimates, focusing on country wise similarities and differences, stability of farms' position within technical efficiency ranking, trend and convergence analysis. We investigate the issue of how relative performance of farms fluctuates in terms of technical efficiency over time. We may hypothesise that many poorly performing farms remain inefficient and some farmers are performing always efficiently. We can identify farms which are usually at the bottom or top of the efficiency ranking.

The rest of this paper is organised as follows. Section 2 describes the methodology, followed by the description of the datasets and variables employed in section 3. Section 4 presents the main results of the analysis in two steps. First we outline the results based on the SFA and DEA approaches. Then we present the trend and stability analysis of the efficiency results, followed by the Total Factor Productivity Analysis. Panel unit root tests are applied to analyse convergence and finally the decomposition analysis of TFPC indicators closes the chapter. The last chapter summarizes main results of the paper and concludes.

## II. Methodology

The technical efficiency refers to the situation where it is impossible for a farm to produce more with given technology. There are two possibilities for farmers. First, produce larger output using the same inputs, second, produce the same output with less amounts of the overall inputs. In practice, the research and policy interests are focusing on the relative position in terms of efficiency of particular farms with respect to others. Consequently, the technical efficiency can be described by the relationship between observed output and some ideal or potential production. There is wealth of methodological and empirical literature focusing on the issues in efficiency and productivity (standard theoretical references Coelli et al., 2005; Kumbhakar and Lovell, 2000; while comprehensive overview on empirical research Bravo-Ureta et al. 2007). Two main approaches developed over time for analysing technical efficiency in agriculture are used in this paper: nonparametric data envelopment analysis (DEA) and the parametric stochastic frontier analysis (SFA). While the vast majority of empirical studies on technical efficiency in the agricultural sector mostly have utilized only one method to estimate their efficiencies, we apply both methodological approaches to measure efficiency. After obtaining efficiency estimates, a number of methodological approaches are employed to analyse first step results. In order to analyse the convergence of selected indicators in a panel framework, Ordinary Least Squares (OLS) on time trend, panel unit root tests and dynamic OLS analysis methods were applied. Stability analysis was used to evaluate the percentage of farms with stable (over a two year period), increasing or decreasing efficiency ranking.

### II.1. Panel Unit Root analysis

Panel unit root tests provide an easy way to econometrically test stationarity, and thus convergence or divergence of total factor productivity change components. Panel unit root tests are similar, but not identical, to unit root tests run on individual series. Consider equation 1:

$$y_{i,t} = \rho y_{i,t-1} + X_{i,t}\delta_i + \varepsilon_{i,t} \tag{1}$$

where $i$ = 1,2,…,$N$ are cross-section units and $t$=1,2,…,$T$ the observed periods, $X_{it}$ possible exogenous variables, $\rho_i$ the autoregressive coefficients, and the errors $\varepsilon_{i,t}$ are assumed to be mutually independent idiosyncratic disturbance terms. If $|\rho_i| < 1$, $y_i$ is considered stationary, while if $|\rho_i| = 1$, the process contains a unit root. With panel unit root tests, there are two assumptions regarding $\rho$. First, the persistence parameters are common across cross-sections, that is to say $\rho_i = \rho$, for all $i$. Second, $\rho_i$ can freely vary across cross-sections. There are a number of panel unit root tests assuming one of the above assumptions. Considering the well known low power properties of unit root tests, in this deliverable we employ a battery of unit root tests: Levin et al. (2002) method (common unit root process), Im et al. (2003) method (assuming individual unit root processes), ADF-Chi square and PP-Chi square.

### II.2. Stability Analysis

Efficiency scores as such, do not reveal much about the fluctuation of farms' relative performance. From policy point of view however, it is an interesting question whether low performing farms are always inefficient and vice versa, i.e. farms with higher TE scores are efficient throughout the period. Policy relevance is given by the fact that chronically lower performing farms may be targeted with specific measures in order to improve their efficiency scores. With large panel datasets however, due to sample attrition it is not feasible to follow the TE scores of given farms through longer time periods, therefore comparisons between consecutive years were done. We follow the stability analysis methodology outlined by Barnes et al. (2010). Yearly farm TE scores were classified by terciles, then transition matrices linking two consecutive years were constructed, that indicate whether the considered farm remained in the same tercile, or its relative position has worsened, or contrary, improved. The degree of mobility in patterns of SFA scores can be summarised using indices of mobility. These formally evaluate the degree of mobility throughout the entire distribution of SFA scores and facilitate direct cross-country comparisons. The first of these indices ($M_1$, following Shorrocks, 1978) evaluates the trace (tr) of the transition probability matrix. This index thus directly captures the relative magnitude of diagonal and off-diagonal terms, and can be shown to equal the inverse of the harmonic mean of the expected duration of remaining in a given cell.

$$M_1 = \frac{K - tr(P)}{K - 1} \qquad (2)$$

where K is the number of cells, and P is the transition probability matrix.

The second index ($M_2$, after Shorrocks, 1978 and Geweke et al., 1986) evaluates the determinant (det) of the transition probability matrix.

$$M_2 = 1 - |\det(P)|. \qquad (3)$$

In both indices, a higher value indicates greater mobility, with a value of zero indicating perfect immobility.

### III. Data

EU FADN data were used for this paper. Two sectors were considered, based on the Type of Farming (TF) variables A28 (one digit TF) and A29 (two digits TF): field crop farms (TF1) and dairy farms (TF41). The following variables were used for the empirical analysis (EU FADN database code in brackets):

TO=Total value of Output in Euros (SE131)
TL=Total labour input in Annual Working Units, AWU corresponds to 2,200 hours, (SE010)
UAA= Utilised Agricultural Area (UAA) in hectares (SE025)
IC= Intermediate consumption in Euros (SE275)
FA= Fixed assets in Euros (SE441).

Efficiency was calculated with SFA and DEA with one single output (TO) and four inputs (TL, UAA, IC, FA). All variables in value were deflated by each country's consumer price indices. Data source is the FADN database from 1990 to the latest available year (2006) in case of "old" Member States and 2004–2006 for "new" Member States. Inconsistent data and outliers were removed from the initial datasets. Annex 1 contains the quantile distribution of the sample farms' area. Taking a closer look on the data a quite clear concentration process can be seen in all countries and in most of the quintiles. This process was even stronger in the dairy sector. Detailed descriptive statistics of the variables employed are presented in the annexes 2 and 3. To assess sample farm size changes between the start period (1990 except Hungary, Estonia and Sweden) and the end period (2006), tables 2., 3., and 4. compare the respective means of farms per country, along with the Gini coefficient, measuring the concentration index. Farm size is measured in Utilised Agricultural Area (UAA) for both field crop and dairy farms. In addition, size of dairy farms is also assessed using livestock numbers.

Table 2. Descriptive statistics and concentration index of field crop farms (UAA)

| Field Crop | Utilised Agricultural Area | | | |
|---|---|---|---|---|
| | start period | | end period | |
| | mean | Gini coefficient | mean | Gini coefficient |
| Belgium | 54.00 | 0.2975 | 73.87 | 0.3159 |
| Estonia | 230.11 | 0.4754 | 240.27 | 0.4824 |
| France | 80.89 | 0.3436 | 135.88 | 0.3323 |
| Germany | 47.11 | 0.3501 | 252.02 | 0.6358 |
| Hungary | 255.45 | 0.6671 | 240.05 | 0.6360 |
| Italy | 19.61 | 0.5081 | 50.96 | 0.6503 |
| Netherlands | 62.34 | 0.3220 | 82.81 | 0.3684 |
| Sweden | 83.61 | 0.2939 | 120.19 | 0.4515 |

Source: authors' calculations

Table 3. Descriptive statistics and concentration index of dairy farms (UAA)

| Dairy | Utilised Agricultural Area | | | |
|---|---|---|---|---|
| | start period | | end period | |
| | mean | Gini coefficient | mean | Gini coefficient |
| Belgium | 33.97 | 0.2739 | 50.95 | 0.2651 |
| Estonia | 204.22 | 0.5538 | 211.89 | 0.5603 |
| France | 46.86 | 0.2616 | 81.43 | 0.2786 |
| Germany | 38.72 | 0.2609 | 113.90 | 0.5716 |
| Hungary | 239.25 | 0.6981 | 270.66 | 0.7247 |
| Italy | 20.45 | 0.5126 | 43.66 | 0.5349 |
| Netherlands | 32.92 | 0.2927 | 51.55 | 0.3041 |
| Sweden | 40.62 | 0.2728 | 84.06 | 0.4076 |

Source: authors' calculations

Table 4. Descriptive statistics and concentration index of dairy farms (livestock units)

| Milk | Livestock unit | | | |
|---|---|---|---|---|
| | Starting period | | End period | |
| | mean | Gini coefficient | mean | Gini coefficient |
| Belgium | 83.59 | 0.2818 | 95.94 | 0.2510 |
| Estonia | 84.53 | 0.5913 | 97.42 | 0.5976 |
| France | 60.55 | 0.2546 | 90.32 | 0.2940 |
| Germany | 64.44 | 0.2740 | 136.58 | 0.4993 |
| Hungary | 234.69 | 0.6755 | 222.83 | 0.6867 |
| Italy | 35.54 | 0.4623 | 100.11 | 0.5491 |
| Netherlands | 106.99 | 0.2967 | 127.80 | 0.3216 |
| Sweden | 43.86 | 0.2795 | 80.22 | 0.4274 |

Source: authors' calculations

Tables 2 and 3 show an obvious concentration process happened in all analysed countries during the period. With the exception of Hungary, sample means of farm size for all countries do increase regardless of the sector or farm size measurement used. In some countries, average sample mean increased dramatically (e.g. field crop farm size in Germany increased fivefold[1], Italian field crop and dairy farm sizes trebled, Swedish, French field crop farm sizes doubled). In both tables the second column for both the starting and end period presents the Gini concentration index. The coefficient measures the inequality of a distribution, its value ranging between 0 (total equality) and 1 (maximum inequality). Generally the concentration index also increases between the start and end periods, but by far not as dramatically as farm size means. In Belgium, despite the increasing sample size mean of dairy farms, the concentration index actually decreased. The highest sample size means and concentration indices are reported for the New Member States, Hungary and Estonia. With the exception of these two countries however, interestingly, a higher sample size mean does not translate into a higher concentration index.

## IV. Results

### IV.1 Technical efficiency analysis

Annex 4 presents the estimated TE scores per country, sector and their respective descriptive statistics. Figure 1 presents the TE scores for field crop farms computed with SFA and DEA methods respectively. Figure 2 shows technical efficiency scores for dairy farms computed with SFA and DEA respectively. DEA estimates are generally lower than SFA estimates. Despite the differences between TE scores estimated with SFA and DEA, the relative position of countries is mostly the same. Notable exceptions are Italian dairy farms, which are located in the top of SFA estimations (figure 2 left) whilst being the lowest ranking when DEA was applied (figure 2 right). Results are plausible, when mean technical efficiency scores are computed they are largely in line with results obtained by previous studies. Some examples confirm this. Zhu and Oude Lansink (2010) employ the longest time-span in their research (see table 1), and focus on several of the countries represented in this deliverable, this paper may be used as a benchmark to assess our results. For German crop farms, average TE score obtained was 0.64, versus 0.48 (DEA) and 0.78 (SFA) computed in this study. Brümmer et al. (2002) report an average TE score of 0.95 for specialised German (Schleswig-Holstein) dairy farms, against 0.84 obtained in this paper, also using parametric methods. For the Netherlands, Zhu and Oude Lansink (2010) report a mean TE score of 0.76, versus 0.90 (SFA) or 0.62 (DEA) in this research. For Dutch dairy farms, Brümmer et al. (2002) present an average TE score of 0.89, we have obtained 0.88 (SFA). Swedish crop farms average TE score was estimated to be 0.71, estimations using same method within this deliverable report 0.77. For French dairy sector, average TE score obtained with DEA in this research was 0.60, Fogarasi and Latruffe (2009) computed 0.76 on a shorter time-span. Barnes et al. (2010) obtained an average TE score of 0.76 using SFA, comparable with 0.74 estimated in this paper with the same method.

[1] Mostly due to the German re-unification process, by incorporating large scale former DDR holdings into the sample.

