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Technical Efficiency of the Crop Farms under the Various CAP Reforms: Empirical Studies for Germany, the Netherlands and Sweden

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Abstract

We analyse the impacts of the CAP reforms on the technical efficiency of the crop farms. We use an output distance function and an inefficiency effects model which incorporates the influences of exogenous variables on farm efficiency. We formulate policy variables (e.g. the CAP subsidies) and producer characteristics as explanatory variables in the inefficiency effects model. We use the 1995-2004 FADN data to estimate the production frontiers of the crop farms in Germany, Netherlands and Sweden, to derive their technical efficiency, and to determine the effects of the explanatory variables. The study shows that the 10-year average technical efficiency of crop farms is 59% in Germany, 75% in Netherlands, and 70% in Sweden. The average annual technical efficiency change is 0.1%, 0.7% and 2.7% respectively for Germany, Netherlands and Sweden

Key words: technical efficiency, the CAP reform, frontier models, crop farming

1. Introduction

The European Union (EU) has adopted *a series of reforms* of its Common Agricultural Policy (CAP) since 1992: the MacSharry reform (1993-1999), the Agenda 2000 (2000-2004), and the 2003 reform (after 2005 onwards). The various CAP reforms have undergone a long process from price support, to the production-related subsidies, and eventually to the decoupled payments. In response to these various reforms of the EU agricultural policies, how the farmers change their economic performance becomes an interesting question.

Theoretically, there are four mechanisms by which coupled and decoupled subsidies can have impacts on production: (i) by changing relative prices of inputs and outputs (Oude Lansink and Peerlings, 1996; Bezlepkina and Oude Lansink, 2006) (ii) through an income effect changing on- and off-farm labour supply (e.g. Newbery and Stiglitz, 1981; Hennessy, 1998; Findeis, 2002), (iii) through an income effect on investment decisions (e.g. Young and Westcott, 1994; Hubbard, 1998), and (iv) through farm growth and exit (e.g. Ahearn et al., 2005; Goodwin and Mishra, 2006). Subsidies influence farmers' behaviors due to the income effect. The income effect combined with the farm specific characteristics (e.g. managerial ability and preferences) change farmers' working motivation (i.e. on- or off-farm labour supply or leisure), investments in new technologies and reallocation of inputs and outputs. Consequently, this will change the economic and technical performance of the farms.

We may expect positive or negative effects of subsidies associated with a policy change on efficiency and productivity under different conditions. Subsidy increases technical efficiency if it provides farmers an incentive to innovate or switch to new technologies. However, technical efficiency might also decrease with the increase of subsidies, if farmers prefer more leisure with a higher income from subsidies. Thus, the income transfers *have* impacts on farms decisions through income effect but how much and in what direction in the context of CAP reform is the subject of empirical study.

Although many studies have been conducted to study the impacts of the CAP reforms at different levels, only few studies on the impacts of the CAP reforms on farm economic performance in terms of efficiency and productivity (see e.g. Brümmer et al., 2002; Hadley, 2005; Ooms and Peerlings, 2005; Coelli et al. 2006). Therefore, the objective of this paper is to analyse the impact of subsidies on technical efficiency. We employ stochastic frontier analysis (SFA) rather than a nonparametric approach (e.g. DEA), because SFA models offer a rich specification, particularly in the case of panel data and because agricultural production is likely stochastic due to unpredictable weather, disease and pest infestation. SFA offers a framework for linking the efficiency estimates of individual producers to a set of exogenous variables including producer characteristics (e.g. size, organizational type, and other structural factors such as level of human capital) and policy measures in an inefficiency effects model.

In this paper, we use an output distance function and an inefficiency effects model which incorporates the influences of exogenous variables on farm efficiency. We formulate policy variables (e.g. the CAP subsidies) and producer characteristics as explanatory variables in the inefficiency effects model. The application focuses on FADN data of crop farms in Germany, Netherlands and Sweden over the period 1995-2004. From the estimated output distance functions, we obtain the technological properties such as production elasticities, returns to scale, and technical change. Furthermore, we decompose the technical efficiency change into the contribution of each explanatory variable and the unspecified factors.

The paper is organized as follows. Section 2 presents the SFA model and the decomposition of technical efficiency change. This is followed by a description of the data in section 3. Section 4 gives the estimated results. Finally in section we conclude.

2 A Model for Technical Efficiency

2.1 Output distance function and inefficiency effects model

The production frontier model with inefficiency effects model allows for a simultaneous estimation of technical efficiency and the impact of factors determining technical efficiency. Considering the multi-outputs nature of agricultural production, we employ an output distance function for efficiency analysis.

The vector of outputs $\mathrm{y} \in \mathrm{R}_{+}^{\mathrm{M}}$ and each output is indexed by *m* or *n*, *m* or *n*=1, 2, … , *M*. The vector $\mathrm{x} \in \mathrm{R}_{+}^{\mathrm{N}}$ and each input is indexed by *j* or *k*, *j* or *k*=1, 2, …, *N*. The vector of exogenous variables $z \in R^{J}$ and each variable is indexed by *p*, *p*=1, 2, …, *J*. Considering the homogeneity of output distance function in outputs, we use the normalized form (see Coelli and Perelman, 1999). This leads to the following Translog specification for the *i*-th firm:

$$\ln y_{1i}^t = \beta_0 + \sum_{k=1}^{N} \beta_k \ln x_{ki}^t + \frac{1}{2}\sum_{k=1}^{N}\sum_{j=1}^{N} \beta_{kj} \ln x_{ki}^t \ln x_{ji}^t$$
$$+\sum_{m=2}^{M} \beta_m \ln \frac{y_{mi}^t}{y_{1i}^t} + \frac{1}{2}\sum_{m=2}^{M}\sum_{n=2}^{M} \beta_{mn} \ln \frac{y_{mi}^t}{y_{1i}^t} \ln \frac{y_{ni}^t}{y_{1i}^t} + \sum_{k=1}^{N}\sum_{m=2}^{M} \beta_{km} \ln x_{ki}^t \ln \frac{y_{mi}^t}{y_{1i}^t} \quad (1)$$
$$+\beta_t t + \frac{1}{2}\beta_{tt} t^2 + \sum_{k=1}^{N} \beta_{kt} \ln x_{ki}^t t + \sum_{m=2}^{N} \beta_{mt} \ln \frac{y_{mi}^t}{y_{1i}^t} t + v_{it} - u_{it},$$

where u_{it} is defined by:

$$u_{it} = z_{it}\delta + w_{it} = \delta_0 + \sum_{p=1}^{J} \delta_p z_{pit} + w_{it}\,. \quad (2)$$

