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The Regional Incidence of European Agricultural Policy: Measurement Concept and Empirical Evidence*

by

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THE REGIONAL INCIDENCE OF EUROPEAN AGRICULTURAL POLICY: MEASUREMENT CONCEPT AND EMPIRICAL EVIDENCE*

Abstract

The Common Agricultural Policy (CAP) of the European Union (EU) is characterized by a wide array of individual policy measures, which differ by the category of instruments, across commodities and over time. This situation is similar to many other industrialized countries. Consequently, the net impact of the policy mix on price incentives for producers and consumers had been intransparent for years. The existing level of agricultural protection, as a basis for agricultural trade liberalization, had also been unknown. This study utilizes a regionalized concept of producer support estimates (PSEs) to elaborate the primary effects of the CAP on producer revenues at the regional level. The data used are based on 26 regions located in Germany as well as the years 1986-1999.

One striking result is that a uniform CAP does affect the regions very differently. This finding is valid according to all suggested measures of producer support. Some regions are clearly more favoured than others. Another main finding is that recent reforms of the CAP have not reduced significantly the average level of agricultural support in the federal state of Hesse, Germany, and in 21 of 26 regions of this state. Statistically significant downward trends in absolute producer support due to price support were associated with significant upward trends due to direct payments. A third interesting outcome is that it is important to define the measurement concept of support precisely, if the CAP is targeted at producer support. Absolute and relative PSE measures due to the CAP and price support are fully uncorrelated with each other. If transfers under the CAP are targeted in terms of absolute support, e.g. may induce an arbitrary interregional distribution of PSE in relation to farm revenues.

1 Introduction

The Common Agricultural Policy (CAP) of the European Union (EU) is characterized by a wide array of individual policy measures, which differ by the category of instruments, across commodities and over time. This situation is similar to many other industrialized countries. Consequently, the net impact of the policy mix on price incentives for producers and consumers had been intransparent for years. The existing level of agricultural protection, as a basis for agricultural trade liberalization, had also been unknown. Given this situation of the 1970s and 1980s, it was a major step forward that producer and consumer subsidy equivalents (PSEs and CSEs) have been introduced and computed by the OECD and the USDA as a continuing basis of information on agricultural support [OECD (a); OECD (1987); WEBB/LOPEZ/PENN (1990)].

Despite this progress, redistributive implications of the CAP remain hidden in several respects even with the aggregate computation of PSEs and CSEs for OECD countries:

1. PSEs are computed at one level of the marketing chain. Due to imperfect policy transmission [COLMAN (1985)], they may be different at other levels of the marketing channel.
2. Average PSEs are computed on the basis of the aggregate production structure within the EU. Due to varying production levels and structures at the farm level, PSEs for individual farm types may well be different from aggregate PSEs. Target groups of interest for farm policy may be large or small farms, family farms, part-time or full-time farmers or conventional versus organic farming.
3. PSEs are computed for the EU as a whole. As natural and economic determinants of production vary within Europe, regional protection levels will vary, too.

Accordingly, disaggregate information and analyses of support levels within the marketing channel, across farm types and regions are needed for a detailed assessment of policy impacts. Here, we will concentrate on the regional implications of the CAP. Theoretical and empirical evidence on regional redistributive effects of the CAP is limited. However, a major and early study on the implications of the CAP for regional development exists with the RICAP study [COMMISSION OF THE EUROPEAN COMMUNITY (1981)]. Regional specialization within agriculture is documented there and linkages between the agricultural market orders and regional agricultural development are investigated. In the RICAP study, which appeared prior to the OECD studies on producer support in agriculture, a regional indicator of support was developed on the basis of nominal protection and computed for EU regions. In its summary, the authors of the RICAP study drew the conclusion that regional divergence in agriculture could not be mitigated with the CAP. A greater need to define regional policy goals as well as to measure regional impacts of the CAP is stressed. In another early contribution, TARDITI and CROCI-ANGELINI (1982) show theoretically that the CAP causes income flows from net-import to net-export regions as producers are supported and consumers are taxed. They present empirical evidence for Italian regions as a result of olive oil support for two years in the 1970s. Net impacts were not computed across commodities, but were limited to the individual product level. More recent analyses on the regional implications of the CAP include simulations of a policy change, with less price support and more direct income transfers, based on input-output analysis [LEON/QUINQU (1995)], and the modeling of multiplicator effects of a reduced price support on the basis of an agricultural sector model [DOYLE/MITCHELL/TOPP (1997)]. These studies refer to France and Scotland, respectively.

This study differs from the earlier analyses in various respects:

(i) Its focus is, like in the RICAP study, on an empirical ex-post analysis of regional impacts of the CAP. All other analyses cited above are simulation or ex-ante analyses of selected regional impacts.

(ii) The analysis presented here is oriented at the overall effects of the whole variety of instruments applied in the CAP. Most earlier studies, with the exception of the RICAP study, referred to the modeling of individual policy instruments.