*Figure 1. Technical efficiency scores for field crop farms (SFA/DEA)*

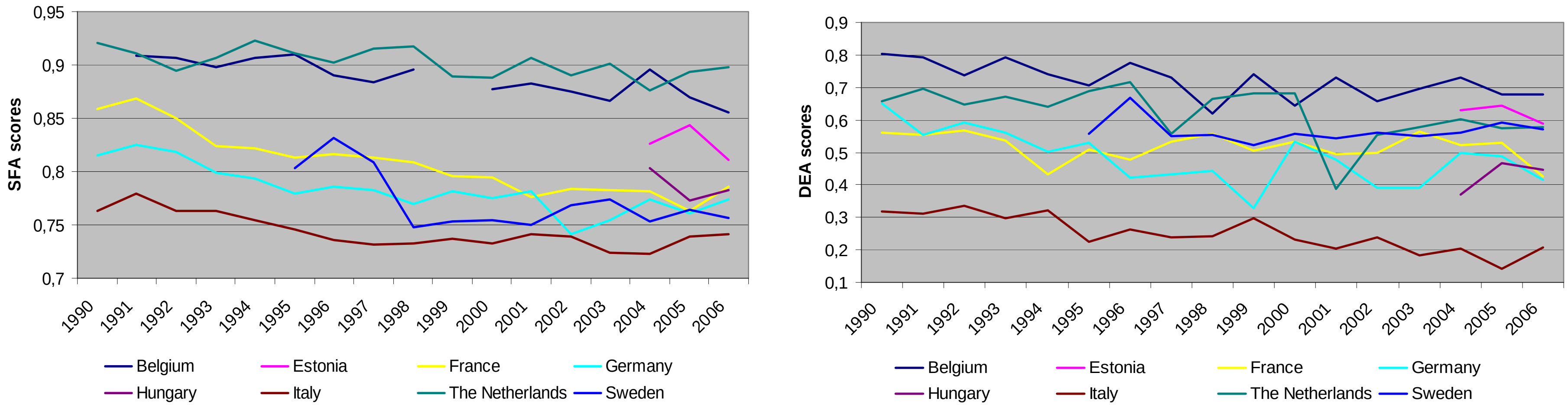
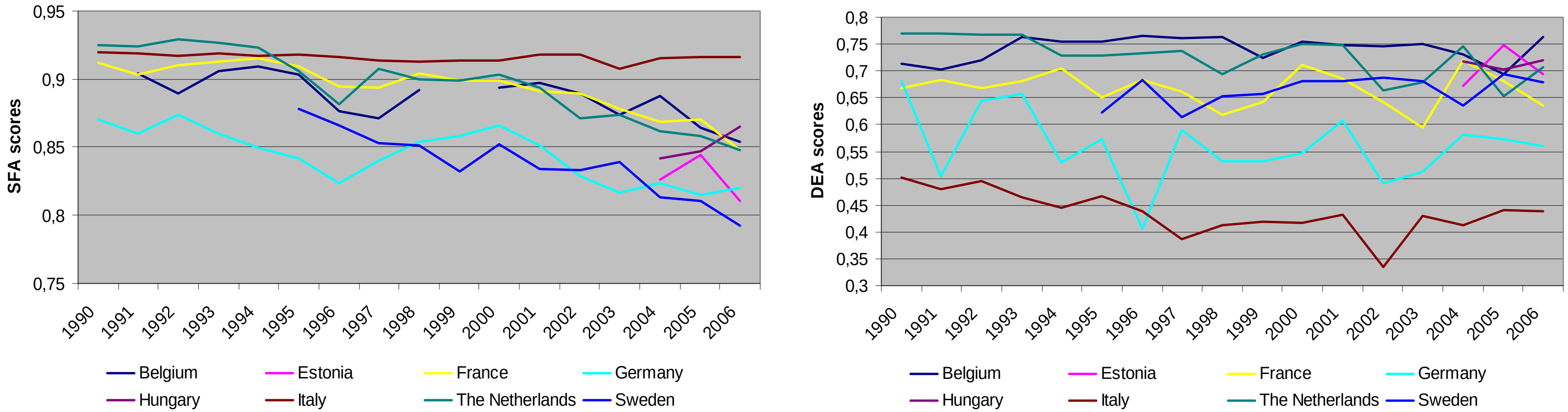



*Figure 2. Technical efficiency scores for dairy farms (SFA/DEA)*



IV.2. OLS on time trend

With simple visual inspection of the efficiency estimation figures, it is difficult to determine whether on long run average per country efficiency scores increase or decrease. We have therefore analysed this issue econometrically by regressing with OLS the TE scores for each sector and each country (for all years pooled together) on a single explanatory variable: the time trend. Table 5 presents the estimated coefficients of per country regressions of efficiency scores on an intercept and time trend as explanatory variable.

Table 5. OLS regression of efficiency scores on a time trend; coefficients' value and significance for the time trend in each country's and TF's regression

| | DEA | | SFA | |
|---|---|---|---|---|
| | Field Crop | Dairy | Field Crop | Dairy |
| Belgium | -0.009*** | 0.001 | -0.003*** | -0.002*** |
| France | -0.005 | -0.002 | -0.007*** | -0.004*** |
| Germany | -0.020** | -0.005 | -0.005*** | -0.003*** |
| Italy | -0.038*** | -0.011** | -0.003*** | -0.001** |
| Netherlands | -0.014** | -0.007*** | -0.002*** | -0.005* |
| Sweden | -0.001 | 0.005* | -0.005** | -0.007*** |

Note: ***, **, * significant on 1, 5 and 10% respectively.
Source: authors' calculations

Significant coefficients are small and negative across regressions, suggesting a decreasing average technical efficiency score for each country and sector included in the analysis. For France, when the dependent variable was computed with DEA, the time trend variable is not significant for either field crop or dairy farms. With SFA, all time trend coefficients are significantly negative in the six countries and the two sectors included in the regression. The regressions were not performed for New Member States since their sample covers only 3 years.

IV.3. Stability Analysis

Following the technique outlined in the methodology section, figures 3 to 10 present the results of the stability analysis for Belgium, Estonia, France, Germany, Hungary, Italy, The Netherlands and Sweden respectively. For each country, left hand graphs depict field crop, whilst right hand side graphs represent dairy farms. Simple visual inspection suggests a surprising stability of results across countries and sectors. Table 6 presents the mean values of the percentage of farms in consecutive years that remain in the same tercile, along those increasing or decreasing their respective terciles.

Table 6. Stability analysis results: percentage of farms in the same tercile during two consecutive years (averages for each country and sector)

| | Field Crop | | | Dairy | | |
|---|---|---|---|---|---|---|
| | increase | remain | decrease | increase | remain | decrease |
| Belgium | 0.20 | 0.61 | 0.19 | 0.16 | 0.66 | 0.17 |
| Estonia | 0.26 | 0.46 | 0.28 | 0.28 | 0.46 | 0.26 |
| France | 0.19 | 0.61 | 0.20 | 0.20 | 0.59 | 0.20 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Germany | 0.20 | 0.61 | 0.19 | 0.21 | 0.59 | 0.20 |
| Hungary | 0.26 | 0.48 | 0.26 | 0.26 | 0.44 | 0.29 |
| Italy | 0.20 | 0.59 | 0.21 | 0.20 | 0.58 | 0.22 |
| Netherlands | 0.20 | 0.58 | 0.21 | 0.17 | 0.65 | 0.18 |
| Sweden | 0.18 | 0.65 | 0.17 | 0.21 | 0.58 | 0.21 |

Source: authors' calculations

Results are surprisingly stable: about 60% of all farms remain in the same tercile two consecutive years, whilst about 15-20% of farms decrease and increase their performance moving down or up a tercile. Results obtained in this section are in line with those of Barnes et al. (2010) for crop and dairy farming in England, Scotland, Wales and Northern Ireland.
On average, 15% (Estonia) to 24% (Germany) of field crop farms remained in the top tercile each year, 13% (Estonia and Hungary) to 17% (Belgium, Germany) in the middle tercile and 17% (Estonia, Hungary) to 22% (France) in the lower tercile (table 7). It is probably more interesting the percentage of farms that changed their terciles over the year. An average of 10% (France, Germany) to 15% (Estonia, Hungary) improved their performance by shifting into a higher (2 to 1 or 3 to 1) tercile, whilst almost the same, on average 10% (France) to 16% (Hungary) fell from the top or middle tercile to the lowest.

Table 7. Average change in technical efficiencies for field crop farms depending on their tercile movement

| | Belgium | Estonia | France | Germany | Hungary | Italy | Netherlands | Sweden |
|---|---|---|---|---|---|---|---|---|
| | | | | Farms remaining each year | | | | |
| tercile 1 | 0.224 | 0.150 | 0.222 | 0.243 | 0.173 | 0.211 | 0.226 | 0.226 |
| tercile 2 | 0.174 | 0.133 | 0.164 | 0.169 | 0.134 | 0.160 | 0.155 | 0.181 |
| tercile 3 | 0.208 | 0.173 | 0.222 | 0.202 | 0.171 | 0.215 | 0.201 | 0.240 |
| | | | | Farms increasing each year | | | | |
| tercile 2-1 | 0.081 | 0.093 | 0.082 | 0.083 | 0.100 | 0.089 | 0.084 | 0.078 |
| tercile 3-1 | 0.030 | 0.058 | 0.022 | 0.025 | 0.057 | 0.031 | 0.026 | 0.017 |
| tercile 3-2 | 0.091 | 0.115 | 0.089 | 0.084 | 0.103 | 0.083 | 0.094 | 0.083 |
| | | | | Farms decreasing each year | | | | |
| tercile 1-2 | 0.076 | 0.102 | 0.086 | 0.088 | 0.103 | 0.091 | 0.087 | 0.082 |
| tercile 1-3 | 0.035 | 0.053 | 0.023 | 0.022 | 0.060 | 0.031 | 0.030 | 0.013 |
| tercile 2-3 | 0.082 | 0.124 | 0.089 | 0.084 | 0.099 | 0.089 | 0.097 | 0.081 |

Source: authors' calculations

For dairy farm analysis (table 8), an average of 9% (France) to 24% (Belgium) remained in the top, 6% (France) to 18% (Belgium) in the middle and 10% (France) to 24% (Belgium) in the lower tercile over one year period. As for field crop farms, it is more of an interest to comment the percentage of farms improving or worsening their positions over the period. On average 9% (Belgium) to 19% (Estonia, Hungary) improved their technical efficiency scores by moving up one or two terciles, whilst a similar number, 9% (Belgium) to 19% (Hungary) fell from the middle or highest tercile to the lowest. It is interesting to note, that for both field crop and dairy farms, New Member States (Estonia and Hungary) register the highest average percentage of farms either dramatically increasing or decreasing their terciles, suggesting a highly unstable yearly performance. These countries also register the lowest percentages of farms that are stable in the same tercile during the year.