The distributions of the error terms in the above model have the assumptions: i.e. $v_{it} \sim iid\, N(0, \sigma_v^2)$, $u_{it} \sim N(z_{it}\delta, \sigma_u{}^2)$ and $w_{it} \sim N(0,\ \sigma_{\mathrm{w}}^2)$. The output distance function (1) and the inefficiency effects model (2) account for both technical change and time-varying inefficiency effects. *Technical efficiency* (*TE*) is defined (Kumbhakar and Lovell, 2000) as:

$$TE_{it} = \exp(-u_{it})\,. \quad (3)$$

Taking the derivative of the definition of technical efficiency (equation 3) with respect to *t* gives:

$$TEC = -\frac{\partial u_t}{\partial t} = \frac{dTE_{it}}{dt}\frac{1}{TE_{it}} = \dot{TE}_{it}\,. \quad (4)$$

After estimating the parameters in the above model, we can calculate some technological parameters such as the scale elasticity (elasticity of multiple outputs with respect to each input) ε_k, the returns to scale of the production *RTS*, technical change *TC*, and technical efficiency change *TEC* (Färe and Primont,1995), i.e.

$$\varepsilon_k = \frac{\partial \ln D_0(x_i^t, y_i^t)}{\partial \ln x_{ki}^t} = \beta_k + \sum_j \beta_{kj} \ln x_{ji}^t + \sum_{m=2} \beta_{km} \ln \frac{y_{mi}^t}{y_{1i}^t} + \beta_{kt} t \quad (5)$$

$$RTS = \sum_{k}^{N} \{\beta_k + \sum_j \beta_{kj} \ln x_{ji}^t + \sum_{m=2} \beta_{km} \ln \frac{y_{mi}^t}{y_{1i}^t} + \beta_{kt} t\} = \sum_{k}^{N} \varepsilon_k \quad (6)$$

$$TC = -\frac{\partial \ln D_{0i}^t}{\partial t} = \frac{\partial \ln y_{1i}^t}{\partial t} = \beta_t + \beta_{tt}\, t + \sum_{k=1}^{N} \beta_{kt} \ln x_{ki}^t + \sum_{m=2}^{N} \beta_{mt} \ln \frac{y_{mi}^t}{y_{1i}^t} \quad (7)$$

$$TEC = -\frac{\partial u_{it}}{\partial t} = \frac{dTE_{it}}{dt}\frac{1}{TE_{it}} \quad (8)$$

In a discrete time context (8) becomes:

$$TEC = \frac{TE_{it} - TE_{it-1}}{TE_{it}} = 1 - \frac{TE_{it-1}}{TE_{it}} \quad (8a)$$

2.3 Decomposition of technical efficiency change

Technical inefficiency or technical efficiency is explained by a set of specified exogenous variables (vector *z*) and the error term *w* captures the influences of the other unspecified factors in the above model (equation 2). In a dynamic environment these exogenous variables are also changing over time. Therefore, technical efficiency change can also be explained by the change of z's. Naturally, we decompose the *technical efficiency change* (*TEC*) into the change of these variables (*z*'s) and the change of the unspecified factors (*w*) in an inefficiency effects model. Using the definition of technical efficiency (3) and equation (2), technical efficiency can be written as: $TE_{it} = \exp(-u_{it}) = \exp(-\delta_1 z_{1it} - \delta_2 z_{2it} - ... - w_{it})$. Totally differentiating it with respect to time *t* gives:

$$\frac{dTE_t}{dt} = TE_{it}(-\delta_1 \frac{dz_{1it}}{dt} - \delta_2 \frac{dz_{2it}}{dt} - ... - \frac{dw_{it}}{dt}) \qquad (9)$$

Rearranging (9) and using (4), we obtain

$$TEC = \overset{\bullet}{TE}_{it} = -\delta_1 \frac{dz_{1it}}{dt} - \delta_2 \frac{dz_{2it}}{dt} - ... - \frac{dw_{it}}{dt}. \qquad (10)$$

We use a slightly different expression for the technical efficiency change in a discrete time context (*t*=1, 2… T), i.e.

$$TEC' = \frac{TE_{it} - TE_{it-1}}{TE_{it-1}} = \frac{TE_{it}}{TE_{it-1}} - 1. \qquad (11)$$

The technical efficiency change can be further decomposed as:

$$TEC'_{it} = (-\delta_1 \frac{dz_{1it}}{dt} - \delta_2 \frac{dz_{2it}}{dt} - ... - \frac{dw_{it}}{dt})\frac{TE_{it}}{TE_{it-1}} = tz_{1it} + tz_{2it} + ...tz_{J\,it} + to_{it}, \qquad (12)$$

where $tz_{1it} = -\delta_1(z_{1it} - z_{1it-1})\frac{TE_{it}}{TE_{it-1}}$, …, and $tz_{J\,it} = -\delta_J(z_{J\,it} - z_{J\,it-1})\frac{TE_{it}}{TE_{it-1}}$ denote the contributions of explanatory variables and $to_{it} = \frac{dw_{it}}{dt}\frac{TE_{it}}{TE_{it-1}}$ the contribution of unspecified factors to technical efficiency change.