(iii) Compared with the RICAP study, we apply more recent data and consider a period in which major policy reforms took place. We rely on an established instrument of protection measurement, too, with producer support estimates and use time series of regional protection which had not been available in the RICAP study. This allows to disaggregate ex-post effects of different policy instruments which was not possible at the beginning of the 1980s.

Thus, the objective of this paper is twofold. First, we intend to show how regional impacts of the CAP can be measured in terms of the price and revenue impacts. Second, new empirical evidence will be presented by use of the proposed method for regions in Germany. Data utilized are available over time (1986-99) and across commodities, so that regional support due to the CAP can be aggregated from support for the individual commodities.

We will address the following questions in detail:

(i) Does European agricultural policy cause differential regional support levels for agriculture and to which extent?

(ii) Did regional income transfers increase or decrease over time and was there a uniform interregional pattern of development?

(iii) Does agricultural support due to the CAP vary more across regions than over time?

(iv) Are the results on regional redistributive effects of the CAP depending on the choice of the measure of protection? In particular, does the regional impact vary when producer support is computed in absolute as opposed to relative terms or if measured per hectare rather than by farm?

(v) How did policy changes affect regional impacts of the CAP? More specifically, to which extent were lower transfers from decreasing price support compensated by increasing direct payments in the context of the 1992 Agricultural Reform or the Agenda 2000? Do these results differ by region?

(vi) From (i) to (v), the question arises whether the CAP diminishes or raises income inequality within the farm community or across regions.

The paper is organized as follows. The methodological framework is presented first. Then, aggregate descriptive and inductive statistics are presented and analyzed in the empirical part in order to elaborate the regional implications of the CAP. Finally, some conclusions for policy and future research are drawn.

2 Regionalisation of the PSE Concept

The major objective of this study consists of an interregional comparison of political support to agriculture in order to answer the question whether some regions gain more from protection policies than others. It is additionally analyzed whether the interregional distribution of support changed over time. Data from the German federal state of Hesse are utilized in the empirical analysis. The federal state of Hesse showed a very strong economic prosperity during the last five decades and is characterized by strong interregional disparities in economic development. Therefore, this state represents an interesting case study for measuring the spatial distribution of support.

The methodological concept for measuring agricultural protection applied in this study is the producer support estimate (PSE). This indicator is based on the original producer subsidy equivalent founded on work by CORDEN (1971) and was introduced as a concept for protection analysis by JOSLING (1979). It is commonly used by the OECD for analyzing issues of agricultural policy in an international context [OECD (2001)].

The PSE can be expressed in several ways, e.g., as a relative term where transfers to farmers are related to farmers total earnings. It can be also derived as an absolute term that adds up the following transfer components to the agricultural sector:

- Market price support,
- payments based on output,
- payments based on area planted or animal numbers,
- payments based on historical entitlements,
- payments based on input use,
- payments based on input constraints,
- payments based on overall farming income,
- miscellaneous payments.

Consequently, in absolute terms, the **PSE** is expressed as a measure of the absolute producer support estimate (**APSE**) as:

$$\textbf{(1)}\ APSE = q \cdot (p^D - p^W) + D - L.$$

The elements incorporated in this equation are defined as follows:

p^D (p^W) = Domestic price (world market price) measured at the farm-gate level,

Q = supply quantity,

D = direct income transfers, e.g., based on cultivated area or numbers of animals,

L = levies and charges paid by farmers.

The PSE concept is also applicable to a comparison of agricultural protection across regions. In a first step towards this end, an absolute producer support estimated per product unit (**apse**) can be derived from the **APSE**. For that purpose, we consider the **APSE** which was paid for a product category i in European Union and divide it by the produced quantity Q_i of that category:

$$\textbf{(2)}\ apse_i = APSE_i / Q_i\ .$$

$\textbf{apse}_\textbf{i}$ reflects the average value of the apse in product category i for the EU as a whole. By utilizing these $apse_i$ values for all product categories i, an absolute producer support estimate for region j ($\textbf{APSE}^\textbf{j}$) is obtained by multiplying with the quantities of the product categories which are produced by the agricultural sector in this region:

$$\textbf{(3)}\ APSE^j = \Sigma_i\, apse_i \cdot q^j{}_i,$$

where $q^j{}_i$ is the quantity of good i produced in region j.

Finally, this leads us to the total support payments paid to farmers located in a region j across several agricultural lines of production. The calculations reported in this paper are derived from data based on 26 regions in combination with 11 product lines.