*Figure 3 . Tercile stability analysis for Belgian field crop and dairy farms*

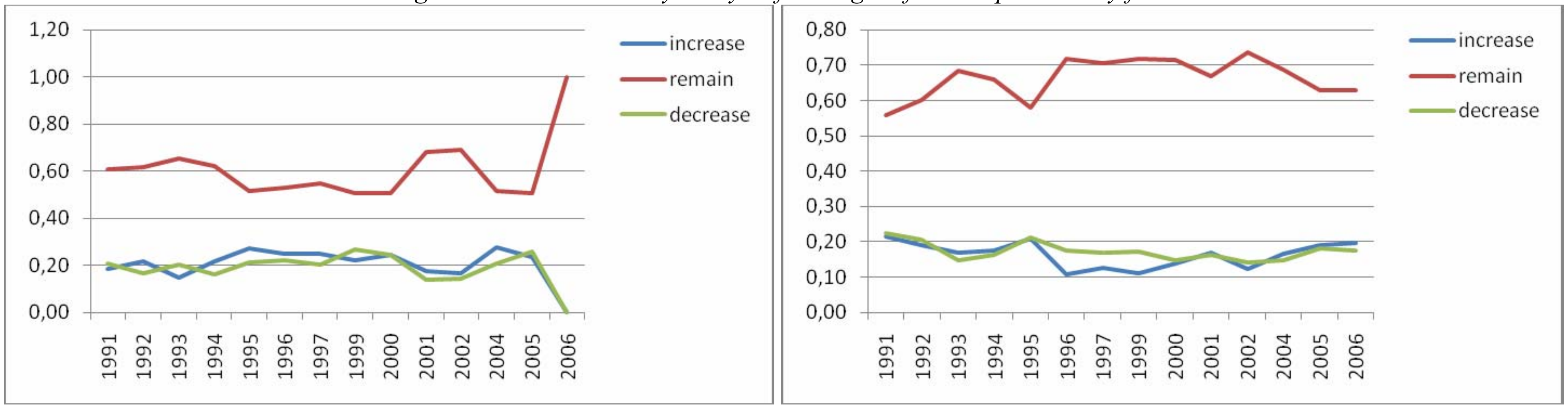



*Figure 4 . Tercile stability analysis for Estonian field crop and dairy farms*

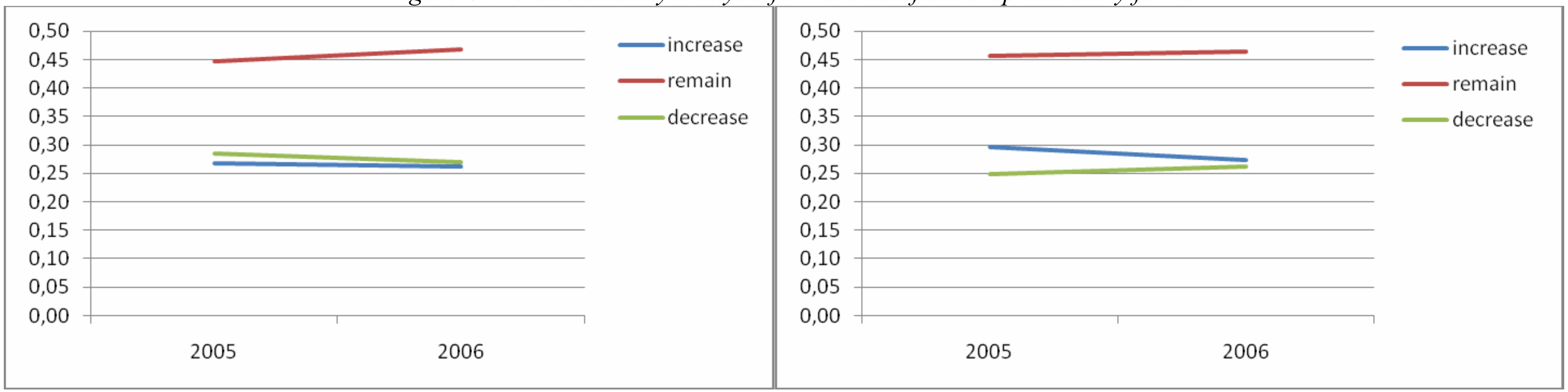


*Figure 5. Tercile stability analysis for French field crop and dairy farms*

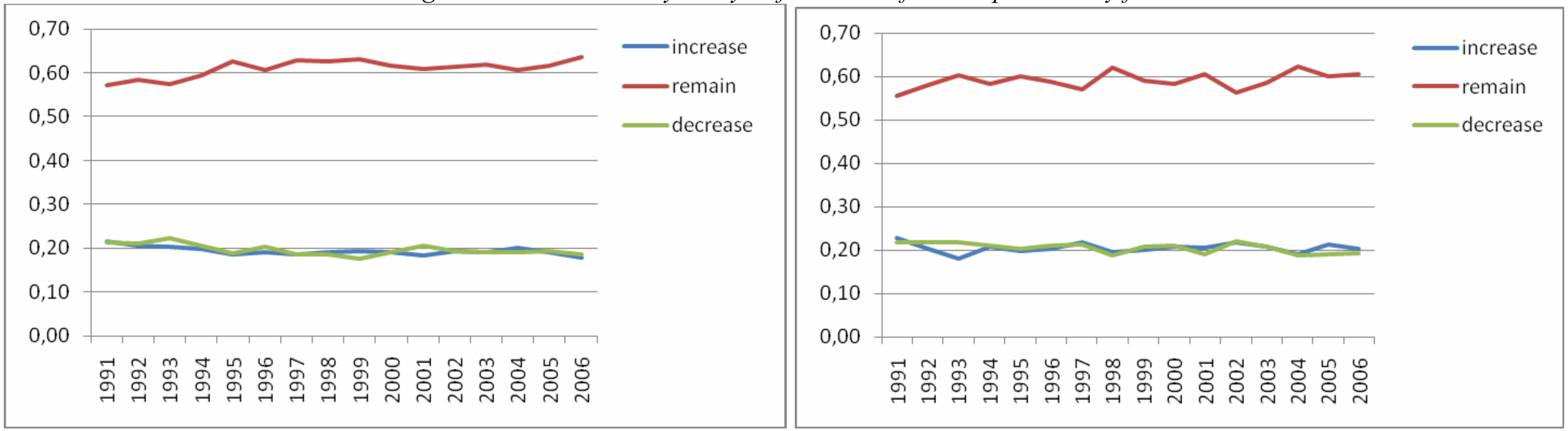



*Figure 6. Tercile stability analysis for German field crop and dairy farms*

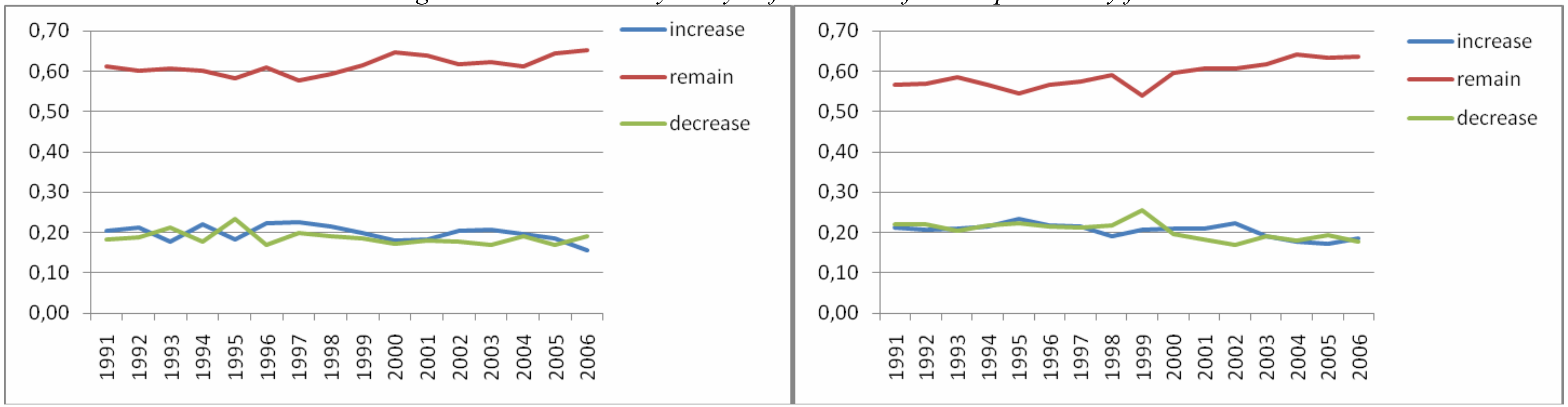


*Figure 7. Tercile stability analysis for Hungarian field crop and dairy farms*

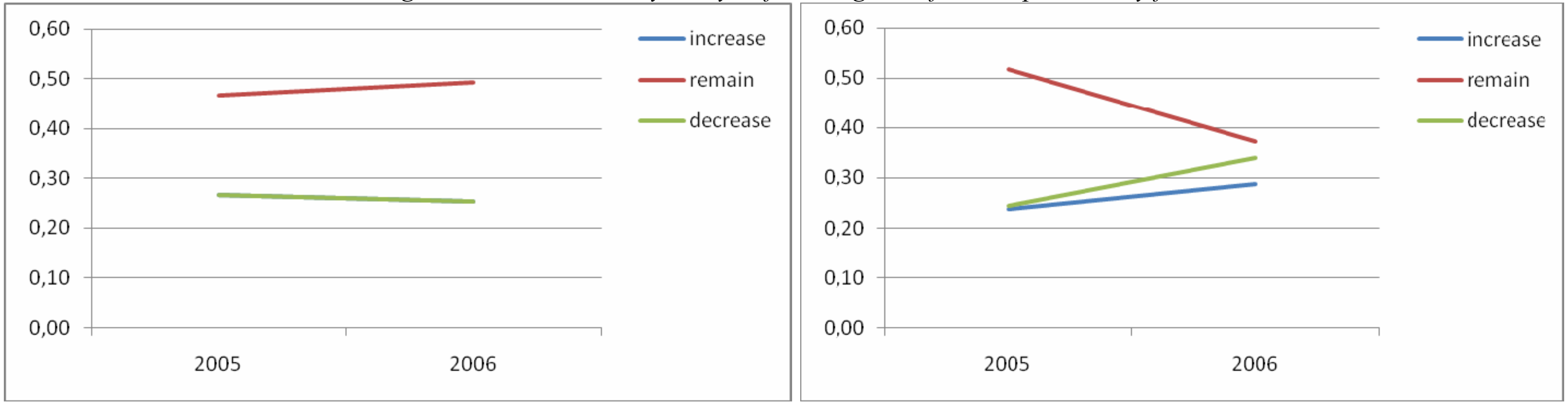



*Figure 8. Tercile stability analysis for Italian field crop and dairy farms*

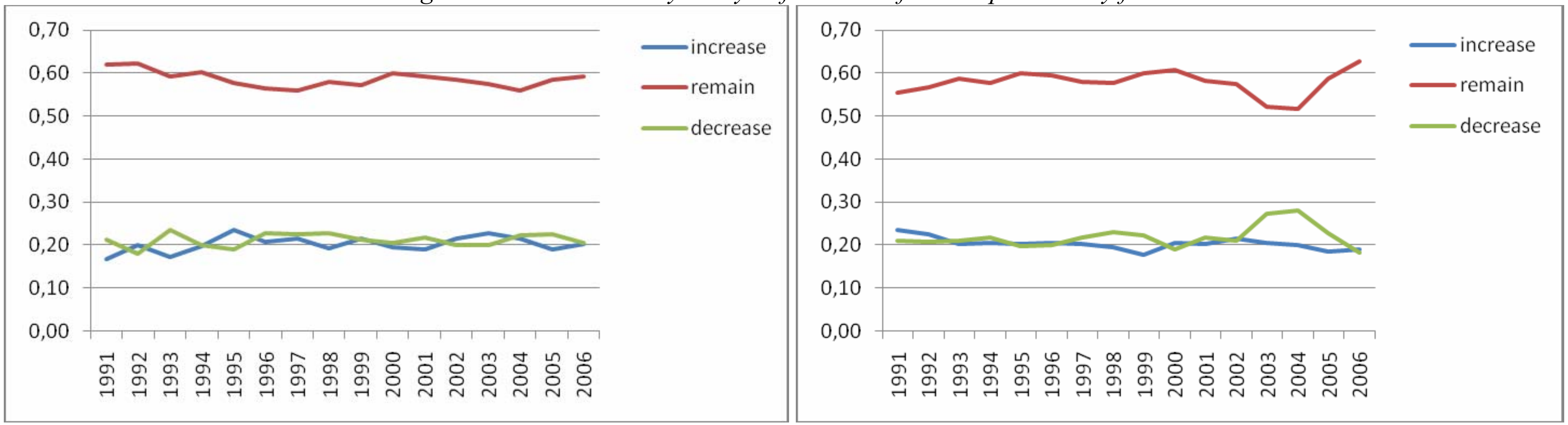


*Figure 9. Tercile stability analysis for Dutch field crop and dairy farms*

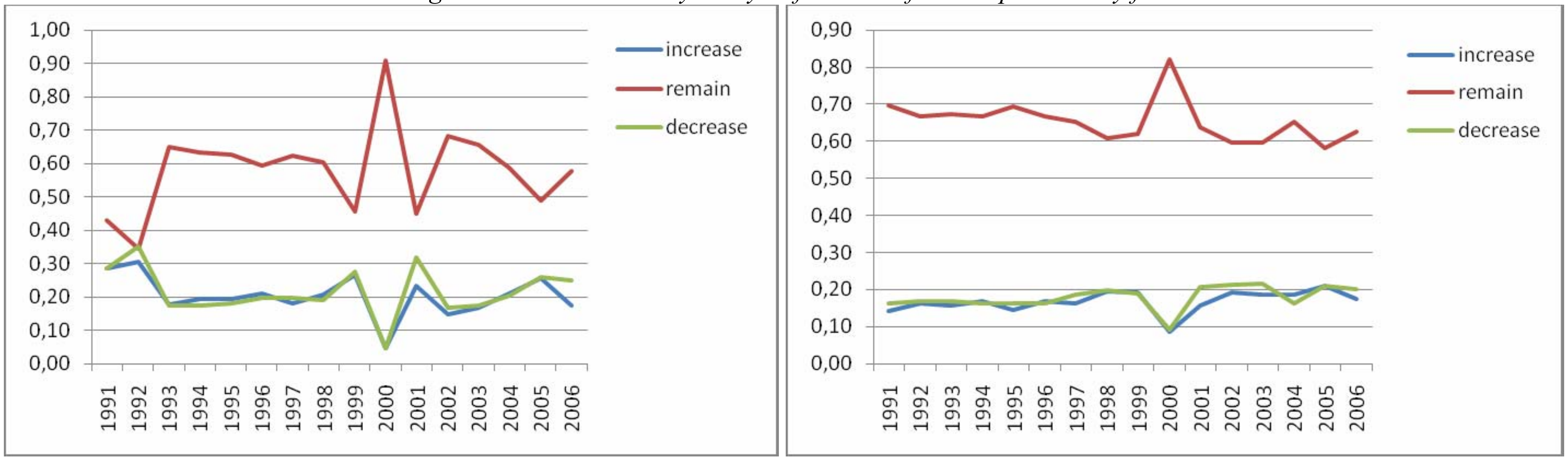



*Figure 10. Tercile stability analysis for Swedish field crop and dairy farms*

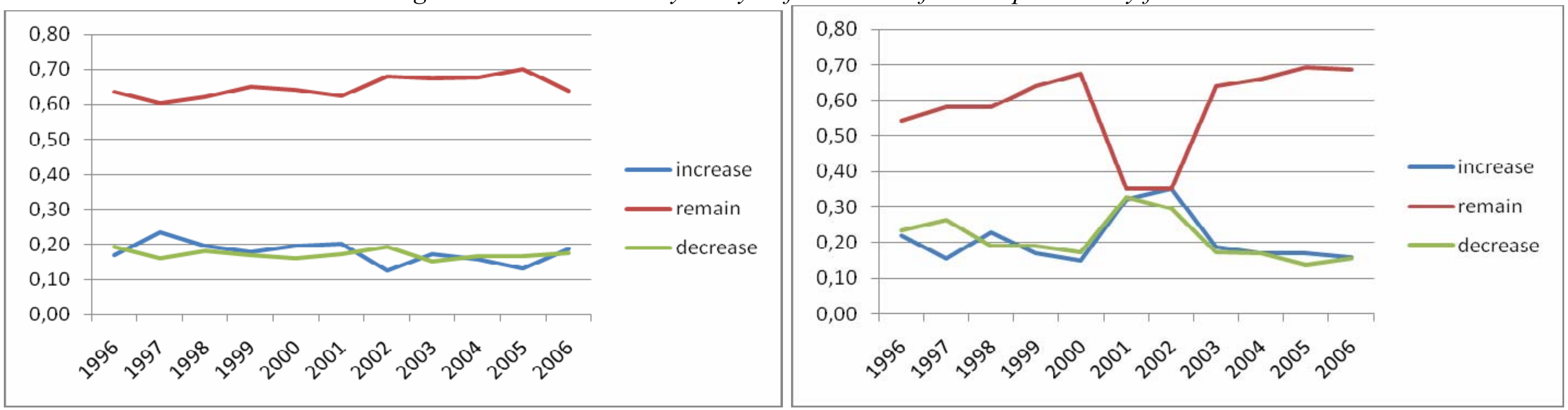


Table 8. Average change in technical efficiencies for dairy farms depending on their tercile movement

| | BE | EST | FR | GER | HU | IT | NL | SW |
|---|---|---|---|---|---|---|---|---|
| | | | | Farms remaining each year | | | | |
| tercile 1 | 0.244 | 0.161 | 0.090 | 0.205 | 0.140 | 0.221 | 0.239 | 0.213 |
| tercile 2 | 0.179 | 0.127 | 0.060 | 0.159 | 0.104 | 0.157 | 0.178 | 0.160 |
| tercile 3 | 0.240 | 0.172 | 0.105 | 0.225 | 0.201 | 0.200 | 0.236 | 0.209 |
| | | | | Farms increasing each year | | | | |
| tercile 2-1 | 0.072 | 0.109 | 0.086 | 0.086 | 0.140 | 0.096 | 0.074 | 0.079 |
| tercile 3-1 | 0.015 | 0.071 | 0.027 | 0.025 | 0.050 | 0.028 | 0.015 | 0.030 |
| tercile 3-2 | 0.077 | 0.105 | 0.094 | 0.090 | 0.073 | 0.084 | 0.078 | 0.096 |
| | | | | Farms decreasing each year | | | | |
| tercile 1-2 | 0.077 | 0.090 | 0.086 | 0.092 | 0.161 | 0.095 | 0.081 | 0.082 |
| tercile 1-3 | 0.012 | 0.060 | 0.026 | 0.027 | 0.029 | 0.033 | 0.015 | 0.032 |
| tercile 2-3 | 0.085 | 0.105 | 0.092 | 0.092 | 0.102 | 0.086 | 0.084 | 0.099 |

Source: authors' calculations

The mean of yearly mobility indexes, M1 and M2 (see equations 14 and 15), for the Old Member States are presented in table 9. For both indices a higher value indicates greater mobility, whilst a value close to zero indicates perfect immobility.