3 Data

In order to assess the change in farm's economic performance, we need farm level panel data. A consistent database for the estimation of the frontier models is the European Community's Farm Accounting Data Network (FADN). The FADN database (EU-FADN-DG AGRI-3 European

Commission, Directorate-General Agriculture, Unit AGRI.G.3 The FADN data set contains information on revenues, expenses and information on farm's structure (e.g. farm size, land use, labour use and capital stock). In order to obtain the quantity of inputs and outputs, we use the price indexes from EUROSTAT. We derive implicit quantities of inputs and outputs as the ratios of values to price indexes.

Considering the information available at the FADN database and the production structure of the crop farms, we distinguish four outputs: cereals, root crops (aggregated by potatoes and sugar beets), other crops and other products. Furthermore, we categorise three variable inputs: seeds, chemicals (aggregated by fertilisers and pesticides) and other variable inputs, and three factor inputs: capital, labour and land. Exogenous variables which may influence farm efficiency include structural variables, management variables as well as public policies (e.g. subsidies). For technical efficiency analysis, we retrieve as much information as possible from the FADN. This includes the subsidy information as above, the farm taxes paid, the farm size, the farm decision on the percentage of crop production, on labour use, land use and their financial decisions such as long-term and short term debts. Besides, the regional differences might also play a role in farmer's production efficiency; therefore it is also important to give an explicit indication of the location of the farms, which is indicated by regional dummies. Specifically, we use the explanatory variables shown in Table 1 in the empirical study. A descriptive statistics for the data are shown in Table 2.

Table 1 Variables in the inefficiency effect model and definitions

Variables (vector z)	*Definition*
z1: subsidy composition	Ratio of crop subsidies and total subsidies
z2: revenue composition	Ratio of total subsidy and total revenue
z3: farm taxes	Farm taxes and other dues
z4: Farm size	Farm size calculated in terms of European size units (ESU)
z5: specialisation	Ratio of crop production and total production
z6: family labour	Ratio of unpaid labour and total labour
z7: rented land	Ratio of rented land and total utilised land
z8: long term debt	Ratio of long and intermediate run loans to total assets
z9: short run debt	Ratio of short run loans to total assets

Table 2 Statistical description for outputs and inputs based on FADN data

	Mean	Std. Dev.	Minimum	Maximum
Germany (Based on 1182 farms and 4755 observations)				
Outputs				
Cereals (€)	65691	162584	60	2716982
Root crops (€)	57732	87096	0	1310043
Other crops (€)	36080	84833	0	1000335
Other products (€)	101876	311302	0	5751433
Variable and factor inputs				
Seeds (€)	14402	29788	0	611867
Chemicals (€)	33585	68808	0	883116
Other variable inputs (€)	114888	283211	4369	5058386
Capital stock (€)	438097	1171747	2606	20247558
Labour (hours)	7988	19170	2208	313599
Land (ha)	175	432	6	6263
Netherlands (Based on 424 farms and 1966 observations)				

Outputs				
Cereals (€)	19579	19626	61	197932
Root crops (€)	141521	141748	0	985566
Other crops (€)	43587	75311	0	1210160
Other products (€)	29807	58196	0	775097
Variable and factor inputs				
Seeds (€)	27006	27526	0	231492
Chemicals (€)	421621	363903	6875	3629547
Other variable inputs (€)	3851	2623	100	31846
Capital stock (€)	71	51	10	348
Labour (hours)	7988	19170	2208	313599
Land (ha)	175	432	6	6263
Sweden (Based on 333 farms and 1009 observations)				
Outputs				
Cereals (€)	33149	36301	5	272627
Root crops (€)	47203	66624	0	610558
Other crops (€)	15681	50968	0	687191
Other products (€)	39829	70641	0	693803
Variable and factor inputs				
Seeds (€)	9200	12032	0	109546
Chemicals (€)	19032	19726	0	141428
Other variable inputs (€)	63579	76606	3385	660951
Capital stock (€)	295854	286988	17423	1909601
Labour (hours)	2808	2267	100	15000
Land (ha)	115	131	9	1523

4 Estimation results

4.1Technical Efficiency (TE)

We estimate the output distance function and inefficiency effects model (see Appendix for the estimated parameters) and obtain the estimates of technical efficiency and technical efficiency change. The results are shown in Table 3.

Table 3 shows that the mean technical efficiency of the crop farms in 1995-2004 is 59% in Germany, 75% in Netherlands, and 70% in Sweden. The parameter sign of inefficiency effects model show that the ratio of the crop subsidy to the total subsidies have positive impacts on the technical efficiency of crop farms in Netherlands and Sweden, but not significant in Germany, and the ratio of the total subsidies received to the total revenue has negative impacts on the technical efficiency in three countries.

The former indicates that crop subsidy (which can be translated into *coupled subsidies*) has positive impacts on the technical efficiency indicating the motivation of improving technical efficiency is higher when farmers obtain specific coupled subsidies, while the latter (which can be translated into *decoupled subsidies*) shows that the motivation for improving technical efficiency is lower when farmers obtain higher extra income from subsidies. *This implies that coupled subsidies increase technical efficiency whereas decoupled subsidies decrease technical efficiency*.

Table 3 Technical efficiency and technical efficiency change in 1995-2004

	Germany		Netherlands		Sweden	
Year	TE	TEC	TE	TEC	TE	TEC
1995	0.562	-	0.729	-	0.647	-
1996	0.604	0.053	0.739	0.004	0.755	0.134
1997	0.591	-0.005	0.746	0.008	0.744	0.021
1998	0.564	-0.039	0.732	-0.018	0.675	-0.045
1999	0.586	0.025	0.752	0.008	0.640	-0.013
2000	0.612	0.036	0.765	0.017	0.742	0.181
2001	0.614	-0.015	0.736	0.020	0.686	-0.041
2002	0.569	-0.045	0.775	0.066	0.706	0.020
2003	0.570	0.006	0.765	-0.013	0.737	0.087
2004	0.585	0.025	0.746	-0.024	0.680	-0.057
Total	**0.587**	0.001	**0.748**	0.007	**0.701**	0.027

4.2 Elasticity, Return to Scale (RTS) and Technical Change (TC)

The production elasticity with respect to each input for each country is reported in Table 4. We also obtain the parameters for return to scale (RTS) for each country in each year in Table 5.