According to different objectives of agricultural policy, it is useful to put transfers paid to the agricultural sector into perspective with different objectives of agricultural policy. This can be achieved by computing protection ratios. Absolute producer support estimates can be expressed per single farm or per unit of agricultural production factors. The amount of agricultural support paid per farm located in region j ($\textbf{apse}^\textbf{Fj}$) can be computed as follows:

$$\textbf{(4)}\ apse^{Fj} = APSE^j / F^j,$$

where F^j indicates the number of farms located in region j. Furthermore, the absolute amount of support derived for a region j may be related to units of agricultural production factors such as land or labor. For this, the absolute producer support estimate calculated for a region j is divided by the quantity of ha cultivated land in hectares located in region j (A^j):

$$(5)\ apse^{Aj} = APSE^j / A^j,$$

Additionally, it is of special interest for an interregional analysis of agricultural protection to calculate the proportion of farm revenues which is due to agricultural policy measures. This is equivalent to the percentage PSE concept as measured by the OECD at the national levels. In the regional concept, the absolute producer support estimate for region j is related to farm revenues in region j (R^j). This results in the computation of a relative producer support estimate for region j (**$RPSE^j$**):

$$(6)\ RPSE^j = APSE^j / R^j ,$$

where product prices at the farm-gate level (p^D_i) are incorporated:

$$(7)\ R^j = \Sigma_i\, q^j_i \cdot p^D_i .$$

Total farm revenues earned in region j are derived by adding up revenues of all agricultural product categories i. Agricultural product prices in Germany are published, for instance, by EUROSTAT (various issues), and these prices are used as approximation for farm prices at the regional levels. Instead of regarding the whole PSE, it may be preferable to relate only price support or direct transfers to farm revenues if it is the subject to study impacts of the major policy instruments. The following chapters present the empirical analysis based on the proposed regional measurement concept.

3 How Does Agricultural Protection Under the CAP Vary Across Regions?

In this section, we present highly aggregated statistics on the average level and variation of producer support estimates based on the suggested measurement approach for regional protection. The dataset refers to the period 1986-99 and 26 subregions of the German federal state of Hesse[1)]. These subregions differ widely in agricultural as well as economic performance and represent different regional impacts of the CAP. In Table 1, average impacts (measured with various indicators of producer support estimates) at the regional and state level in the period 1986-99 are presented as well as the interregional variation, measured by the coefficient of variation in these average impacts. In Table 2, coefficients of variations for the producer support estimates are shown at the regional and state level in order to illustrate the intertemporal variation of regional protection.

In Table 1, mean values of **APSE**, **apse^{F}**, **apse^{A}** and **RPSE** are presented and are further disaggregated due to price support and direct payments.

A major result of Table 1 is that the regional impacts of the CAP differ widely across regions. Furthermore, the interregional variation of the CAP impacts is highly dependent of the PSE measure utilized. Looking at the overall effects of agricultural policies under the CAP, the interregional variation of policy impacts is highest for APSE (87.2 %), followed by RPSE (35.4 %), apse^{F} (30.5 %) and apse^{A} (20.5 %). Of course, the huge interregional variation of APSE is driven by the differential sizes of the regions and of the corresponding agricultural sectors. The correlation coefficient (ν) between the APSE values in the first columns of Table 1 and the respective values of the agricultural area is 0.993. The interregional variation of RPSE and the apse estimates, however, are rather related to interregional differences in comparative advantage of agriculture and in production structure within the agricultural sector [1].

The APSE computations reveal that in the whole federal state of Hesse, an average annual transfer to farmers of 501.4 mio. ECU occurred as a consequence of the CAP. 401.8 mio. ECU of this transfer was due to price support and 99.6 mio. ECU to direct payments. This coincided, on average for 1986-99, with an RPSE of 28 % for the influence of the CAP as a whole and 22.3 % and 5.7 % for price support and direct payments respectively.

The large variation of APSEs across regions is visible in the overall policy impacts, which range between 0.12 and 51.5 mio. ECU, as well as in the impact of price support (direct payments) between 0.09 (0.03) and 41.8 (11.0) mio. ECU. The interregional coefficients of variation for the values of APSE are above 80 % in all three cases.

With regard to the interregional variation of producer support estimates, different groups of subregions can be identified according to differences in geographical size, the status of agricultural production and the number of farms operating. Major agricultural production areas in the federal state of Hesse tend to achieve above-average apse^{F} values and below-average RPSE values. Given the existence of larger farms in these regions, this structural effect raises apse^{F}. On the other hand, large agricultural production areas are less dependent of governmental support as the lower RPSE values indicate.

[1] apse^{F}, e.g., in the second column of Table 1 is highly correlated with farm size. The correlation coefficient with agricultural area per farm is 0.78. RPSE is negatively correlated with agricultural area per farm (r = - 0.43) at the 95 %-level, and with soil quality at the 99 %-level (r = 0.652) on the basis of two-sided tests.