Table 9. Means of M1 and M2 mobility indices for field crop and dairy farms

| | Field Crop | | Dairy | |
|---|---|---|---|---|
| | M1 | M2 | M1 | M2 |
| Belgium | 0.59 | 0.82 | 0.50 | 0.79 |
| Estonia | 0.81 | 0.99 | 0.81 | 0.98 |
| France | 0.59 | 0.86 | 0.61 | 0.89 |
| Germany | 0.58 | 0.85 | 0.62 | 0.89 |
| Hungary | 0.78 | 0.97 | 0.83 | 0.97 |
| Italy | 0.62 | 0.88 | 0.63 | 0.89 |
| Netherlands | 0.63 | 0.86 | 0.52 | 0.80 |
| Sweden | 0.52 | 0.81 | 0.63 | 0.87 |

Source: authors' calculations

Index means are remarkably similar across countries in this research. It is important to notice, that the M2 index ranks countries in the same way as M1 does, implying consistency of results. M1 ranges from 0.52 to 0.63 (0.50 to 0.63) for field crop (dairy) farms, and M2 from 0.81 to 0.88 (0.79 to 0.89) for field crop (dairy) farms indicating a similar degree of mobility for the Old Member States represented here. M1 and M2 indices are significantly higher for New Member States (Estonia and Hungary). M2 reaches 0.97 and 0.99 for both sectors in Hungary and Estonia, suggesting higher mobility of SFA scores throughout the entire distribution. For field crop farming, the lowest mobility scores are recorded for Sweden, whilst for dairy farms in Belgium and Netherlands.

IV.4. Total Factor Productivity Analysis

Detailed results computed with non-parametric methods of Total Factor Productivity Change, and its driving components, Technical Change (TC), Technical Efficiency Change (TEC), Scale Efficiency Change (SEC) and Allocative Efficiency Change (AEC) are available upon request. To get a picture about the volatility of indicators, tables 10 and 11 present the coefficient of variation for TFPC and its components for the field crop and dairy farms.

Table 10. Coefficient of variation for Total Factor Productivity Changes and its components for field crop farms

| | TFPC | TC | TEC | SEC | AEC |
|---|---|---|---|---|---|
| Belgium | 0.593 | 0.236 | 0.152 | 0.093 | 0.132 |
| France | 0.054 | 0.130 | 0.104 | 0.084 | 0.294 |
| Germany | 0.053 | 0.181 | 0.216 | 0.154 | 0.454 |
| Italy | 0.044 | 0.267 | 0.260 | 0.226 | 0.180 |
| Netherlands | 0.150 | 0.376 | 0.196 | 0.086 | 0.298 |
| Sweden | 0.228 | 0.102 | 0.125 | 0.083 | 0.174 |
| Pooled | 0.228 | 0.102 | 0.125 | 0.083 | 0.174 |

Source: authors' calculations

Table 11. Coefficient of variation for Total Factor Productivity Changes and its components for dairy farms

| | TFPC | TC | TEC | SEC | AEC |
|---|---|---|---|---|---|
| Belgium | 0.044 | 0.064 | 0.046 | 0.034 | 0.149 |
| France | 0.026 | 0.068 | 0.056 | 0.037 | 0.478 |
| Germany | 0.043 | 0.181 | 0.175 | 0.122 | 0.221 |
| Italy | 0.025 | 0.078 | 0.080 | 0.045 | 0.141 |
| Netherlands | 0.126 | 0.079 | 0.063 | 0.042 | 0.583 |
| Sweden | 0.077 | 0.051 | 0.083 | 0.064 | 0.131 |
| Pooled | 0.093 | 0.101 | 0.094 | 0.064 | 0.361 |

Source: authors' calculations

There is no obvious common trend. The highest volatility is recorded for Belgium field crop farms' TFPC, lowest for French dairy farms' TFPC. Field crop farm indicators generally present a significantly higher volatility than dairy farms. Notable exception is the AEC variable that (a) has much higher volatility in the case of dairy farms, (b) has the highest volatility of all indicators within dairy farms.

As indicated in the methodology section, panel unit root tests may provide information about whether TFPC and its components have the tendency to converge, or contrary, to diverge between countries. Table 12 and 13 present the panel unit root analysis results for field crop and dairy farms respectively.

Table 12. Panel unit root analysis for field crop farms

| | | | | | |
|---|---|---|---|---|---|
| Exogenous variables: Individual effects | | | | | |
| Levin, Lin & Chu t | TFPC | TC | TEC | SEC | AEC |
| Im, Pesaran and Shin W-stat | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ADF - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PP - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Exogenous variables: Individual effects, individual linear trends | | | | | |
| Levin, Lin & Chu t | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Im, Pesaran and Shin W-stat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ADF - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PP - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Source: authors' calculations

Table 13. Panel unit root analysis for dairy farms

| | | | | | |
|---|---|---|---|---|---|
| Exogenous variables: Individual effects | | | | | |
| | TFPC | TC | TEC | SEC | AEC |
| Levin, Lin & Chu t | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Im, Pesaran and Shin W-stat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ADF - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PP - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Exogenous variables: Individual effects, individual linear trends | | | | | |
| Levin, Lin & Chu t | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Im, Pesaran and Shin W-stat | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ADF - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PP - Fisher Chi-square | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Source: authors' calculations

All unit root tests applied here have non-stationarity (i.e. unit root) as their null hypothesis. With the exception of the Levin, Lin & Chu t-test for TFPC variable for field crop farms, the panel unit root hypothesis is strongly rejected by all tests for all variables, concluding stationary processes. It follows, that country estimates of TFPC and its components do not diverge over time.

To evaluate more formally the possible factors influencing TFPC we apply panel model estimations for Old EU Member States. We need to exclude Estonia and Hungary from the sample due to short time span. We regress TFPC on its components: TC, TEC, SEC, AEC (model 1). In addition, we employ two other variables: time trend (model 2), and a reform dummy which equal to one in 1992 and 2000, otherwise zero (model 3). We applied both random and fixed effects models, but the Hausman test always favours the fixed effect models at 5 per cent.

Our results are not really straightforward for field crop farms (table 14). Except for technical change, all other variables are insignificant. In line with our a priori expectations, technical change positively influences the total productivity changes. Interestingly, the CAP reform dummy variable is not significant.

Table 14. Panel estimations for total productivity changes for field crop farms

| | (1) | (2) | (3) |
|---|---|---|---|
| TC | 0.509** | 0.626*** | 0.657*** |
| TEC | 0.203 | 0.518 | 0.643 |
| SEC | 0.260 | 0.002 | -0.130 |
| AEC | -0.112 | -0.073 | -0.077 |
| Time | - | 0.007 | - |
| CAP Reform | - | - | -0.007 |
| Constant | 0.103 | -0.186 | -0.137 |
| N | 90 | 90 | 90 |
| $R^2$ | 0.0735 | 0.0785 | 0.0681 |
| Hausman test (p value) | 0.000 | 0.000 | 0.000 |

Sources: own calculations

Estimations show promising results for the milk farms (Table 15). Technical change, technical efficiency change and allocative efficiency change have positive impact on the total productivity change. Similarly to crop farms, additional variables as time trend and CAP reform are insignificant.

Table 15. Panel estimations for total productivity changes for milk farms

| | (1) | (2) | (3) |
|---|---|---|---|
| TC | 0.678*** | 0.683*** | 0.648*** |
| TEC | 0.984*** | 0.967*** | 0.950*** |
| SEC | -0.269 | -0.246 | -0.271 |
| AEC | 0.044*** | 0.043*** | 0.039** |
| Time | - | 0.001 | - |
| CAP Reform | - | - | 0.022 |
| constant | -0.489* | -0.509* | -0.420 |
| N | 90 | 90 | 90 |
| $R^2$ | 0.0508 | 0.0522 | |
| Hausman test (p value) | 0.0927 | 0.0063 | 0.0049 |

Sources: own calculations

## V. Conclusions

In this paper we present and analyse various efficiency indicators for countries included in an FP7 (FACEPA) project, Belgium, Estonia, France, Germany, Hungary, Italy, The Netherlands and Sweden. The availability of long period datasets between 1990 and 2006, allows us to concentrate on the long time trends in technical efficiency especially in Old Member States. This study is the first which may provide a comprehensive overview on the development in farm level efficiency across eight European countries. We apply both DEA and SFA methodological approaches to measure efficiency, focusing on the field crops and dairy sectors. Our main results are following. Generally, all countries have relatively high levels of mean efficiency ranging from 0.72 to 0.92 for both field crops and dairy farms. Interestingly majority of countries have better performance in dairy sectors in terms of higher levels of mean efficiency than in field crop production. This suggests that larger heterogeneity in terms of agricultural practices apply in crop farming than in dairy farming. This is contrary to the intuition that livestock farming, which requires more human input than crop farming, would present a larger heterogeneity of human practices (this assumption was for example put forward by Curtiss 2000). However, an explanation may be that crop farming is more affected by land quality and climate conditions than livestock farming. Latruffe et al. (2009) have for example provided evidence of the role of climate conditions on farms' technical efficiency. Input quality is not taken into account within our analysis, as it is impossible to find equivalent proxy across all countries. Therefore, lower efficiency in field crop sector than in dairy sector may in fact be due to different land quality, which may affect farms' performance more than labour quality for example. A slightly decreasing trend of efficiency may be observed for all countries. Technical Efficiency estimates are largely in line with those obtained by previous studies.
We investigate the issue of how relative performance of farms fluctuates in terms of technical efficiency over time. We may hypothesise that many poorly performed farms remaining inefficient and some farmers are performing always very efficiently. We can identify farms which are usually at the bottom or top of the efficiency ranking. However, the FADN data has an inherent problem for long time period analysis arising from its rotated panel nature, namely that not all the farms are observed for the whole period. So we need to calculate transition matrices in each consecutive year. Surprisingly stability analysis revealed that in average 60% of farms maintain their efficiency ranking in two consecutive years, whilst 20% improve and 20% worsen their positions for all countries. However, these ratios slightly fluctuate around these values for one year to next year. Mobility analysis ranks countries according to the mobility of SFA scores within the distribution. Farms in New Member States are more mobile than those in EU15. This may be due to the unstable economic conditions of farms in these countries, where e.g. inputs access is not always secured or is costly.

The DEA estimation shows a similar declining trend on the development of technical efficiency over time except Swedish dairy sector increasing efficiency trend. We investigate the total productivity changes in two steps. First, we do not find a definite trend in total factor productivity changes. Second, we address the question whether total factor productivity changes converge or diverge over time. Using panel unit root tests our estimations reveals a convergence of productivity across old EU member countries during analysed period. Panel unit root tests also reject the divergent technical change, technical efficiency change, scale efficiency change and allocative efficiency change null hypothesis across countries.

Finally, we decompose the total factor productivity changes into its main elements. Total Factor Productivity Change analysis, is first done graphically, showing rather different behaviour of TFPC and its components across countries and sectors. Indicators are represented by high volatility, a trend analysis does not however produce conclusive results except for Italy. In addition, field crop farm indicators generally present a significantly higher volatility than dairy farms. Random effect panel regression of Total Factor Productivity Change on its components shows Technological Change as being the significant positive driver for crop farms, whilst technical efficiency change followed by technological change are the most important for dairy farms. In addition we do not find significant impacts on CAP reform in 1992 and 2000 on total productivity changes.

This deliverable has highlighted the usefulness of FADN data in conducting a comparative analysis of farms' performance across EU Member States. The FADN database enables to use homogenous variables and indicators across countries and over time. A few shortcomings of the database can also be underlined. Firstly, the rotating nature of the panel makes it difficult to perform a long term investigation. The samples' changes imply that balanced panels over several years are too small to produce robust results. Therefore, we had to resort to balanced panels over two consecutive years only, limiting the possibility to follow the performance of the same farms over a long period and assess truly the effect of shocks such as CAP reforms. Secondly, the FADN database is too poor in terms of input prices. Regarding rentals, the variable includes both rentals for land and rentals for other assets (buildings, livestock), and therefore land price is difficult to assess. As for variable inputs, the absence of prices in the FADN database forces to use yearly price indices that are similar for all farms in each country, which reduces the information available in the calculations.