Table 4 Production elasticity with respect to each of the six inputs (ε_k)

	Germany	Netherlands	Sweden
Seeds	0.029	0.048	0.008
Chemicals	0.067	0.050	0.163
Others	0.139	0.264	0.235
Capital	0.028	0.143	0.166
Labour	*-0.022*	0.046	0.028
Land	0.628	0.663	0.426

Note: estimation on the mean values of the data.

Table 5 Return to Scale (RTS) and Technical Change (TC) in 1995-2004

Year	Germany		Netherlands		Sweden	
	RTS	TC	RTS	TC	RTS	TC
1995	0.935	-	1.258	-	1.045	-
1996	0.935	0.027	1.247	0.0227	1.042	0.001
1997	0.936	0.023	1.237	0.0227	1.038	0.005
1998	0.937	0.020	1.227	0.0227	1.034	0.009
1999	0.938	0.017	1.216	0.0227	1.031	0.012
2000	0.939	0.014	1.206	0.0228	1.027	0.016
2001	0.939	0.011	1.196	0.0228	1.024	0.020
2002	0.940	0.008	1.185	0.0228	1.020	0.024
2003	0.941	0.004	1.175	0.0228	1.017	0.027
2004	0.942	0.001	1.165	0.0229	1.013	0.031
Average	**0.938**	0.013	**1.214**	0.023	**1.026**	0.020

Table 4 shows that the production elasticity of output with respect to each input is generally positive as expected, except for the elasticity with respect to labour in Germany. This is probably due to the overuse of labour on the big German farms. Table 5 shows that crop farms in the Netherlands and Sweden exhibit increasing returns to scale, whereas those in Germany exhibit decreasing returns to scale.

The annual average technical change in the period of 1995-2004 is 1.3% for Germany, 2.3% for the Netherlands and 2.0% for Sweden. Technical change in each country has different patterns. Technical change slows down over time in Germany, although it is positive in the whole period. In the Netherlands, it is almost constant whereas in Sweden technical change increases in the period 1995-2004.

4.3 Technical Efficiency Change and its decomposition

Technical efficiency also changes over time, following the trend of the different CAP reforms. The results show that the mean technical efficiency change in the 10-year period is 0.1%, 0.7 % and 2.7% respectively for Germany, Netherlands and Sweden. That is, Sweden on average has the highest improvement in technical efficiency, while the Netherlands has the lowest increase in technical efficiency over time. However, the technical efficiency change is fluctuating over time with increase in some years but decrease in other years.

The change in technical efficiency can also be decomposed into different components. The contributions of the specified exogenous variables and the other unspecified variables to the technical efficiency change are presented in Table 6. For Germany, the contribution from the specified variables is 1.1%, while from the unspecified factors is -1.0%. Both together contribute to an average technical efficiency change of 0.1% in the time period of 1995-2004. In Netherlands, technical efficiency change in the time period of 1995-2004 is on average 0.7%, of which 2.0% is explained from the change in the specified variables and -1.3% is due to change in the unspecified factors. In Sweden, the average technical efficiency change is 2.6%, which is largely explained by the change of specified variables (2.8%); only -0.2% is explained by the change of unspecified factors.

Table 6 Contributions of specified variables and unspecified factors to tec

	Specified variables (*z*)	Unspecified factors (*w*)	TEC
Germany	0.011	-0.010	0.001
Netherlands	0.020	-0.013	0.007
Sweden	0.028	-0.002	0.026

Table 7 decomposes technical efficiency change into the contributions of each specified variable. It shows in Germany the main contribution among the specified variables is from the change of z2 (the ratio of the total subsidies to the total farm revenue) and z5 (the degree of specialization). In Netherlands, the contribution from the specified variables is 0.1% from the change of z1 (ratio of crop subsidy to total subsidy), -0.6% from z2 (ratio of total subsidies to farm revenues), 0.5% from z3 (farm tax), -0.1% from z4 (farm size), 2.2% from z5 (specialisation), -0.1% from z7 (rented land). In the Netherlands, the main contributor to technical efficiency changes is therefore the degree of specialization in crop production. In Sweden, the main contributors to technical efficiency change are the degree of specialization (1.6%), farm size (0.6%) and ratio of total subsidy to revenues (0.8%).

Table 7 Contributions of exogenous variables to TEC in 1995-2004

	Δz_1	Δz_2	Δz_3	Δz_4	Δz_5	Δz_6	Δz_7	Δz_8	Δz_9	Δz
GE	-0.000	0.008	0.000	0.000	0.003	0.000	-0.000	-0.000	0.000	0.011
NL	0.001	-0.006	0.005	-0.001	0.023	0.000	-0.001	0.000	-0.000	0.020
SW	-0.004	0.008	0.001	0.006	0.016	0.000	0.001	-0.001	0.001	0.028

We have to acknowledge that the discussion on the technical efficiency change so far is only based on a 10-year average rate of technical efficiency change. However in different years, technical efficiency change exhibits both positive and negative rates due to the fact that the subsidies received and taxes paid over time change with CAP reforms; also the degree of specialization in crop production is changeable as a response to changes in the production environment.

5 Discussion and conclusions

We apply the stochastic frontier framework and FADN data of crop farms in three EU countries to estimate output distance functions and inefficiency effects model in the period 1995-2004, when different CAP reforms take place. We also calculate the yearly technical efficiency change and decompose the change of technical efficiency into the components of specified explanatory variables and the unspecified variables.