Table 1: Average Regional Producer Support Estimates, Federal State of Hesse, Germany, 1986-99

Region	Impacts of the CAP			Impacts of Price Support			Impacts of Direct Payments			Relative Effects: RPSE		
	APSE (mio. ECU)	$apse^F$ (tsd. ECU)	$apse^A$ (ECU)	APSE (mio. ECU)	$apse^F$ (tsd. ECU)	$apse^A$ (ECU)	APSE (mio. ECU)	$apse^F$ (mio ECU)	$apse^A$ (ECU)	CAP	Price Support	Direct Payments
DA	0.74	11.39	432.66	0,59	9.04	350.63	0.15	2.35	82.03	16.07	12.85	3.22
FFM	2.33	8.95	548.75	1,79	6.63	424.09	0.54	2.32	124.66	13.43	10.39	3.04
OF	0.12	6.16	431.35	0,09	4.59	325.11	0.03	1.57	106.24	42.65	31.79	10.85
WI	2.39	7.48	501.89	1,83	5.53	387.97	0.56	1.95	113.92	12.72	9.95	2.92
BERG	15.00	11.11	609.33	12,64	9.18	513.05	2.36	1.93	96.29	22.96	19.20	3.75
DADIE	17.13	15.71	657.05	14,01	12.43	536.46	3.12	3.27	120.59	18.92	15.44	3.49
GG	8.88	13.36	489.04	7,00	10.03	383.51	1.88	3.33	105.54	13.85	10.89	2.97
HTK	5.57	9.97	509.72	4,27	7.37	392.16	1.30	2.60	117.56	23.29	17.86	5.43
MKK	30.12	11.69	665.14	24,67	9.37	545.08	5.44	2.32	120.06	32.81	26.65	6.16
MTK	3.55	8.39	494.55	2,69	6.09	375.76	0.86	2.30	118.79	15.74	12.03	3.72
OD	13.46	11.74	751.62	11,62	9.99	649.84	1.84	1.75	101.78	43.07	37.02	6.05
OFL	3.23	11.59	563.06	2,46	8.65	437.16	0.76	2.94	125.90	36.25	27.27	8.97
RTK	6.76	4.47	376.09	4,59	2.89	255.67	2.17	1.57	120.42	31.59	20.85	10.74
WE	36.17	15.46	693.90	29,04	11.90	556.97	7.13	3.57	136.93	18.41	14.69	3.72
GI	18.44	10.61	563.21	14,39	7.85	438.71	4.05	2.76	124.50	27.74	21.12	6.62
LDK	8.99	6.15	458.00	6,84	4.47	353.47	2.15	1.67	104.53	38.46	28.59	9.87
LM	19.67	17.09	625.87	15,43	12.93	492.97	4.24	4.16	132.90	33.68	26.27	7.41
MB	34.35	10.56	696.01	27,04	8.03	548.73	7.30	2.53	147.27	34.00	26.49	7.51
VB	45.62	13.20	693.14	37,89	10.67	575.53	7.73	2.53	117.62	38.41	31.71	6.70
KS	0.35	6.11	382.31	0,25	3.94	252.68	0.10	2.16	129.64	31.13	19.68	11.45
FD	44.80	10.66	692.52	37,34	8.71	577.75	7.45	1.95	114.76	39.28	32.65	6.63
HR	24.85	9.10	646.41	19,78	6.99	513.44	5.07	2.12	132.97	35.21	27.65	7.57
KSL	32.29	13.52	611.50	24,19	9.63	457.69	8.09	3.89	153.81	23.74	17.46	6.28
SEK	51.52	13.68	731.34	40,51	10.35	574.26	11.01	3.33	157.08	22.36	17.52	4.84
WF	50.99	12.26	702.56	41,83	9.83	575.22	9.16	2.43	127.34	36.13	29.44	6.69
WM	23.38	12.34	607.12	18,31	9.29	476.70	5.07	3.05	130.42	26.13	20.26	5.87
Average of Regions	19.26	10.87	582.08	15.43	8.32	460.41	3.83	2.55	121.67	28.00	21.75	6.25
Interregional Variation	87.18	30.45	20.48	89.73	33.70	26.28	82.33	32.43	23.19	35.38	38.80	45.33
State of Hesse	501.39	11.68	647.41	401.81	9.06	518.95	99.58	2.62	128.46	28.01	22.34	5.67

Source: Authors' computations.

Like $apse^F$, the size of $apse^A$ is a function of farm structure. For the federal state of Hesse, an average annual producer support estimate per hectare of 647 ECU was transferred by the CAP in the period 1986-99. 519 ECU of average $apse^A$ arose from price support and 128 ECU from deficiency payments. The example supports the statement of dominating price support over direct payments with shares of 80.2 % as opposed 19.8 % in $apse^A$. The interregional variation of $apse^A$, as measured by the coefficient of variation, is lower than for APSE and $apse^F$. Correlation analysis additionally proves that the interregional distributions of $apse^A$ and APSE are highly correlated ($r = 0.797$ for the values in the first and third column of Table 1).

While major producing regions, such as Wetterau (WE), Darmstadt Dieburg (DADIE), Groß Gerau (GG) and Main Taunus Kreis (MTK), show an average RPSE of 17 %, less profitable and peripheral regions, for instance Lahn Dill Kreis (LDK), Vogelsberg (VB) and Odenwald (OD), have average shares of agricultural support of about 40 %. Thus, one can observe a regional variation of 35 %. The corresponding values of the relative shares of price support and direct payments show similar results.