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## Annex 1

**Quintile distribution of sample farms according to area in hectares**

| Quintiles | Crop farms (TF 1) | | Dairy farms (TF 41) | |
|---|---|---|---|---|
| | **Mean** | | **Mean** | |
| | **Start of the period** | **End of the period** | **Start of the period** | **End of the period** |
| **BELGIUM** | | | | |
| Q1 | 1.899 | 3.744 | 1.069 | 0.000 |
| Q2 | 13.667 | 22.842 | 37.092 | 33.901 |
| Q3 | 23.944 | 40.060 | 70.630 | 73.382 |
| Q4 | 37.691 | 59.971 | 109.312 | 125.362 |
| Q5 | 66.505 | 106.533 | 261.660 | 315.325 |
| **ESTONIA** | | | | |
| Q1 | 25.843 | 27.179 | 0.000 | 0.000 |
| Q2 | 64.823 | 67.462 | 5.878 | 5.456 |
| Q3 | 113.643 | 118.739 | 18.311 | 18.814 |
| Q4 | 206.577 | 217.458 | 41.585 | 46.273 |
| Q5 | 613.707 | 708.010 | 262.883 | 330.392 |
| **FRANCE** | | | | |
| Q1 | 11.406 | 11.795 | 0.000 | 0.000 |
| Q2 | 29.383 | 42.563 | 7.581 | - |
| Q3 | 44.282 | 73.860 | 31.580 | 35.892 |
| Q4 | 65.494 | 114.953 | 56.888 | 87.519 |
| Q5 | 125.835 | 211.322 | 145.942 | 253.414 |
| **GERMANY** | | | | |
| Q1 | 10.428 | 9.935 | 1.287 | 0.000 |
| Q2 | 23.457 | 34.784 | 25.671 | 21.674 |
| Q3 | 32.965 | 58.442 | 46.320 | 59.221 |
| Q4 | 44.875 | 96.461 | 68.903 | 121.962 |
| Q5 | 74.178 | 604.002 | 134.795 | 448.259 |
| **HUNGARY** | | | | |
| Q1 | 22.478 | 24.320 | 10.668 | 12.810 |
| Q2 | 56.547 | 59.738 | 29.418 | 35.153 |
| Q3 | 101.165 | 105.905 | 69.776 | 62.133 |
| Q4 | 188.587 | 198.948 | 221.116 | 175.177 |
| Q5 | 911.343 | 815.989 | 842.472 | 847.454 |
| **ITALY** | | | | |
| Q1 | 2.376 | 2.273 | 0 | 0 |
| Q2 | 5.553 | 6.522 | - | - |
| Q3 | 9.074 | 13.281 | 2.785 | - |
| Q4 | 15.295 | 27.954 | 10.640 | 11.450 |
| Q5 | 50.263 | 122.099 | 52.827 | 188.44 |
| **THE NETHERLANDS** | | | | |
| Q1 | 1.166 | 1.179 | 0.000 | 0.000 |
| Q2 | 8.101 | 5.876 | - | - |
| Q3 | 19.906 | 19.490 | 33.844 | 45.546 |
| Q4 | 35.269 | 41.034 | 101.211 | 135.334 |
| Q5 | 74.570 | 98.826 | 312.098 | 687.946 |
| **SWEDEN** | | | | |
| Q1 | 19.675 | 22.634 | 0.183 | 0.629 |
| Q2 | 33.703 | 47.414 | 15.995 | 24.556 |
| Q3 | 45.010 | 70.443 | 32.743 | 48.595 |
| Q4 | 60.592 | 105.279 | 49.634 | 87.945 |
| Q5 | 112.837 | 245.062 | 97.629 | 261.339 |

Source: FADN database

## Annex 2

Descriptive statistics of variables used – first and last years of sample
Crop farms (TF 1)

| Countries | First year of sample | | | | Last year of sample | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | St. Dev. | Min | Max | Mean | St. Dev. | Min | Max |
| **BELGIUM** | | | | | | | | |
| Total Output deflated (TO) | 118,172 | 67,802 | 20,894 | 337,157 | 114,646 | 95,258 | 14,477 | 527,785 |
| Utilised Agricultural Area (UAA) | 54.00 | 29.39 | 5.18 | 169.37 | 73.87 | 42.29 | 17.35 | 223.96 |
| Total Labour (TL) | 1.47 | 0.64 | 0.46 | 4.96 | 1.40 | 0.59 | 0.40 | 3.91 |
| Intermediate consumption deflated (IC) | 53,664 | 30,294 | 8,570 | 170,436 | 55,047 | 43,568 | 7,653 | 229,866 |
| Fixed Assets deflated (FA) | 205,672 | 156,483 | 19,107 | 745, 961 | 314,747 | 288,662 | 2,268 | 1,605,155 |
| Land price deflated (PL) | 155 | 40 | 65 | 300 | 180 | 89 | 45 | 494 |
| Labour price deflated (PL) | 11,422 | 3,327 | 2,942 | 25,681 | 16,199 | 2,953 | 5,899 | 31,578 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 112 | 0 | 112 | 112 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 157 | 0 | 157 | 157 |
| **ESTONIA** | | | | | | | | |
| Total Output deflated (TO) | 69,556 | 71,093 | 4,329 | 369,571 | 68,604 | 75,946 | 2,238 | 419,243 |
| Utilised Agricultural Area (UAA) | 230.11 | 213.95 | 9.10 | 984.95 | 240.27 | 235.24 | 8.20 | 1,247.55 |
| Total Labour (TL) | 2.40 | 1.89 | 0.27 | 12.66 | 2.37 | 1.90 | 0.55 | 12.54 |
| Intermediate consumption deflated (IC) | 52,106 | 53,263 | 3,775 | 250,006 | 56,194 | 63,625 | 2,008 | 342,887 |
| Fixed Assets deflated (FA) | 159,346 | 190,892 | 188 | 1,204,610 | 156,800 | 167,492 | 1,061 | 879,786 |
| Land price deflated (PL) | 8 | 22 | 0 | 271 | 9 | 9 | 0 | 67 |
| Labour price deflated (PL) | 3,173 | 1,348 | 714 | 7,645 | 3,498 | 1,290 | 996 | 8,181 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 109 | 0 | 109 | 109 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 106 | 0 | 106 | 106 |
| **FRANCE** | | | | | | | | |
| Total Output deflated (TO) | 109,611 | 76,576 | 8,667 | 765,489 | 114,639 | 95,250 | 2,064 | 1,235,507 |
| Utilised Agricultural Area (UAA) | 80.89 | 53.77 | 1.40 | 435.00 | 135.88 | 84.87 | 2.17 | 705.63 |
| Total Labour (TL) | 1.52 | 0.82 | 0.76 | 12.55 | 1.84 | 1.35 | 0.76 | 21.81 |
| Intermediate consumption deflated (IC) | 53,410 | 35,812 | 5,518 | 345,301 | 73,920 | 51,121 | 3,707 | 484,101 |
| Fixed Assets deflated (FA) | 136,700 | 106,646 | 432 | 1,538,609 | 150,089 | 134,145 | 19 | 1,449,649 |
| Land price deflated (PL) | 110 | 68 | 0 | 1,104 | 107 | 96 | 0 | 2,942 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Labour price deflated (PL) | 14,346 | 5,713 | 1,058 | 53,540 | 14,154 | 5,159 | 569 | 96,520 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 124 | 0 | 124 | 124 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 135 | 0 | 135 | 135 |
| **GERMANY** | | | | | | | | |
| Total Output deflated (TO) | 91,084.40 | 67,661.11 | 11,366.00 | 475,584.00 | 229,618.10 | 429,410.25 | 3,327.00 | 6,610,749.00 |
| Utilised Agricultural Area (UAA) | 47.11 | 32.04 | 3.53 | 267.59 | 252.02 | 470.17 | 3.37 | 5,196.70 |
| Total Labour (TL) | 1.49 | 0.70 | 0.17 | 6.52 | 3.37 | 6.33 | 1.00 | 95.50 |
| Intermediate consumption deflated (IC) | 50,295.05 | 36,500.36 | 7,750.00 | 239,026.00 | 155,091.19 | 297,504.53 | 7,289.00 | 4,416,859.00 |
| Fixed Assets deflated (FA) | 300,327.56 | 282,800.77 | 2,239.00 | 3,094,287.00 | 690,661.40 | 719,602.79 | 368.00 | 9,250,715.00 |
| Land price deflated (PL) | 254.40 | 155.14 | 14.22 | 1,898.87 | 205.58 | 406.67 | 1.46 | 14,274.86 |
| Labour price deflated (PL) | 12,221.86 | 5,923.79 | 1,699.33 | 47,793.15 | 14,067.40 | 6,374.18 | 2,071.15 | 47,380.12 |
| Intermediate consumption price index (PIC) | 100.00 | 0.00 | 100.00 | 100.00 | 127.10 | 0.00 | 127.10 | 127.10 |
| Capital price index (PC) | 100.00 | 0.00 | 100.00 | 100.00 | 131.30 | 0.00 | 131.30 | 131.30 |
| **HUNGARY** | | | | | | | | |
| Total Output deflated (TO) | 189,179 | 454,328 | 2,198 | 5,426,983 | 141,741 | 276,075 | 492 | 2,217,689 |
| Utilised Agricultural Area (UAA) | 255.45 | 500.9 | 5.07 | 5,078.00 | 240.05 | 426.50 | 3.68 | 3,681.00 |
| Total Labour (TL) | 4.34 | 10.18 | 0.01 | 97.4 | 4.05 | 9 | 0.01 | 100.09 |
| Intermediate consumption deflated (IC) | 122,299 | 280,757 | 2,685 | 3,276,464 | 100,238 | 199,847 | 2,080 | 1,657,006 |
| Fixed Assets deflated (FA) | 232,577 | 406,143 | 397 | 5,692,597 | 203,281 | 299,100 | 225 | 2,973,876 |
| Land price deflated (PL) | 49 | 41 | 0 | 503 | 53 | 39 | 0 | 257 |
| Labour price deflated (PL) | 4,848 | 2,322 | 0 | 18,919 | 4,718 | 1,829 | 0 | 15,284 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 105 | 0 | 105 | 105 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 111 | 0 | 111 | 111 |
| **ITALY** | | | | | | | | |
| Total Output deflated (TO) | 35,444 | 44,944 | 263 | 570,335 | 48,070 | 117,616 | 325 | 2,467,585 |
| Utilised Agricultural Area (UAA) | 19.61 | 24.48 | 0.24 | 378.00 | 50.96 | 101.26 | 0.50 | 1,846.87 |
| Total Labour (TL) | 1.66 | 1.00 | 0.04 | 11.58 | 1.74 | 2.60 | 0.06 | 45.76 |
| Intermediate consumption deflated (IC) | 13,992 | 18,733 | 417 | 211,490 | 23,549 | 62,006 | 244 | 1,225,770 |
| Fixed Assets deflated (FA) | 197,325 | 247,516 | 53 | 3,086,357 | 440,172 | 1,462,303 | 12 | 35,561,353 |
| Land price deflated (PL) | 216 | 163 | 0 | 3,942 | 163 | 138 | 0 | 3,078 |
| Labour price deflated (PL) | 12,063 | 1,932 | 2,634 | 25,032 | 10,255 | 1,883 | 1,206 | 26,348 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 140 | 0 | 140 | 140 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 168 | 0 | 168 | 168 |
| **THE NETHERLANDS** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Output deflated (TO) | 182,102 | 122,456 | 22,930 | 639,138 | 238,599 | 202,012 | 10,989 | 1,124,646 |
| Utilised Agricultural Area (UAA) | 62.34 | 38.23 | 13.37 | 222.97 | 82.81 | 56.68 | 11.20 | 302.45 |
| Total Labour (TL) | 1.78 | 0.96 | 0.10 | 7.93 | 1.95 | 1.50 | 0.05 | 12.18 |
| Intermediate consumption deflated (IC) | 79,091 | 48,424 | 15,656 | 260,114 | 110,104 | 83,121 | 7,732 | 493,261 |
| Fixed Assets deflated (FA) | 598,801 | 542,053 | 8,452 | 3,443,725 | 1,330,608 | 1,079,767 | 30,458 | 5,728,201 |
| Land price deflated (PL) | 399 | 224 | 68 | 2,324 | 632 | 667 | 0 | 5,145 |
| Labour price deflated (PL) | 18,155 | 5,961 | 2,402 | 34,625 | 19,775 | 10,029 | 1,127 | 87,489 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 131 | 0 | 131 | 131 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 136 | 0 | 136 | 136 |
| **SWEDEN** | | | | | | | | |
| Total Output deflated (TO) | 64,946 | 50,936 | 3,055 | 307,021 | 98,799 | 126,077 | 5,781 | 694,016 |
| Utilised Agricultural Area (UAA) | 83,61 | 46,55 | 14,00 | 275,60 | 120,19 | 124,52 | 16,97 | 890,50 |
| Total Labour (TL) | 1,01 | 0,52 | 0,09 | 2,51 | 1,16 | 0,89 | 0,11 | 5,53 |
| Intermediate consumption deflated (IC) | 43,485 | 27,375 | 5,547 | 213,335 | 73,111 | 83,018 | 8,322 | 523,867 |
| Fixed Assets deflated (FA) | 277,539 | 219,414 | 13,536 | 1,249,065 | 576,479 | 560,391 | 2,389 | 3,568,796 |
| Land price deflated (PL) | 133 | 128 | 12 | 1541 | 166 | 113 | 7 | 941 |
| Labour price deflated (PL) | 25,839 | 3,651 | 2,099 | 37,961 | 22,312 | 4,180 | 1,552 | 38,312 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 128 | 0 | 128 | 128 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 132 | 0 | 132 | 132 |