We find that the average technical efficiency is 59% in Germany, 75% in Netherlands and 70% in Sweden in the period of 1995-2004. The ratio of crop subsidy to the total subsidy has positive impacts on the technical efficiency in the Netherlands and Sweden but no significant impacts in Germany. The ratio of total subsidy to total farm revenue has significantly negative impacts on the technical efficiency in the three countries investigated. The study suggests that the 2003 CAP reforms (from coupled subsidy to decoupled subsidy) have profound impacts on the technical efficiency and technical efficiency change. Coupled subsidies (e.g. crop subsidy) have positive impacts on technical efficiency, whereas decoupled subsidies (e.g. part of the total subsidy in his total revenue) as an extra income reduce the motivation of the crop farmers in the sample to work efficiently.

The average annual technical efficiency change is 0.1% in Germany, 0.7% in the Netherlands and 2.6% in Sweden. Over time technical efficiency change can be explained by the change of a set of specified explanatory variables and the unspecified factors. Those specified variables (e.g. subsidy's, taxes, farm size, hired labour, and rented land as well as debts) have different contributions to the technical efficiency change in different countries. In Germany the main contributor to technical efficiency change among the specified variables is the share of crop subsidy in total subsidies. In the Netherlands specialisation is the main positive contributor, followed by farm tax, whereas the ratio of total subsidy to total revenues has a negative impact on the technical efficiency change. In Sweden the main positive contributor is specialisation, followed by the ratio of total subsidy to total revenue.

Although the impacts of crop subsidy on technical efficiency are both positive in the Netherlands and Sweden, the impacts on the technical efficiency change are not necessarily in the same direction because the latter also depends on the change rate of subsidy, which might have different signs. The important role of farm size in changing technical efficiency in the Netherlands and Sweden can be explained by the fact that crop farms in both countries exhibit increasing returns to scale.

We may draw some policy implication of the CAP reform based on this empirical study. The decoupled subsidy might not have positive impacts on the technical efficiency in the case study countries, while coupled subsidy might have positive impacts in at least the Netherlands and Sweden.

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Appendix Estimation results of output distance functions

Germany

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Lx1	-0.10877	0.083749	-1.3	0.194	-0.27292	0.055374
Lx2	0.47311	0.076145	6.21	0	0.323868	0.622352
Lx3	-0.15862	0.160133	-0.99	0.322	-0.47248	0.155233
Lx4	-0.49659	0.1171	-4.24	0	-0.7261	-0.26708
Lx5	-0.65313	0.176531	-3.7	0	-0.99913	-0.30714
Lx6	1.835653	0.181739	10.1	0	1.47945	2.191856
Ly21	-0.43502	0.058599	-7.42	0	-0.54987	-0.32016
Ly31	0.20298	0.041721	4.87	0	0.12121	0.284751
Ly41	-0.57507	0.060435	-9.52	0	-0.69352	-0.45662
t	0.040257	0.018944	2.13	0.034	0.003128	0.077385
Lx1Lx1	0.00125	0.003198	0.39	0.696	-0.00502	0.007517
Lx1Lx2	0.006944	0.004173	1.66	0.096	-0.00124	0.015123
Lx1Lx3	0.003171	0.011604	0.27	0.785	-0.01957	0.025913
Lx1Lx4	-4.9E-05	0.009115	-0.01	0.996	-0.01792	0.017816
Lx1Lx5	0.02667	0.012133	2.2	0.028	0.00289	0.050449
Lx1Lx6	-0.04383	0.010792	-4.06	0	-0.06498	-0.02267
Lx1Ly21	-0.03247	0.005179	-6.27	0	-0.04262	-0.02232
Lx1Ly31	-0.01224	0.003168	-3.86	0	-0.01845	-0.00603
Lx1Ly41	0.022923	0.003955	5.8	0	0.015172	0.030675
Lx2Lx2	0.019091	0.002267	8.42	0	0.014647	0.023534
Lx2Lx3	-0.0571	0.010281	-5.55	0	-0.07725	-0.03695
Lx2Lx4	-0.01879	0.008283	-2.27	0.023	-0.03502	-0.00255
Lx2Lx5	-0.02956	0.010907	-2.71	0.007	-0.05094	-0.00818
Lx2Lx6	0.030621	0.009947	3.08	0.002	0.011126	0.050116
Lx2Ly21	-0.01352	0.005182	-2.61	0.009	-0.02368	-0.00336
Lx2Ly31	-0.00023	0.003166	-0.07	0.941	-0.00644	0.005971
Lx2Ly41	0.03701	0.003805	9.73	0	0.029553	0.044467
Lx3Lx3	0.046772	0.015513	3.01	0.003	0.016367	0.077178
Lx3Lx4	0.022424	0.016412	1.37	0.172	-0.00974	0.054591
Lx3Lx5	0.002817	0.021957	0.13	0.898	-0.04022	0.045851
Lx3Lx6	-0.04555	0.025847	-1.76	0.078	-0.09621	0.005112
Lx3Ly21	0.027113	0.008927	3.04	0.002	0.009617	0.044608
Lx3Ly31	-0.02329	0.005275	-4.42	0	-0.03363	-0.01295
Lx3Ly41	0.062193	0.009812	6.34	0	0.042963	0.081423
Lx4Lx4	0.012756	0.00628	2.03	0.042	0.000448	0.025065