In general, an additional correlation analysis among all PSE measures does uncover some interesting general findings. Whereas APSE, $apse^F$ and $apse^A$ are positively correlated, there is no statistically significant correlation among all absolute producer support estimates and RPSE. This is a striking result with regard to regional policy goals. If price support or the total CAP, e.g., is oriented at an APSE, $apse^F$ or $apse^A$ target, this will lead to an untargeted and uncorrelated distribution of RPSE across regions.

Another interesting outcome refers to direct payments, which are becoming increasingly popular within the CAP, although accounting for only one fifth of total transfers to farmers. The correlation coefficients between $apse^F$ and the RPSE are negative, namely at the 90 %-value of statistical significance under a two-tailed test. Here, a negative correlation means that regions with a high absolute producer support per farms due to direct payments tend to be associated with lower RPSEs. This is the typical case of favoured versus disfavoured agricultural regions where the first group ranks higher (lower) in terms of $apse^F$ (RPSE).

In Table 2, regional protection levels are measured in their intertemporal variation in the period 1986-99. Intertemporal coefficients of variation are outlined for the different concepts of producer support estimates as well as for the state of Hesse. Variation is also measured by an interregional coefficient showing how the intertemporal variation of support differs across regions.

For total Hesse, the coefficients of variation for APSE, $apse^F$ and $apse^A$ are 10.9 %, 18.7 % and 10.8 % respectively. This implies that the intertemporal variation of protection is clearly lower than the interregional variation of protection levels as shown in Table 1.

With the exception of one single region, the values of APSE show rather similar levels of instability in the protection of agriculture, i.e. between 9.9 and 20.1 %. Mainly influenced by the European agricultural policy, the evolution of agricultural production and the general economic performance, the variation of APSE, $apse^F$ and $apse^A$ show moderate coefficients of variation over time and across subregions suggesting rather uniform impacts of agricultural policy reforms at the regional level.

How did the impacts of price support vary over time? It is notable that structural changes in agricultural support due to policy reforms in the nineties had major impacts at the regional level with average coefficients of variation of 26.2 % and 19.6 % for APSE and $apse^F$. With a coefficient of variation of about 30 %, price support per hectare faced the highest variation over time. While favored producing regions faced a variation in price support of 36 % on average, disfavoured regions were affected by only 25 %. On the side of the relative price support differences are even larger. While the percentage share of payments due to price support changed by 36 % in the case of major producing regions less profitable regions only faced changes of 18 % and so suffered less under a transforming European agricultural price policy.

Although direct payments to agriculture at the regional level are still rather small in magnitude and in its share of total PSE, they exhibited an extremely strong intertemporal variation. This holds true for virtually all regions and all measures - APSE, $apse^F$, $apse^A$ and RPSE due to direct payments. We will show in Section 4 that this high variation is caused by the trend towards direct payments and away from price support in the CAP. Trend-corrected coefficients of variation would range much lower than the uncorrected coefficients presented in Table 2. Even here, where the intertemporal variation of PSEs is very high, this pattern is rather uniform across regions. The interregional coefficients of variation show a relatively modest instability over time.

Summing up, a uniform CAP leads to very different regional protection levels according to all utilized indicators – APSE, $apse^F$, $apse^A$ and RPSE. The intertemporal variation in producer support according to the CAP was modest in all regions. However, this is not the case for the policy components price support and direct payments, where the intertemporal variation in producer support was very strong as a consequence of structural policy changes in the 1990s. Some strong interregional differences occurred here, too.

Table 2: Coefficients of Time Series Variation of Regional Producer Support Estimates, Federal State of Hesse, Germany, 1986-99