Source: authors' calculations

## Annex 3

Descriptive statistics of variables used – first and last years of sample
Dairy farms (TF4 1)

| Countries | First year of sample | | | | Last year of sample | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | St. Dev. | Min | Max | Mean | St. Dev. | Min | Max |
| **BELGIUM** | | | | | | | | |
| Total Output deflated (TO) | 98,966 | 52,406 | 21,241 | 297,678 | 95,979 | 43,768 | 18,352 | 246,730 |
| Utilised Agricultural Area (UAA) | 33.97 | 17.61 | 6.20 | 107.16 | 50.95 | 25.66 | 10.38 | 158.46 |
| Total Labour (TL) | 1.66 | 0.47 | 0.80 | 3.78 | 1.62 | 0.52 | 1.00 | 3.98 |
| Intermediate consumption deflated (IC) | 45,953 | 27,422 | 10,025 | 146,875 | 49,269 | 24,011 | 7,047 | 142,025 |
| Fixed Assets deflated (FA) | 215,187 | 128,066 | 23,337 | 642,098 | 354,465 | 196,105 | 50,327 | 1,066,675 |
| Land price deflated (PL) | 127 | 51 | 32 | 306 | 157 | 96 | 26 | 590 |
| Labour price deflated (PL) | 11,649 | 2,230 | 3,074 | 23,594 | 16,645 | 2,702 | 6,304 | 37,132 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 112 | 0 | 112 | 112 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 157 | 0 | 157 | 157 |
| **ESTONIA** | | | | | | | | |
| Total Output deflated (TO) | 105,273 | 182,927 | 9,368 | 1,455,085 | 124,488 | 203,379 | 6,868 | 1,353,182 |
| Utilised Agricultural Area (UAA) | 204.22 | 271.27 | 15.25 | 1,949.06 | 211.89 | 277.85 | 17.47 | 1,840.70 |
| Total Labour (TL) | 5.03 | 7.52 | 1.00 | 51.86 | 5.74 | 8.58 | 1.00 | 52.00 |
| Intermediate consumption deflated (IC) | 66,748 | 98,512 | 5,463 | 629,469 | 90,266 | 144,108 | 5,469 | 909,802 |
| Fixed Assets deflated (FA) | 169,473 | 366,737 | 9,051 | 2,873,491 | 215,198 | 363,710 | 1,164 | 2,955,239 |
| Land price deflated (PL) | 5 | 8 | 0 | 67 | 7 | 7 | 0 | 45 |
| Labour price deflated (PL) | 3,414 | 1,364 | 776 | 6,635 | 4,092 | 1,507 | 992 | 7,842 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 109 | 0 | 109 | 109 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 106 | 0 | 106 | 106 |
| **FRANCE** | | | | | | | | |
| Total Output deflated (TO) | 79,205 | 42,959 | 3,397 | 313,545 | 93,200 | 54,619 | 7,647 | 407,519 |
| Utilised Agricultural Area (UAA) | 46.86 | 23.54 | 9.00 | 190.00 | 81.43 | 42.25 | 8.15 | 322.98 |
| Total Labour (TL) | 1.62 | 0.54 | 0.9 | 4.64 | 1.83 | 0.87 | 1.0 | 8.18 |
| Intermediate consumption deflated (IC) | 43,307 | 24,898 | 4,731 | 181,621 | 61,061 | 34,789 | 9,104 | 239,970 |
| Fixed Assets deflated (FA) | 129,114 | 67,838 | 8,647 | 716,539 | 182,706 | 110,699 | 19,955 | 821,970 |
| Land price deflated (PL) | 151 | 1,752 | 0 | 65,789 | 89 | 47 | 0 | 564 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Labour price deflated (PL) | 10,552 | 5,215 | 640 | 34,532 | 11,123 | 4,699 | 1,789 | 33,769 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 124 | 0 | 124 | 124 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 135 | 0 | 135 | 135 |
| **GERMANY** | | | | | | | | |
| Total Output deflated (TO) | 86,592 | 44,248 | 7,440 | 297,251 | 187,568 | 395,986 | 9,769 | 5,113,708 |
| Utilised Agricultural Area (UAA) | 38.72 | 18.85 | 5.46 | 177.66 | 113.90 | 244.68 | 11.38 | 3,011.62 |
| Total Labour (TL) | 1.64 | 0.55 | 0.32 | 5.01 | 3.08 | 7.36 | 1.00 | 102.00 |
| Intermediate consumption deflated (IC) | 47,387 | 24,750 | 6,651 | 205,401 | 123,123 | 271,364 | 7,494 | 3,557,392 |
| Fixed Assets deflated (FA) | 268,619 | 146,617 | 23,783 | 1,374,886 | 523,228 | 490,516 | 10,730 | 5,230,291 |
| Land price deflated (PL) | 217 | 195 | 14 | 3 647 | 200 | 190 | 2 | 2 851 |
| Labour price deflated (PL) | 10,731 | 5,679 | 1,535 | 44,463 | 14,258 | 6,794 | 1,775 | 47,374 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 127 | 0 | 127 | 127 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 131 | 0 | 131 | 131 |
| **HUNGARY** | | | | | | | | |
| Total Output deflated (TO) | 399,165 | 610,083 | 3,571 | 2,582,967 | 381,994 | 631,126 | 4,115 | 3,045,291 |
| Utilised Agricultural Area (UAA) | 239.25 | 402.78 | 0.00 | 2,138.49 | 270.66 | 515.61 | 0.00 | 3,059.36 |
| Total Labour (TL) | 11.34 | 17.51 | 0.10 | 76.30 | 11.34 | 19.74 | 0.32 | 112.17 |
| Intermediate consumption deflated (IC) | 331,305 | 521,984 | 3,197 | 2,028,763 | 280,582 | 494,461 | 2,442 | 2,151,636 |
| Fixed Assets deflated (FA) | 488,580 | 711,646 | 6,951 | 3,429,804 | 432,007 | 614,096 | 5,105 | 3,125,486 |
| Land price deflated (PL) | 59 | 97 | 0 | 684 | 306 | 2,309 | 0 | 21,081 |
| Labour price deflated (PL) | 4,777 | 1,944 | 2,282 | 9,100 | 4,794 | 1,802 | 2,649 | 10,628 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 105 | 0 | 105 | 105 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 111 | 0 | 111 | 111 |
| **ITALY** | | | | | | | | |
| Total Output deflated (TO) | 77,154 | 87,420 | 1,970 | 1,018,518 | 139,789 | 189,013 | 4,627 | 1,659,249 |
| Utilised Agricultural Area (UAA) | 20.45 | 36.33 | 0.10 | 588.00 | 43.66 | 54.16 | 0.59 | 490.31 |
| Total Labour (TL) | 2.09 | 0.93 | 0.39 | 9.62 | 2.54 | 1.87 | 0.44 | 21.33 |
| Intermediate consumption deflated (IC) | 38,581.36 | 45,991 | 1,975 | 591,180 | 75,832 | 114,350 | 1,666 | 1,384,779 |
| Fixed Assets deflated (FA) | 235,991.37 | 217.445 | 5,924 | 2,332,024 | 462,126 | 687,046 | 5,628 | 7,711,387 |
| Land price deflated (PL) | 154.16 | 114 | 0 | 1,544 | 169 | 183 | 0 | 2,717 |
| Labour price deflated (PL) | 10,864 | 1,928 | 2,395 | 37,908 | 10,618 | 1,814 | 1,649 | 23,529 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 140 | 0 | 140 | 140 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 168 | 0 | 168 | 168 |
| **THE NETHERLANDS** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Output deflated (TO) | 159,590 | 90,748 | 28,814 | 615,757 | 166,326 | 107,554 | 1,902 | 802,786 |
| Utilised Agricultural Area (UAA) | 32.92 | 17.98 | 4.93 | 132.50 | 51.55 | 30.04 | 6.21 | 221.04 |
| Total Labour (TL) | 1.69 | 0.57 | 0.60 | 4.11 | 1.72 | 0.65 | 0.66 | 4.54 |
| Intermediate consumption deflated (IC) | 74,418 | 43,438 | 10,706 | 293,802 | 90,430 | 53,675 | 11,090 | 427,527 |
| Fixed Assets deflated (FA) | 616,962 | 362,534 | 40,049 | 2,332,102 | 1,554,447 | 978,106 | 69,400 | 6,774,708 |
| Land price deflated (PL) | 364 | 690 | 14 | 15,105 | 525 | 604 | 15 | 6,570 |
| Labour price deflated (PL) | 18,009 | 6,403 | 2,611 | 66,046 | 19,465 | 8,989 | 1,400 | 90,505 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 131 | 0 | 131 | 131 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 136 | 0 | 136 | 136 |
| **SWEDEN** | | | | | | | | |
| Total Output deflated (TO) | 70,759 | 39,469 | 3,875 | 257,642 | 131,843 | 129,835 | 12,274 | 797,823 |
| Utilised Agricultural Area (UAA) | 40.62 | 21.46 | 9.50 | 144.79 | 84.06 | 80.85 | 9.53 | 756.70 |
| Total Labour (TL) | 1.49 | 0.49 | 0.38 | 3.27 | 1.91 | 1.06 | 0.50 | 9.22 |
| Intermediate consumption deflated (IC) | 45,897 | 23,759 | 8,097 | 146,268 | 105,422 | 101,116 | 7,971 | 860,600 |
| Fixed Assets deflated (FA) | 231,170 | 133,405 | 12,862 | 786,807 | 362,104 | 377,782 | 38,610 | 3,459,396 |
| Land price deflated (PL) | 78 | 94 | 1 | 1,293 | 88 | 127 | 0 | 1,426 |
| Labour price deflated (PL) | 26,063 | 3,491 | 11,553 | 58,856 | 24,624 | 4,172 | 4,469 | 45,860 |
| Intermediate consumption price index (PIC) | 100 | 0 | 100 | 100 | 128 | 0 | 128 | 128 |
| Capital price index (PC) | 100 | 0 | 100 | 100 | 132 | 0 | 132 | 132 |

Source: authors' calculations

## Annex 4

**Yearly technical efficiency estimates**

Crop farms (TF 1)