Lx4Lx5	0.052947	0.016805	3.15	0.002	0.02001	0.085884
Lx4Lx6	-0.04877	0.019341	-2.52	0.012	-0.08667	-0.01086
Lx4Ly21	0.003017	0.008126	0.37	0.71	-0.01291	0.018944
Lx4Ly31	-0.02616	0.003665	-7.14	0	-0.03334	-0.01897
Lx4Ly41	0.012531	0.005808	2.16	0.031	0.001148	0.023915
Lx5Lx5	0.043893	0.013676	3.21	0.001	0.017088	0.070697
Lx5Lx6	-0.11273	0.023399	-4.82	0	-0.15859	-0.06687
Lx5Ly21	0.029098	0.008715	3.34	0.001	0.012018	0.046179
Lx5Ly31	-0.03349	0.005618	-5.96	0	-0.0445	-0.02248
Lx5Ly41	0.005745	0.008237	0.7	0.485	-0.0104	0.02189
Lx6Lx6	0.063451	0.018576	3.42	0.001	0.027042	0.099859
Lx6Ly21	-0.0114	0.008833	-1.29	0.197	-0.02871	0.005914
Lx6Ly31	0.083428	0.006021	13.86	0	0.071627	0.095228
Lx6Ly41	-0.14508	0.0093	-15.6	0	-0.16331	-0.12685
Ly21Ly21	-0.04321	0.002029	-21.29	0	-0.04719	-0.03923
Ly21Ly31	0.0152	0.002513	6.05	0	0.010275	0.020124
Ly21Ly41	0.033578	0.003381	9.93	0	0.026952	0.040205
Ly31Ly31	-0.02218	0.000931	-23.84	0	-0.02401	-0.02036
Ly31Ly41	0.023673	0.002066	11.46	0	0.019623	0.027722
Ly41Ly41	-0.06295	0.001873	-33.62	0	-0.06662	-0.05928
tLx1	0.005424	0.001745	3.11	0.002	0.002004	0.008845
tLx2	-0.00161	0.001574	-1.03	0.305	-0.0047	0.001472
tLx3	-0.00622	0.003163	-1.97	0.049	-0.01242	-1.8E-05
tLx4	0.005648	0.002292	2.46	0.014	0.001157	0.01014
tLx5	-0.00418	0.002755	-1.52	0.129	-0.00958	0.00122
tLx6	0.001734	0.003318	0.52	0.601	-0.00477	0.008236
tLy21	0.005214	0.001362	3.83	0	0.002544	0.007885
tLy31	-0.00262	0.000745	-3.52	0	-0.00408	-0.00116
tLy41	0.00205	0.001159	1.77	0.077	-0.00022	0.004322
tsquare	-0.00158	0.000457	-3.45	0.001	-0.00248	-0.00068
_cons	4.319181	0.710978	6.07	0	2.92569	5.712673
mu						
z1	0.016359	0.027243	0.6	0.548	-0.03704	0.069755
z2	3.065657	0.077777	39.42	0	2.913217	3.218098
z3	-8.85E-06	1.75E-06	-5.05	0	-1.2E-05	-5.42E-06
z4	-5.2E-05	4.15E-05	-1.26	0.206	-0.00013	2.89E-05
z5	1.108325	0.065568	16.9	0	0.979814	1.236836
z6	0.106567	0.020352	5.24	0	0.066679	0.146455
z7	0.048754	0.014318	3.41	0.001	0.020692	0.076816
z8	0.030548	0.021218	1.44	0.15	-0.01104	0.072134
z9	0.114855	0.023256	4.94	0	0.069273	0.160437
Dum2	0.025486	0.023681	1.08	0.282	-0.02093	0.0719
Dum3	-0.00941	0.02488	-0.38	0.705	-0.05818	0.039352
Dum4	0.013778	0.025486	0.54	0.589	-0.03617	0.063729
Dum5	0.092401	0.02705	3.42	0.001	0.039385	0.145418
Dum6	-0.10685	0.026967	-3.96	0	-0.15971	-0.054
Dum7	-0.08237	0.024432	-3.37	0.001	-0.13026	-0.03448
Dum8	0.036625	0.088052	0.42	0.677	-0.13595	0.209203
Dum9	0.250104	0.03309	7.56	0	0.185249	0.31496
Dum10	0.117077	0.047065	2.49	0.013	0.024831	0.209323
Dum11	0.05201	0.030409	1.71	0.087	-0.00759	0.111611
Dum12	0.08442	0.031467	2.68	0.007	0.022745	0.146095
Dum13	-0.04275	0.038778	-1.1	0.27	-0.11875	0.033257
_cons	-0.7831	0.079718	-9.82	0	-0.93934	-0.62685