Region	Impacts of the CAP			Impacts of Price Support			Impacts of Direct Payments			Relative Effects: RPSE		
	APSE	apse^F	apse^A	APSE	apse^F	apse^A	APSE	apse^F	apse^A	CAP	Price Support	Direct Payments
DA	16.54	19.91	20.24	31.99	31.64	37.04	90.84	91.38	89.42	15.89	31.37	90.18
FFM	20.10	22.27	20.76	44.12	38.80	45.00	92.66	96.23	92.11	19.84	44.90	92.68
OF	17.49	41.22	17.77	41.72	60.53	42.06	92.66	94.21	93.27	12.77	38.15	95.86
WI	16.11	20.45	18.24	39.85	33.98	42.27	91.91	95.48	90.71	18.88	42.31	92.44
BERG	14.69	13.46	14.43	28.46	19.52	28.08	75.79	83.24	76.32	12.59	24.55	78.55
DADIE	15.11	12.58	14.47	33.84	20.92	33.10	81.24	88.40	81.76	15.19	33.07	81.40
GG	17.27	16.49	15.66	40.10	25.68	38.15	88.06	95.18	88.92	16.33	38.80	88.91
HTK	13.27	19.98	13.20	31.36	21.18	32.22	88.26	93.33	87.83	13.54	31.40	88.73
MKK	11.00	15.83	10.67	24.35	16.08	24,32	81.44	87.41	81.41	10.53	20.32	83.60
MTK	14.70	19.30	14.85	37.67	28.43	38.30	90.97	95.14	90.43	17.61	40.40	89.75
OD	10.38	16.46	10.64	17.74	13.10	18.59	77.32	84.30	76.88	10.64	14.84	79.05
OFL	11.33	13.59	14.65	31.90	25.78	37.66	84.25	87.86	81.06	10.27	26.36	86.38
RTK	12.82	17.89	12.69	45.26	38.00	45.48	91.60	95.44	91.63	16.91	39.93	93.20
WE	14.40	17.90	14.34	34.34	21.55	34.27	86.90	94.36	87.08	13.81	32.46	88.14
GI	15.22	18.82	14.56	37.60	21.53	36.97	84.74	92.74	85.06	11.96	29.06	87.93
LDK	12.77	20.25	15.54	32.27	18.80	37.32	76.84	85.50	73.35	12.25	22.85	80.64
LM	11.48	20.09	11.68	27.91	17.59	29.41	87.84	93.64	87.19	11.91	25.45	88.41
MB	10.37	20.05	10.23	26.17	15.91	26.56	86.56	92.60	86.37	11.79	21.60	87.74
VB	10.00	21.50	10.01	20.58	14.17	20.39	84.31	91.10	84.46	10.36	17.22	85.46
KS	25.09	33.19	21.17	52.46	41.23	35.55	95.03	98.10	97.11	36.37	41.41	99.28
FD	10.02	20.54	9.97	17.16	13.60	17.60	84.06	90.20	83.97	10.93	15.63	84.53
HR	9.85	20.82	9.37	25.28	14.74	24.14	86.55	92.96	87.02	12.07	19.59	88.60
KSL	12.66	20.31	12.40	34.90	21.68	34.59	95.05	96.99	92.28	14.04	29.40	93.69
SEK	11.48	21.44	11.55	27.43	17.22	27.0	90.78	96.02	91.04	12.41	26.46	91.35
WF	10.47	20.66	10.94	18.22	12.78	17.43	87.07	91.97	87.62	12.85	15.36	88.33
WM	11.31	22.70	11.01	26.44	16.74	27.35	89.91	95.03	89.67	12.36	22.61	91.38
Average of Regions	10.56	17.31	11.39	26.21	19.57	29,77	86.30	92.14	86.60	11.42	25.07	88.23
Interregional Variation	2.85	8.38	14.02	5.77	14.96	32.92	4.42	11.56	32.37	10.53	20.44	11.30
State of Hesse	10.87	18.67	10.77	26.51	16.25	26.57	86.29	92.28	86.34	12.91	25.84	87.26

Source: Authors' computations.

4 How did the Regional Pattern of Agricultural Protection Under the CAP Change over Time?

In this section, we analyze the growth or decline of regional producer support estimates in the 26 subregions and the federal state of Hesse for 1986-99. All PSE concepts are utilized and again applied to the sum of policy transfers under the CAP and to the major policy instruments price support and direct payments.

Table 3 captures the annual growth of producer support estimates and its statistical significance. In the first column, annual growth of total protection under the **CAP** is presented. Apart from four regions with a negative trend, there is no significant increase or decline in APSE for all other 22 regions as well as for the federal state of Hesse. The APSEs were rather stable during the period 1986-99.

Contrary to this, numbers for the two main components of CAP, namely price support and transfers based on area planted/numbers of animals, show totally different results.

As a result of recent CAP reforms, price support decreased immensely over the last decade. In terms of the federal state of Hesse, the APSE due to price support fell by 20.5 million ECU annually. For the average region, this development results in a significant trend indicating a yearly decline of 779,000 ECU per region. In the same period, direct transfers gained strongly in importance. Consequently, Table 4 indicates that trends in price support are strongly negatively correlated with trends in direct transfers. Direct payments raised the APSE for agriculture in the federal state of Hesse by 18.8 million ECU annually. This significant change did nearly, but not fully, compensate the downward trend in APSE induced by lower price support. For the average region, direct payments rose yearly by 723,000 ECU. Significantly positive trends in the APSE caused by direct payments occurred in all 26 regions. Only in the case of some regions, namely Bergstrasse (BERG), Darmstadt-Dieburg (DADIE) and Wetterau (WE) as well as Giessen (GI), the reduction in price support overcompensated the increase in direct transfers, so that the APSE trend for the CAP is significantly negative. The rationale may be that these regions had gained strongly from price support in the earlier years because of their specific agricultural production conditions being characterized by high yields per hectare.