| **Years** | **SFA** | | | | **DEA** | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | St. Dev. | Min | Max | Mean | St. Dev. | Min | Max |
| **BELGIUM** | | | | | | | | |
| 1990 | - | - | - | - | 0.802 | 0.139 | 0.488 | 1.000 |
| 1991 | 0.909 | 0.025 | 0.805 | 0.948 | 0.793 | 0.122 | 0.491 | 1.000 |
| 1992 | 0.906 | 0.029 | 0.790 | 0.946 | 0.736 | 0.145 | 0.362 | 1.000 |
| 1993 | 0.898 | 0.047 | 0.627 | 0.953 | 0.791 | 0.147 | 0.456 | 1.000 |
| 1994 | 0.907 | 0.039 | 0.769 | 0.951 | 0.741 | 0.171 | 0.405 | 1.000 |
| 1995 | 0.910 | 0.038 | 0.742 | 0.963 | 0.707 | 0.174 | 0.179 | 1.000 |
| 1996 | 0.890 | 0.082 | 0.362 | 0.957 | 0.775 | 0.153 | 0.301 | 1.000 |
| 1997 | 0.884 | 0.073 | 0.508 | 0.948 | 0.731 | 0.167 | 0.307 | 1.000 |
| 1998 | 0.896 | 0.052 | 0.554 | 0.951 | 0.621 | 0.220 | 0.190 | 1.000 |
| 1999 | | | | | 0.741 | 0.160 | 0.245 | 1.000 |
| 2000 | 0.877 | 0.066 | 0.506 | 0.968 | 0.643 | 0.174 | 0.211 | 1.000 |
| 2001 | 0.883 | 0.068 | 0.468 | 0.964 | 0.732 | 0.177 | 0.202 | 1.000 |
| 2002 | 0.875 | 0.081 | 0.422 | 0.967 | 0.656 | 0.185 | 0.203 | 1.000 |
| 2003 | 0.866 | 0.079 | 0.446 | 0.967 | 0.697 | 0.170 | 0.240 | 1.000 |
| 2004 | 0.896 | 0.057 | 0.531 | 0.971 | 0.730 | 0.169 | 0.358 | 1.000 |
| 2005 | 0.870 | 0.064 | 0.587 | 0.971 | 0.679 | 0.159 | 0.368 | 1.000 |
| 2006 | 0.855 | 0.064 | 0.607 | 0.944 | 0.678 | 0.172 | 0.381 | 1.000 |
| Whole period | 0.887 | 0.061 | 0.362 | 0.971 | 0.720 | 0.173 | 0.179 | 1.000 |
| **ESTONIA** | | | | | | | | |
| 2004 | 0.826 | 0.070 | 0.451 | 0.948 | 0.630 | 0.208 | 0.112 | 1.000 |
| 2005 | 0.844 | 0.051 | 0.686 | 0.931 | 0.642 | 0.199 | 0.128 | 1.000 |
| 2006 | 0.811 | 0.068 | 0.492 | 0.936 | 0.588 | 0.198 | 0.228 | 1.000 |
| Whole period | 0.826 | 0.064 | 0.450 | 0.947 | 0.620 | 0.203 | 0.112 | 1.000 |
| **FRANCE** | | | | | | | | |
| 1990 | 0.859 | 0.059 | 0.441 | 0.955 | 0.562 | 0.154 | 0.127 | 1.000 |
| 1991 | 0.869 | 0.049 | 0.461 | 0.965 | 0.555 | 0.167 | 0.080 | 1.000 |
| 1992 | 0.850 | 0.064 | 0.389 | 0.957 | 0.568 | 0.155 | 0.095 | 1.000 |
| 1993 | 0.824 | 0.070 | 0.247 | 0.952 | 0.537 | 0.160 | 0.062 | 1.000 |
| 1994 | 0.822 | 0.073 | 0.210 | 0.956 | 0.431 | 0.145 | 0.034 | 1.000 |
| 1995 | 0.813 | 0.072 | 0.339 | 0.953 | 0.508 | 0.148 | 0.072 | 1.000 |
| 1996 | 0.816 | 0.066 | 0.404 | 0.957 | 0.479 | 0.152 | 0.083 | 1.000 |
| 1997 | 0.813 | 0.071 | 0.425 | 0.946 | 0.533 | 0.151 | 0.102 | 1.000 |
| 1998 | 0.809 | 0.067 | 0.382 | 0.951 | 0.558 | 0.144 | 0.143 | 1.000 |
| 1999 | 0.796 | 0.077 | 0.215 | 0.955 | 0.505 | 0.152 | 0.046 | 1.000 |
| 2000 | 0.795 | 0.073 | 0.337 | 0.927 | 0.534 | 0.144 | 0.106 | 1.000 |
| 2001 | 0.776 | 0.085 | 0.225 | 0.950 | 0.495 | 0.161 | 0.043 | 1.000 |
| 2002 | 0.784 | 0.076 | 0.312 | 0.948 | 0.500 | 0.143 | 0.105 | 1.000 |
| 2003 | 0.783 | 0.086 | 0.267 | 0.957 | 0.565 | 0.144 | 0.143 | 1.000 |
| 2004 | 0.781 | 0.081 | 0.304 | 0.959 | 0.524 | 0.151 | 0.071 | 1.000 |
| 2005 | 0.763 | 0.086 | 0.308 | 0.967 | 0.531 | 0.164 | 0.048 | 1.000 |
| 2006 | 0.786 | 0.086 | 0.149 | 0.965 | 0.424 | 0.141 | 0.023 | 1.000 |
| Whole period | 0.807 | 0.079 | 0.148 | 0.967 | 0.518 | 0.157 | 0.023 | 1.000 |
| **GERMANY** | | | | | | | | |
| 1990 | 0.815 | 0.073 | 0.365 | 0.942 | 0.649 | 0.167 | 0.166 | 1.000 |
| 1991 | 0.825 | 0.072 | 0.416 | 0.951 | 0.554 | 0.162 | 0.133 | 1.000 |
| 1992 | 0.819 | 0.083 | 0.367 | 0.956 | 0.592 | 0.170 | 0.167 | 1.000 |
| 1993 | 0.799 | 0.093 | 0.106 | 0.949 | 0.559 | 0.175 | 0.034 | 1.000 |
| 1994 | 0.793 | 0.091 | 0.291 | 0.958 | 0.501 | 0.180 | 0.092 | 1.000 |
| 1995 | 0.779 | 0.094 | 0.160 | 0.934 | 0.530 | 0.156 | 0.068 | 1.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1996 | 0.786 | 0.082 | 0.418 | 0.959 | 0.422 | 0.137 | 0.109 | 1.000 |
| 1997 | 0.783 | 0.095 | 0.071 | 0.958 | 0.433 | 0.148 | 0.010 | 1.000 |
| 1998 | 0.770 | 0.103 | 0.072 | 0.946 | 0.443 | 0.147 | 0.011 | 1.000 |
| 1999 | 0.781 | 0.091 | 0.333 | 0.968 | 0.327 | 0.146 | 0.062 | 1.000 |
| 2000 | 0.775 | 0.087 | 0.353 | 0.953 | 0.534 | 0.165 | 0.122 | 1.000 |
| 2001 | 0.781 | 0.089 | 0.221 | 0.941 | 0.476 | 0.145 | 0.092 | 1.000 |
| 2002 | 0.741 | 0.110 | 0.049 | 0.955 | 0.391 | 0.151 | 0.066 | 1.000 |
| 2003 | 0.754 | 0.112 | 0.073 | 0.967 | 0.392 | 0.178 | 0.008 | 1.000 |
| 2004 | 0.774 | 0.093 | 0.245 | 0.967 | 0.500 | 0.171 | 0.087 | 1.000 |
| 2005 | 0.761 | 0.089 | 0.315 | 0.946 | 0.488 | 0.163 | 0.105 | 1.000 |
| 2006 | 0.774 | 0.092 | 0.151 | 0.963 | 0.414 | 0.163 | 0.022 | 1.000 |
| Whole period | 0.779 | 0.094 | 0.048 | 0.968 | 0.472 | 0.177 | 0.008 | 1.000 |
| **HUNGARY** | | | | | | | | |
| 2004 | 0.803 | 0.075 | 0.335 | 0.952 | 0.369 | 0.163 | 0.089 | 1.000 |
| 2005 | 0.773 | 0.082 | 0.152 | 0.937 | 0.466 | 0.169 | 0.022 | 1.000 |
| 2006 | 0.783 | 0.094 | 0.177 | 0.968 | 0.446 | 0.178 | 0.024 | 1.000 |
| Whole period | 0.786 | 0.084 | 0.151 | 0.968 | 0.425 | 0.175 | 0.022 | 1.000 |
| **ITALY** | | | | | | | | |
| 1990 | 0.763 | 0.082 | 0.128 | 0.931 | 0.318 | 0.149 | 0.010 | 1.000 |
| 1991 | 0.779 | 0.064 | 0.467 | 0.930 | 0.312 | 0.148 | 0.056 | 1.000 |
| 1992 | 0.763 | 0.073 | 0.241 | 0.917 | 0.334 | 0.162 | 0.027 | 1.000 |
| 1993 | 0.763 | 0.075 | 0.216 | 0.939 | 0.298 | 0.160 | 0.024 | 1.000 |
| 1994 | 0.754 | 0.080 | 0.215 | 0.921 | 0.320 | 0.159 | 0.019 | 1.000 |
| 1995 | 0.746 | 0.088 | 0.178 | 0.938 | 0.225 | 0.160 | 0.008 | 1.000 |
| 1996 | 0.736 | 0.089 | 0.056 | 0.953 | 0.263 | 0.168 | 0.002 | 1.000 |
| 1997 | 0.732 | 0.090 | 0.108 | 0.927 | 0.239 | 0.153 | 0.003 | 1.000 |
| 1998 | 0.733 | 0.089 | 0.126 | 0.920 | 0.241 | 0.155 | 0.003 | 1.000 |
| 1999 | 0.737 | 0.089 | 0.226 | 0.926 | 0.296 | 0.166 | 0.024 | 1.000 |
| 2000 | 0.733 | 0.096 | 0.096 | 0.938 | 0.231 | 0.149 | 0.003 | 1.000 |
| 2001 | 0.741 | 0.090 | 0.164 | 0.943 | 0.203 | 0.110 | 0.012 | 1.000 |
| 2002 | 0.739 | 0.098 | 0.061 | 0.954 | 0.239 | 0.153 | 0.001 | 1.000 |
| 2003 | 0.724 | 0.105 | 0.154 | 0.941 | 0.183 | 0.138 | 0,007 | 1.000 |
| 2004 | 0.723 | 0.102 | 0.218 | 0.966 | 0.203 | 0.142 | 0.023 | 1.000 |
| 2005 | 0.739 | 0.100 | 0.145 | 0.969 | 0.142 | 0.134 | 0.003 | 1.000 |
| 2006 | 0.741 | 0.095 | 0.184 | 0.934 | 0.208 | 0.141 | 0.008 | 1.000 |
| Whole period | 0.744 | 0.089 | 0.055 | 0.968 | 0.255 | 0.160 | 0.001 | 1.000 |
| **THE NETHERLANDS** | | | | | | | | |
| 1990 | 0.921 | 0.001 | 0.803 | 0.957 | 0.658 | 0.161 | 0.282 | 1.000 |
| 1991 | 0.911 | 0.001 | 0.744 | 0.950 | 0.696 | 0.165 | 0.344 | 1.000 |
| 1992 | 0.895 | 0.002 | 0.488 | 0.954 | 0.646 | 0.173 | 0.200 | 1.000 |
| 1993 | 0.906 | 0.002 | 0.749 | 0.953 | 0.673 | 0.170 | 0.335 | 1.000 |
| 1994 | 0.923 | 0.001 | 0.792 | 0.959 | 0.639 | 0.201 | 0.281 | 1.000 |
| 1995 | 0.911 | 0.002 | 0.660 | 0.961 | 0.688 | 0.180 | 0.224 | 1.000 |
| 1996 | 0.902 | 0.002 | 0.752 | 0.954 | 0.715 | 0.168 | 0.249 | 1.000 |
| 1997 | 0.915 | 0.001 | 0.815 | 0.960 | 0.558 | 0.189 | 0.212 | 1.000 |
| 1998 | 0.917 | 0.002 | 0.737 | 0.955 | 0.666 | 0.183 | 0.229 | 1.000 |
| 1999 | 0.889 | 0.003 | 0.561 | 0.953 | 0.683 | 0.190 | 0.179 | 1.000 |
| 2000 | 0.888 | 0.003 | 0.521 | 0.951 | 0.681 | 0.186 | 0.180 | 1.000 |
| 2001 | 0.906 | 0.003 | 0.623 | 0.969 | 0.387 | 0.179 | 0.105 | 1.000 |
| 2002 | 0.890 | 0.003 | 0.658 | 0.964 | 0.555 | 0.198 | 0.192 | 1.000 |
| 2003 | 0.901 | 0.003 | 0.560 | 0.957 | 0.579 | 0.207 | 0.229 | 1.000 |
| 2004 | 0.876 | 0.004 | 0.507 | 0.946 | 0.603 | 0.177 | 0.161 | 1.000 |
| 2005 | 0.893 | 0.003 | 0.726 | 0.949 | 0.574 | 0.166 | 0.236 | 1.000 |
| 2006 | 0.898 | 0.004 | 0.597 | 0.955 | 0.578 | 0.212 | 0.196 | 1.000 |
| Whole period | 0.904 | 0.039 | 0.488 | 1.000 | 0.630 | 0.196 | 0.105 | 1.000 |
| **SWEDEN** | | | | | | | | |
| 1995 | 0.803 | 0.010 | 0.114 | 0.941 | 0.556 | 0.220 | 0.044 | 1.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1996 | 0.831 | 0.008 | 0.342 | 0.942 | 0.669 | 0.206 | 0.164 | 1.000 |
| 1997 | 0.809 | 0.008 | 0.405 | 0.941 | 0.549 | 0.200 | 0.149 | 1.000 |
| 1998 | 0.748 | 0.012 | 0.152 | 0.938 | 0.553 | 0.221 | 0.095 | 1.000 |
| 1999 | 0.753 | 0.012 | 0.211 | 0.945 | 0.523 | 0.219 | 0.091 | 1.000 |
| 2000 | 0.754 | 0.010 | 0.087 | 0.931 | 0.556 | 0.224 | 0.037 | 1.000 |
| 2001 | 0.750 | 0.010 | 0.061 | 0.938 | 0.544 | 0.231 | 0.026 | 1.000 |
| 2002 | 0.769 | 0.009 | 0.178 | 0.936 | 0.562 | 0.216 | 0.072 | 1.000 |
| 2003 | 0.774 | 0.009 | 0.270 | 0.937 | 0.549 | 0.211 | 0.132 | 1.000 |
| 2004 | 0.753 | 0.009 | 0.158 | 0.929 | 0.561 | 0.205 | 0.075 | 1.000 |
| 2005 | 0.764 | 0.008 | 0.286 | 0.930 | 0.591 | 0.208 | 0.158 | 1.000 |
| 2006 | 0.757 | 0.009 | 0.204 | 0.928 | 0.572 | 0.214 | 0.096 | 1.000 |
| Whole period | 0.769 | 0.141 | 0.061 | 1.000 | 0.563 | 0.217 | 0.026 | 1.000 |
| **ALL COUNTRIES** | | | | | | | | |
| 1990 | 0.788 | 0.081 | 0.107 | 0.948 | 0.384 | 0.173 | 0.009 | 1.000 |
| 1991 | 0.800 | 0.066 | 0.423 | 0.947 | 0.366 | 0.177 | 0.055 | 1.000 |
| 1992 | 0.784 | 0.077 | 0.216 | 0.936 | 0.393 | 0.175 | 0.026 | 1.000 |
| 1993 | 0.778 | 0.079 | 0.133 | 0.952 | 0.361 | 0.179 | 0.024 | 1.000 |
| 1994 | 0.772 | 0.083 | 0.189 | 0.938 | 0.351 | 0.156 | 0.019 | 1.000 |
| 1995 | 0.762 | 0.089 | 0.154 | 0.953 | 0.308 | 0.181 | 0.008 | 1.000 |
| 1996 | 0.757 | 0.087 | 0.044 | 0.965 | 0.324 | 0.166 | 0.002 | 1.000 |
| 1997 | 0.753 | 0.092 | 0.089 | 0.944 | 0.312 | 0.169 | 0.003 | 1.000 |
| 1998 | 0.749 | 0.093 | 0.088 | 0.940 | 0.298 | 0.145 | 0.008 | 1.000 |
| 1999 | 0.749 | 0.092 | 0.200 | 0.944 | 0.283 | 0.144 | 0.021 | 1.000 |
| 2000 | 0.746 | 0.095 | 0.078 | 0.955 | 0.298 | 0.166 | 0.003 | 1.000 |
| 2001 | 0.749 | 0.094 | 0.130 | 0.957 | 0.206 | 0.099 | 0.012 | 1.000 |
| 2002 | 0.744 | 0.098 | 0.047 | 0.966 | 0.280 | 0.150 | 0.001 | 1.000 |
| 2003 | 0.738 | 0.104 | 0.096 | 0.955 | 0.242 | 0.143 | 0.007 | 1.000 |
| 2004 | 0.738 | 0.096 | 0.197 | 0.975 | 0.207 | 0.108 | 0.023 | 1.000 |
| 2005 | 0.737 | 0.096 | 0.124 | 0.978 | 0.172 | 0.118 | 0.003 | 1.000 |
| 2006 | 0.745 | 0.096 | 0.152 | 0.951 | 0.223 | 0.133 | 0.008 | 1.000 |
| Whole period | 0.757 | 0.091 | 0.044 | 0.977 | 0.293 | 0.166 | 0.001 | 1.000 |