Netherlands

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Lx1	0.42966	0.170049	2.53	0.012	0.096371	0.76295
Lx2	0.191188	0.136347	1.4	0.161	-0.07605	0.458423
Lx3	0.04392	0.225264	0.19	0.845	-0.39759	0.48543
Lx4	-0.06308	0.152051	-0.41	0.678	-0.36109	0.234936
Lx5	-0.4961	0.143546	-3.46	0.001	-0.77745	-0.21476
Lx6	-0.51044	0.24919	-2.05	0.041	-0.99885	-0.02204
Ly21	-0.5669	0.073192	-7.75	0	-0.71036	-0.42345
Ly31	-0.01108	0.025259	-0.44	0.661	-0.06058	0.03843
Ly41	-0.27136	0.056635	-4.79	0	-0.38236	-0.16036
t	0.144064	0.033979	4.24	0	0.077466	0.210662
Lx1Lx1	0.045116	0.012813	3.52	0	0.020003	0.070229
Lx1Lx2	-0.07672	0.025592	-3	0.003	-0.12688	-0.02656
Lx1Lx3	-0.01157	0.036171	-0.32	0.749	-0.08247	0.05932
Lx1Lx4	0.085679	0.026542	3.23	0.001	0.033657	0.137701
Lx1Lx5	-0.1289	0.027492	-4.69	0	-0.18278	-0.07502
Lx1Lx6	-0.00909	0.03677	-0.25	0.805	-0.08116	0.062981
Lx1Ly21	0.010976	0.011987	0.92	0.36	-0.01252	0.034471
Lx1Ly31	-0.00179	0.004937	-0.36	0.718	-0.01146	0.007891
Lx1Ly41	0.012504	0.009592	1.3	0.192	-0.0063	0.031304
Lx2Lx2	0.038019	0.008405	4.52	0	0.021546	0.054493
Lx2Lx3	-0.04841	0.030633	-1.58	0.114	-0.10845	0.011626
Lx2Lx4	-0.01911	0.024682	-0.77	0.439	-0.06748	0.02927
Lx2Lx5	-0.01081	0.01743	-0.62	0.535	-0.04497	0.023355
Lx2Lx6	0.076745	0.034227	2.24	0.025	0.009661	0.143829
Lx2Ly21	0.002732	0.012451	0.22	0.826	-0.02167	0.027135
Lx2Ly31	0.035857	0.008537	4.2	0	0.019125	0.052589
Lx2Ly41	0.026696	0.008891	3	0.003	0.009269	0.044123
Lx3Lx3	0.025193	0.030448	0.83	0.408	-0.03448	0.084869
Lx3Lx4	-0.04985	0.039862	-1.25	0.211	-0.12798	0.028272
Lx3Lx5	0.073998	0.034354	2.15	0.031	0.006665	0.141332
Lx3Lx6	0.006559	0.051112	0.13	0.898	-0.09362	0.106738
Lx3Ly21	0.026108	0.020127	1.3	0.195	-0.01334	0.065557
Lx3Ly31	-0.00554	0.007613	-0.73	0.467	-0.02046	0.009386
Lx3Ly41	0.000975	0.014037	0.07	0.945	-0.02654	0.028487
Lx4Lx4	-0.01277	0.017675	-0.72	0.47	-0.04741	0.021876
Lx4Lx5	0.048877	0.027401	1.78	0.074	-0.00483	0.102582
Lx4Lx6	0.022287	0.036735	0.61	0.544	-0.04971	0.094286
Lx4Ly21	-0.02946	0.014846	-1.98	0.047	-0.05856	-0.00036
Lx4Ly31	0.008569	0.006197	1.38	0.167	-0.00358	0.020715
Lx4Ly41	0.017587	0.009528	1.85	0.065	-0.00109	0.036261
Lx5Lx5	0.009456	0.01442	0.66	0.512	-0.01881	0.037719
Lx5Lx6	0.055769	0.037006	1.51	0.132	-0.01676	0.1283
Lx5Ly21	0.06652	0.016795	3.96	0	0.033603	0.099437
Lx5Ly31	-0.04323	0.006624	-6.53	0	-0.05621	-0.03025
Lx5Ly41	0.010582	0.009454	1.12	0.263	-0.00795	0.029111
Lx6Lx6	0.021633	0.04037	0.54	0.592	-0.05749	0.100756
Lx6Ly21	-0.04234	0.02074	-2.04	0.041	-0.08299	-0.00169
Lx6Ly31	0.007533	0.008823	0.85	0.393	-0.00976	0.024826
Lx6Ly41	-0.1065	0.014578	-7.31	0	-0.13507	-0.07793
Ly21Ly21	-0.07164	0.004217	-16.99	0	-0.07991	-0.06338
Ly21Ly31	0.016804	0.003103	5.42	0	0.010722	0.022886
Ly21Ly41	0.01945	0.004225	4.6	0	0.01117	0.027731

Ly31Ly31	-0.00434	0.000237	-18.29	0	-0.0048	-0.00387
Ly31Ly41	-0.00088	0.001577	-0.56	0.577	-0.00397	0.002211
Ly41Ly41	-0.02892	0.001981	-14.6	0	-0.03281	-0.02504
tLx1	0.001241	0.004927	0.25	0.801	-0.00842	0.010898
tLx2	0.014154	0.005767	2.45	0.014	0.002852	0.025457
tLx3	-0.00675	0.005691	-1.19	0.236	-0.0179	0.004408
tLx4	-0.01036	0.00462	-2.24	0.025	-0.01941	-0.0013
tLx5	-0.01172	0.005158	-2.27	0.023	-0.02184	-0.00161
tLx6	0.003085	0.006981	0.44	0.659	-0.0106	0.016766
tLy21	0.002643	0.002885	0.92	0.36	-0.00301	0.008298
tLy31	-0.00282	0.001041	-2.71	0.007	-0.00487	-0.00078
tLy41	0.001428	0.001682	0.85	0.396	-0.00187	0.004725
tsquare	1.36E-05	0.000782	0.02	0.986	-0.00152	0.001545
_cons	3.857728	0.603985	6.39	0	2.67394	5.041516
mu						
z1	-0.06737	0.040257	-1.67	0.094	-0.14627	0.011531
z2	1.624251	0.141716	11.46	0	1.346493	1.902009
z3	-1.4E-05	2.96E-06	-4.73	0	-2E-05	-8.21E-06
z4	0.001492	0.000234	6.38	0	0.001034	0.00195
z5	1.915545	0.223415	8.57	0	1.47766	2.353429
z6	0.023949	0.036078	0.66	0.507	-0.04676	0.09466
z7	-0.10614	0.023093	-4.6	0	-0.1514	-0.06088
z8	-0.00316	0.023957	-0.13	0.895	-0.05011	0.043797
z9	0.038211	0.06438	0.59	0.553	-0.08797	0.164393
_cons	-1.58985	0.212288	-7.49	0	-2.00593	-1.17378