Table 3: Annual Growth of Regional Producer Support Estimates, Federal State of Hesse, Germany, 1986-99

	APSE, mio. ECU			$apse^F$, tsd. ECU			$apse^A$, ECU			RPSE, %		
Region	CAP	Price support	Direct transfers	CAP	Price support	Direct transfers	CAP	Price support	Direct transfers	CAP	Price support	Direct transfers
DA	-0.009	-0.037***	0.029***	-0.034	-0.495***	0.461***	-10.526*	-26.221***	15.695***	-0.096	-0.718***	0.623***
FFM	-0.045	-0.152***	0.107***	0.094	-0.394***	0.488***	-11.901	-36.686***	24.785***	-0.301	-0.906***	0.606***
OF	-0.001	-0.007***	0.006***	-0.089	-0.404**	0.315***	-4.425	-26.513***	22.089***	0.025	-2.307***	2.333***
WI	-0.024	-0.135***	0.111***	0.158	-0.252**	0.410***	-8.061	-30.455***	22.395***	-0.208	-0.778***	0.570***
BERG	-0.303**	-0.705***	0.403***	0.143	-0.220*	0.364***	-11.345**	-27.914***	16.569***	-0.176	-0.838***	0.662***
DADIE	-0.433***	-0.992***	0.559***	0.263**	-0.383**	0.646***	-15.067***	-36.855***	21.788***	-0.395**	-1.018***	0.623***
GG	-0.227**	-0.588***	0.362***	0.313**	-0.389**	0.702***	-9.569	-30.175***	20.606***	-0.284**	-0.855***	0.571***
HTK	-0.010	-0.259***	0.249***	0.362***	-0.175*	0.537***	-2.462	-24.873***	22.411***	-0.030	-1.073***	1.043***
MKK	-0.132	-1.118***	0.986***	0.336***	-0.120	0.456***	-3.052	-24.814***	21.761***	0.249	-0.896***	1.145***
MTK	-0.032	-0.201***	0.170***	0.231**	-0.249**	0.480***	-5.290	-28.570***	23.280***	-0.217	-0.938***	0.721***
OD	-0.005	-0.325***	0.320***	0.370***	0.038	0.332***	-1.991	-19.637***	17.646***	0.433	-0.647*	1.080***
OFL	-0.018	-0.161***	0.143***	0.185*	-0.392***	0.578***	-12.208**	-34.926***	22.718***	0.354	-1.373***	1.727***
RTK	-0.018	-0.445***	0.427***	0.111**	-0.217***	0.328***	-1.248	-24.928***	23.680***	0.477	-1.678***	2.155***
WE	-0.635*	-1.999***	1.364***	0.488***	-0.266	0.753***	-11.791*	-38.099***	26.308***	-0.192	-0.914***	0.722***
GI	-0.381**	-1.132***	0.751***	0.371***	-0.203*	0.575***	-10.379*	-33.616***	23.237***	0.061	-1.204***	1.264***
LDK	-0.074	-0.435***	0.361***	0.251***	-0.067	0.318***	-10.475**	-27.213***	16.737***	0.629**	-1.110***	1.739***
LM	-0.011	-0.821***	0.810***	0.688***	-0.175	0.863***	-2.881	-28.109***	25.228***	0.184	-1.244***	1.429***
MB	0.002	-1.366***	1.369***	0.443***	-0.075	0.518***	-0.497	-28.151***	27.654***	0.451	-0.984***	1.435***
VB	0.060	-1.367***	1.427***	0.611***	0.096	0.515***	1.626	-20.193***	21.819***	0.386	-0.864***	1.250***
KS	-0.007	-0.027***	0.020***	0.186	-0.251***	0.436***	9.460*	-17.079***	26.539***	1.512**	-0.772	2.285***
FD	0.419	-0.976***	1.395***	0.470***	0.075	0.395***	5.733	-15.752***	21.484***	0.561**	-0.686**	1.247***
HR	-0.025	-0.973***	0.948***	0.407***	-0.028	0.435***	1.319	-23.778***	25.098***	0.541**	-0.912***	1.453***
KSL	-0.148	-1.742***	1.594***	0.534***	-0.291**	0.825***	-2.026	-32.480***	30.454***	0.261	-0.996***	1.257***
SEK	0.065	-2.107***	2.172***	0.603***	-0.105	0.708***	2.052	-29.066***	31.118***	0.087	-0.865***	0.953***
WF	0.462	-1.264***	1.726***	0.541***	0.047	0.494***	8.539*	-15.722***	24.261***	0.671	-0.611***	1.282***
WM	0.070	-0.916***	0.986***	0.590***	-0.050	0.641***	0.206	-25.147***	25.353***	0.340	-0.818***	1.157***
State of Hesse	-1.743	-20.539***	18.796***	0.436***	-0.101***	0.537***	-2.205	-26.518***	24.313***	0.028	-1.052***	1.080***
Average of regions	-0.056	-0.779***	0.723***	0.332***	-0.190	0.522***	-4.087	-27.191***	23.104***	0.205	-1.000***	1.205***
Variance of regions	1.539	-14.900***	4.107***	0.826***	0.067	0.246***	236.576	87.538	135.017***	5.015***	-0.968	2.899***
Stand. dev. of reg.	0.055	-0.533***	0.617***	0.118***	0.010	0.152***	0.986	0.364	3.263***	0.254***	-0.058	0.516***
Coeff. of var. of reg.	0.526***	1.086***	0.676***	0.111	0.897***	-0.573***	0.293	1.707***	-1.510***	0.626***	1.584***	-0.559*

*** (**, *) t-test significant at 99 %- (95 %- , 90 %-) level.

Source: Authors' computations with data from OECD, various issues and Hessisches Statistisches Landesamt, various issues.