Source: authors' calculations

## Annex 5

**Yearly technical efficiency estimates**

Dairy farms (TF 41)

| **Years** | **SFA** | | | | **DEA** | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | St. Dev. | Min | Max | Mean | St. Dev. | Min | Max |
| **BELGIUM** | | | | | | | | |
| 1990 | - | - | - | - | 0.714 | 0.136 | 0.336 | 1.000 |
| 1991 | 0.904 | 0.044 | 0.638 | 0.964 | 0.703 | 0.145 | 0.226 | 1.000 |
| 1992 | 0.889 | 0.062 | 0.352 | 0.966 | 0.720 | 0.139 | 0.367 | 1.000 |
| 1993 | 0.906 | 0.048 | 0.601 | 0.971 | 0.763 | 0.143 | 0.395 | 1.000 |
| 1994 | 0.909 | 0.049 | 0.660 | 0.965 | 0.755 | 0.130 | 0.314 | 1.000 |
| 1995 | 0.903 | 0.050 | 0.464 | 0.961 | 0.754 | 0.148 | 0.019 | 1.000 |
| 1996 | 0.876 | 0.088 | 0.029 | 0.958 | 0.766 | 0.135 | 0.434 | 1.000 |
| 1997 | 0.871 | 0.066 | 0.584 | 0.954 | 0.760 | 0.138 | 0.298 | 1.000 |
| 1998 | 0.892 | 0.063 | 0.534 | 0.963 | 0.764 | 0.137 | 0.422 | 1.000 |
| 1999 | | | | | 0.724 | 0.139 | 0.316 | 1.000 |
| 2000 | 0.894 | 0.064 | 0.514 | 0.967 | 0.755 | 0.144 | 0.337 | 1.000 |
| 2001 | 0.897 | 0.061 | 0.530 | 0.962 | 0.749 | 0.161 | 0.289 | 1.000 |
| 2002 | 0.889 | 0.079 | 0.368 | 0.964 | 0.746 | 0.154 | 0.295 | 1.000 |
| 2003 | 0.874 | 0.085 | 0.424 | 0.965 | 0.751 | 0.140 | 0.325 | 1.000 |
| 2004 | 0.888 | 0.062 | 0.515 | 0.965 | 0.730 | 0.147 | 0.264 | 1.000 |
| 2005 | 0.864 | 0.080 | 0.321 | 0.963 | 0.695 | 0.156 | 0.233 | 1.000 |
| 2006 | 0.854 | 0.074 | 0.410 | 0.973 | 0.763 | 0.139 | 0.394 | 1.000 |
| Whole period | 0.884 | 0.073 | 0.029 | 0.973 | 0.742 | 0.145 | 0.019 | 1.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ESTONIA** | | | | | | | | |
| 2004 | 0.826 | 0.070 | 0.451 | 0.948 | 0.672 | 0.152 | 0.326 | 1.000 |
| 2005 | 0.844 | 0.051 | 0.686 | 0.931 | 0.747 | 0.148 | 0.335 | 1.000 |
| 2006 | 0.811 | 0.068 | 0.492 | 0.936 | 0.693 | 0.161 | 0.291 | 1.000 |
| Whole period | 0.915 | 0.040 | 0.646 | 0.971 | 0.704 | 0.157 | 0.291 | 1.000 |
| **FRANCE** | | | | | | | | |
| 1990 | 0.912 | 0.053 | 0.220 | 0.975 | 0.667 | 0.120 | 0.142 | 1.000 |
| 1991 | 0.903 | 0.058 | 0.233 | 0.975 | 0.683 | 0.124 | 0.144 | 1.000 |
| 1992 | 0.910 | 0.063 | 0.258 | 0.979 | 0.667 | 0.131 | 0.147 | 1.000 |
| 1993 | 0.913 | 0.055 | 0.340 | 0.978 | 0.680 | 0.131 | 0.176 | 1.000 |
| 1994 | 0.915 | 0.049 | 0.462 | 0.980 | 0.705 | 0.118 | 0.299 | 1.000 |
| 1995 | 0.909 | 0.054 | 0.217 | 0.975 | 0.651 | 0.116 | 0.121 | 1.000 |
| 1996 | 0.895 | 0.065 | 0.260 | 0.972 | 0.684 | 0.121 | 0.166 | 1.000 |
| 1997 | 0.894 | 0.064 | 0.375 | 0.975 | 0.661 | 0.118 | 0.205 | 1.000 |
| 1998 | 0.904 | 0.055 | 0.431 | 0.977 | 0.618 | 0.120 | 0.235 | 1.000 |
| 1999 | 0.899 | 0.063 | 0.284 | 0.974 | 0.643 | 0.125 | 0.156 | 1.000 |
| 2000 | 0.899 | 0.068 | 0.112 | 0.971 | 0.711 | 0.126 | 0.075 | 1.000 |
| 2001 | 0.891 | 0.064 | 0.405 | 0.975 | 0.686 | 0.123 | 0.252 | 1.000 |
| 2002 | 0.889 | 0.074 | 0.030 | 0.976 | 0.643 | 0.126 | 0.016 | 1.000 |
| 2003 | 0.878 | 0.072 | 0.247 | 0.970 | 0.595 | 0.140 | 0.143 | 1.000 |
| 2004 | 0.869 | 0.083 | 0.381 | 0.974 | 0.719 | 0.132 | 0.260 | 1.000 |
| 2005 | 0.870 | 0.081 | 0.210 | 0.970 | 0.681 | 0.133 | 0.146 | 1.000 |
| 2006 | 0.848 | 0.096 | 0.276 | 0.974 | 0.635 | 0.131 | 0.162 | 1.000 |
| Whole period | 0.895 | 0.067 | 0.030 | 0.980 | 0.667 | 0.129 | 0.016 | 1.000 |
| **GERMANY** | | | | | | | | |
| 1990 | 0.870 | 0.060 | 0.336 | 0.962 | 0.682 | 0.127 | 0.130 | 1.000 |
| 1991 | 0.860 | 0.063 | 0.356 | 0.977 | 0.503 | 0.142 | 0.100 | 1.000 |
| 1992 | 0.874 | 0.055 | 0.532 | 0.970 | 0.644 | 0.126 | 0.234 | 1.000 |
| 1993 | 0.860 | 0.064 | 0.463 | 0.966 | 0.657 | 0.131 | 0.205 | 1.000 |
| 1994 | 0.850 | 0.068 | 0.354 | 0.981 | 0.529 | 0.130 | 0.129 | 1.000 |
| 1995 | 0.842 | 0.073 | 0.399 | 0.965 | 0.573 | 0.121 | 0.173 | 1.000 |
| 1996 | 0.824 | 0.068 | 0.493 | 0.979 | 0.407 | 0.127 | 0.141 | 1.000 |
| 1997 | 0.840 | 0.069 | 0.398 | 0.967 | 0.591 | 0.131 | 0.189 | 1.000 |
| 1998 | 0.854 | 0.073 | 0.152 | 0.975 | 0.532 | 0.135 | 0.082 | 1.000 |
| 1999 | 0.858 | 0.067 | 0.334 | 0.976 | 0.532 | 0.143 | 0.089 | 1.000 |
| 2000 | 0.866 | 0.060 | 0.471 | 0.974 | 0.547 | 0.132 | 0.191 | 1.000 |
| 2001 | 0.851 | 0.071 | 0.375 | 0.963 | 0.607 | 0.129 | 0.156 | 1.000 |
| 2002 | 0.829 | 0.079 | 0.340 | 0.974 | 0.491 | 0.134 | 0.105 | 1.000 |
| 2003 | 0.817 | 0.081 | 0.402 | 0.980 | 0.512 | 0.155 | 0.122 | 1.000 |
| 2004 | 0.824 | 0.079 | 0.279 | 0.965 | 0.581 | 0.124 | 0.109 | 1.000 |
| 2005 | 0.815 | 0.072 | 0.345 | 0.972 | 0.572 | 0.146 | 0.114 | 1.000 |
| 2006 | 0.820 | 0.078 | 0.312 | 0.965 | 0.560 | 0.132 | 0.121 | 1.000 |
| Whole period | 0.843 | 0.072 | 0.152 | 0.981 | 0.558 | 0.148 | 0.082 | 1.000 |
| **HUNGARY** | | | | | | | | |
| 2004 | 0.842 | 0.065 | 0.544 | 0.940 | 0.717 | 0.189 | 0.230 | 1.000 |
| 2005 | 0.847 | 0.062 | 0.566 | 0.944 | 0.703 | 0.185 | 0.248 | 1.000 |
| 2006 | 0.865 | 0.042 | 0.723 | 0.953 | 0.720 | 0.189 | 0.362 | 1.000 |
| Whole period | 0.851 | 0.057 | 0.544 | 0.953 | 0.714 | 0.187 | 0.230 | 1.000 |
| **ITALY** | | | | | | | | |
| 1990 | 0.920 | 0.029 | 0.144 | 0.962 | 0.502 | 0.150 | 0.026 | 1.000 |
| 1991 | 0.919 | 0.021 | 0.683 | 0.967 | 0.480 | 0.170 | 0.094 | 1.000 |
| 1992 | 0.917 | 0.023 | 0.666 | 0.965 | 0.494 | 0.167 | 0.144 | 1.000 |
| 1993 | 0.919 | 0.024 | 0.462 | 0.966 | 0.464 | 0.157 | 0.085 | 1.000 |
| 1994 | 0.917 | 0.038 | 0.092 | 0.963 | 0.444 | 0.164 | 0.015 | 1.000 |
| 1995 | 0.918 | 0.030 | 0.067 | 0.961 | 0.466 | 0.155 | 0.013 | 1.000 |
| 1996 | 0.916 | 0.027 | 0.513 | 0.967 | 0.439 | 0.175 | 0.105 | 1.000 |
| 1997 | 0.914 | 0.029 | 0.477 | 0.966 | 0.387 | 0.169 | 0.078 | 1.000 |
| 1998 | 0.913 | 0.028 | 0.530 | 0.966 | 0.412 | 0.166 | 0.084 | 1.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1999 | 0.914 | 0.028 | 0.568 | 0.963 | 0.419 | 0.161 | 0.088 | 1.000 |
| 2000 | 0.914 | 0.028 | 0.476 | 0.961 | 0.416 | 0.148 | 0.091 | 1.000 |
| 2001 | 0.918 | 0.024 | 0.658 | 0.962 | 0.432 | 0.159 | 0.145 | 1.000 |
| 2002 | 0.918 | 0.023 | 0.555 | 0.975 | 0.334 | 0.145 | 0.051 | 1.000 |
| 2003 | 0.908 | 0.038 | 0.359 | 0.967 | 0.429 | 0.181 | 0.058 | 1.000 |
| 2004 | 0.915 | 0.026 | 0.669 | 0.972 | 0.413 | 0.175 | 0.111 | 1.000 |
| 2005 | 0.916 | 0.025 | 0.688 | 0.963 | 0.440 | 0.172 | 0.114 | 1.000 |
| 2006 | 0.916 | 0.027 | 0.713 | 0.969 | 0.438 | 0.201 | 0.090 | 1.000 |
| Whole period | 0.916 | 0.027 | 0.067 | 0.974 | 0.438 | 0.169 | 0.013 | 1.000 |
| **THE NETHERLANDS** | | | | | | | | |
| 1990 | 0.925 | 0.002 | 0.632 | 0.966 | 0.770 | 0.119 | 0.388 | 1.000 |
| 1991 | 0.924 | 0.001 | 0.698 | 0.966 | 0.770 | 0.116 | 0.392 | 1.000 |
| 1992 | 0.929 | 0.001 | 0.722 | 0.970 | 0.767 | 0.110 | 0.399 | 1.000 |
| 1993 | 0.927 | 0.001 | 0.731 | 0.971 | 0.767 | 0.114 | 0.419 | 1.000 |
| 1994 | 0.923 | 0.002 | 0.768 | 0.970 | 0.729 | 0.114 | 0.424 | 1.000 |
| 1995 | 0.906 | 0.002 | 0.686 | 0.970 | 0.728 | 0.122 | 0.386 | 1.000 |
| 1996 | 0.882 | 0.003 | 0.496 | 0.957 | 0.733 | 0.121 | 0.332 | 1.000 |
| 1997 | 0.908 | 0.002 | 0.345 | 0.968 | 0.738 | 0.126 | 0.208 | 1.000 |
| 1998 | 0.900 | 0.003 | 0.560 | 0.975 | 0.695 | 0.134 | 0.309 | 1.000 |
| 1999 | 0.899 | 0.003 | 0.539 | 0.967 | 0.731 | 0.132 | 0.350 | 1.000 |
| 2000 | 0.903 | 0.003 | 0.585 | 0.968 | 0.751 | 0.126 | 0.359 | 1.000 |
| 2001 | 0.894 | 0.003 | 0.565 | 0.970 | 0.749 | 0.131 | 0.346 | 1.000 |
| 2002 | 0.871 | 0.004 | 0.566 | 0.972 | 0.663 | 0.139 | 0.372 | 1.000 |
| 2003 | 0.874 | 0.004 | 0.452 | 0.969 | 0.678 | 0.127 | 0.309 | 1.000 |
| 2004 | 0.862 | 0.004 | 0.510 | 0.965 | 0.745 | 0.125 | 0.460 | 1.000 |
| 2005 | 0.858 | 0.005 | 0.219 | 0.967 | 0.652 | 0.145 | 0.224 | 1.000 |
| 2006 | 0.848 | 0.005 | 0.078 | 0.959 | 0.708 | 0.143 | 0.081 | 1.000 |
| Whole period | 0.899 | 0.060 | 0.078 | 1.000 | 0.732 | 0.130 | 0.081 | 1.000 |
| **SWEDEN** | | | | | | | | |
| 1995 | 0.878 | 0.006 | 0.193 | 0.975 | 0.623 | 0.169 | 0.092 | 1.000 |
| 1996 | 0.866 | 0.006 | 0.285 | 0.977 | 0.683 | 0.177 | 0.188 | 1.000 |
| 1997 | 0.853 | 0.006 | 0.137 | 0.971 | 0.613 | 0.158 | 0.094 | 1.000 |
| 1998 | 0.851 | 0.006 | 0.285 | 0.963 | 0.653 | 0.150 | 0.179 | 1.000 |
| 1999 | 0.832 | 0.007 | 0.198 | 0.960 | 0.658 | 0.168 | 0.127 | 1.000 |
| 2000 | 0.852 | 0.006 | 0.270 | 0.956 | 0.682 | 0.166 | 0.162 | 1.000 |
| 2001 | 0.834 | 0.006 | 0.315 | 0.963 | 0.681 | 0.165 | 0.162 | 1.000 |
| 2002 | 0.833 | 0.006 | 0.180 | 0.954 | 0.687 | 0.169 | 0.117 | 1.000 |
| 2003 | 0.839 | 0.005 | 0.294 | 0.957 | 0.682 | 0.154 | 0.180 | 1.000 |
| 2004 | 0.813 | 0.006 | 0.342 | 0.961 | 0.635 | 0.164 | 0.212 | 1.000 |
| 2005 | 0.811 | 0.006 | 0.259 | 0.947 | 0.693 | 0.157 | 0.192 | 1.000 |
| 2006 | 0.792 | 0.006 | 0.495 | 0.947 | 0.679 | 0.149 | 0.360 | 1.000 |
| Whole period | 0.837 | 0.113 | 0.137 | 1.000 | 0.665 | 0.164 | 0.092 | 1.000 |