Sweden

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Lx1	0.600359	0.195411	3.07	0.002	0.217361	0.983356
Lx2	0.442107	0.16957	2.61	0.009	0.109756	0.774458
Lx3	0.419447	0.292895	1.43	0.152	-0.15462	0.99351
Lx4	0.325965	0.255107	1.28	0.201	-0.17404	0.825966
Lx5	0.661596	0.254662	2.6	0.009	0.162468	1.160725
Lx6	-0.79015	0.282642	-2.8	0.005	-1.34412	-0.23618
Ly21	-0.49278	0.185171	-2.66	0.008	-0.85571	-0.12985
Ly31	-0.0285	0.029992	-0.95	0.342	-0.08728	0.030284
Ly41	-0.40636	0.146334	-2.78	0.005	-0.69316	-0.11955
t	0.004662	0.057665	0.08	0.936	-0.10836	0.117682
Lx1Lx1	0.002941	0.008177	0.36	0.719	-0.01308	0.018968
Lx1Lx2	0.013069	0.011326	1.15	0.249	-0.00913	0.035266
Lx1Lx3	-0.0765	0.027134	-2.82	0.005	-0.12968	-0.02332
Lx1Lx4	0.03747	0.023668	1.58	0.113	-0.00892	0.083857
Lx1Lx5	-0.10071	0.023627	-4.26	0	-0.14702	-0.05441
Lx1Lx6	0.063706	0.026845	2.37	0.018	0.01109	0.116322
Lx1Ly21	-0.00752	0.019859	-0.38	0.705	-0.04644	0.031407
Lx1Ly31	0.005188	0.003657	1.42	0.156	-0.00198	0.012355
Lx1Ly41	0.033399	0.011253	2.97	0.003	0.011344	0.055455
Lx2Lx2	0.046733	0.007292	6.41	0	0.032441	0.061025
Lx2Lx3	-0.08756	0.023381	-3.74	0	-0.13338	-0.04173
Lx2Lx4	-0.02939	0.021164	-1.39	0.165	-0.07087	0.012087
Lx2Lx5	0.004362	0.021208	0.21	0.837	-0.0372	0.045928
Lx2Lx6	0.00264	0.023741	0.11	0.911	-0.04389	0.049172
Lx2Ly21	-0.01953	0.017979	-1.09	0.277	-0.05477	0.015711
Lx2Ly31	8.33E-05	0.003627	0.02	0.982	-0.00703	0.007193

Lx2Ly41	0.056086	0.0113	4.96	0	0.033938	0.078233
Lx3Lx3	0.067637	0.034026	1.99	0.047	0.000947	0.134328
Lx3Lx4	-0.18072	0.041606	-4.34	0	-0.26226	-0.09917
Lx3Lx5	0.024327	0.045124	0.54	0.59	-0.06411	0.112767
Lx3Lx6	0.238703	0.056942	4.19	0	0.127099	0.350307
Lx3Ly21	0.035651	0.029571	1.21	0.228	-0.02231	0.093609
Lx3Ly31	0.00555	0.004261	1.3	0.193	-0.0028	0.0139
Lx3Ly41	0.051683	0.021081	2.45	0.014	0.010365	0.093001
Lx4Lx4	0.0421	0.021058	2	0.046	0.000828	0.083373
Lx4Lx5	-0.02191	0.034163	-0.64	0.521	-0.08886	0.045052
Lx4Lx6	0.085072	0.041126	2.07	0.039	0.004467	0.165677
Lx4Ly21	-0.02559	0.026002	-0.98	0.325	-0.07655	0.025375
Lx4Ly31	0.002192	0.002578	0.85	0.395	-0.00286	0.007245
Lx4Ly41	-0.0092	0.014899	-0.62	0.537	-0.0384	0.019999
Lx5Lx5	-0.06501	0.025326	-2.57	0.01	-0.11465	-0.01537
Lx5Lx6	0.16198	0.040502	4	0	0.082598	0.241361
Lx5Ly21	0.095625	0.02526	3.79	0	0.046115	0.145134
Lx5Ly31	-0.00659	0.004253	-1.55	0.121	-0.01493	0.001742
Lx5Ly41	0.010658	0.016007	0.67	0.506	-0.02072	0.042031
Lx6Lx6	-0.27928	0.033998	-8.21	0	-0.34591	-0.21264
Lx6Ly21	-0.10662	0.025389	-4.2	0	-0.15638	-0.05686
Lx6Ly31	-0.0097	0.004903	-1.98	0.048	-0.01931	-8.7E-05
Lx6Ly41	-0.14138	0.019796	-7.14	0	-0.18018	-0.10258
Ly21Ly21	-0.06552	0.006397	-10.24	0	-0.07806	-0.05299
Ly21Ly31	0.005294	0.002695	1.96	0.05	1.12E-05	0.010577
Ly21Ly41	0.016541	0.01186	1.39	0.163	-0.0067	0.039786
Ly31Ly31	-0.00132	0.000197	-6.72	0	-0.00171	-0.00094
Ly31Ly41	0.001992	0.001574	1.27	0.206	-0.00109	0.005077
Ly41Ly41	-0.04059	0.005002	-8.11	0	-0.05039	-0.03079
tLx1	0.002376	0.005087	0.47	0.64	-0.0076	0.012347
tLx2	-0.00486	0.004461	-1.09	0.276	-0.01361	0.00388
tLx3	-0.01957	0.008327	-2.35	0.019	-0.03589	-0.00325
tLx4	0.011404	0.006918	1.65	0.099	-0.00215	0.024962
tLx5	0.000348	0.008178	0.04	0.966	-0.01568	0.016376
tLx6	0.006775	0.009242	0.73	0.463	-0.01134	0.02489
tLy21	0.010453	0.004258	2.46	0.014	0.002108	0.018798
tLy31	0.000645	0.000803	0.8	0.422	-0.00093	0.002219
tLy41	0.002776	0.003296	0.84	0.4	-0.00368	0.009236
tsquare	0.00189	0.001508	1.25	0.21	-0.00107	0.004845
_cons	-2.57023	1.099141	-2.34	0.019	-4.7245	-0.41595
mu						
z1	-0.69179	0.166121	-4.16	0	-1.01738	-0.36619
z2	2.651806	0.245326	10.81	0	2.170976	3.132636
z3	5.01E-05	2.45E-05	2.05	0.04	2.20E-06	9.81E-05
z4	-0.0044	0.00106	-4.15	0	-0.00648	-0.00232
z5	1.135637	0.158628	7.16	0	0.824732	1.446541
z6	0.059561	0.140071	0.43	0.671	-0.21497	0.334095
z7	-0.27406	0.087812	-3.12	0.002	-0.44616	-0.10195
z8	-0.15633	0.096106	-1.63	0.104	-0.3447	0.032034
z9	0.20524	0.178031	1.15	0.249	-0.14369	0.554173
Dum1	-0.19945	0.081366	-2.45	0.014	-0.35893	-0.03998
Dum2	-0.18071	0.090163	-2	0.045	-0.35742	-0.00399
_cons	-0.22405	0.220921	-1.01	0.31	-0.65705	0.208943