A most interesting result of Table 3 concerns trends in the interregional variation of subsidy payments. Regarding the positive trend functions, it is visible that the interregional variation of the APSE due to the CAP as well as price support and direct payments increased during the period 1986-99. The coefficient of variation across regions rose by 0.5 percentage points per year for the APSE due to the CAP and the respective growth for price support and direct payments is 1.1 and 0.7 percentage points respectively. Therefore, there exists a stable trend verifying a steady increase of interregional disparities in policy support. This finding contradicts strongly the aim of European Agricultural Policy to reduce interregional disparities.

The findings for trends in producer support estimates per farm are remarkable, too. Because these payments indicate the transfers paid on average per family operating a farm business, this may be of special interest related to objectives of social policy. The results for the growth and decline of $apse^F$ at the regional level partly confirms the findings for APSEs.

There are some marked differences first. In the case of the average region, in contrast to the APSE, a strongly significant positive trend occurs for $apse^F$. Moreover, this holds true for the majority of regions, too. For the average region, the yearly growth amounts to 332 ECU per farm as a consequence of changes in the CAP. This growth occurs despite the fact that price support diminished $apse^F$ by almost two hundred ECU per farm (although this change is not statistically significant). The dominating cause of growth in $apse^F$ were changes in direct payments. Direct transfers based on area planted and number of animals increased from 1986 until 1999 by 537 ECU annually per farm for the average region. Certainly, the overall reduction in numbers of farms during the last decades is a major determinant of the steady increase in $apse^F$. On the one hand, this development reinforces the trend effect on $apse^F$ due to the CAP as a whole and direct payments, but on the other hand, it reduces the decrease of price support per farm. In summary, it contributes to a significantly positive trend in PSE per farm.

In assessing spatial issues, one can recognize significant trends in interregional disparities due to price support as well as direct transfers. The coefficient of interregional variation for $apse^F$ exhibits an annual increase by 0.9 percentage points annually due to changes in price support. The interregional variation of direct transfers per farm moved in the opposite direction and reveals a decrease by 0.6 percentage points per year. This implies that a reduction of interregional disparities in $apse^F$ was only achieved by changes in direct payments.

The next topic to be discussed here is the political support which is given in relation to units of agricultural production factors. In particular, we concentrate on payments per hectare cultivated area. In general, cultivated area in Hesse decreased slightly during the last twenty years, and therefore, payments based on political support, as numerator, were the main component for the

development of the indicator apse^{A}. As reported in Table 3 for the federal state of Hesse, there is a significant decline of apse^{A} due to price support, whereas direct payments contribute to its growth. The two opposite trends do not lead to a significant growth or decline of apse^{A} as a consequence of all CAP instruments in the period 1966-89. Significant changes in apse^{A} as a consequence of the CAP do exist, however, for some of the regions. For example, Bergstrasse (BERG), Darmstadt-Dieburg (DADIE), Offenbach Kreis (OFL) and seven other regions show significant negative trends in apse^{A} due to the CAP as a whole. In two cases, regional values of apse^{A} due to the CAP move upward. Apparently, absolute producer support estimates per hectare developed differently across regions. In some cases, growth of direct payments per hectare overcompensated the decline of price support per hectare. This heterogeneous pattern is caused by differences in production structure and technical progress. Therefore, growth of direct transfers over time was overcompensated by the parallel reduction of price support which results in an overall decrease of PSE. Moreover, a strong positive correlation between growth rates of PSE per hectare and price support per hectare is striking in Table 4.

The influence of the major policy instruments, i. e. price support and direct payments, on apse^{A} was crucially altered in all regions in the period 1986-99. Price support per hectare was starkly reduced by 27 ECU per year for the average region. In the same period, payments based on area planted/animal numbers showed an enormous growth of 23 ECU per year. These developments were accompanied by a growth of interregional disparities in apse^{A} concerning price support, whereas interregional variation due to direct transfers was reduced over time. The rationale may be that regions which were originally favoured particularly by price support, gained even more from this policy instrument at the end of the period, possibly as a consequence of technical change. According to direct transfers, the contrary might be the case.

Finally Table 3 captures changes in the share of producer support estimates in farm revenue – i. e. RPSEs. The computations reveal that some developments are similar to those of the other categories analyzed above. For the average region, price support in relation to overall farm revenues was reduced over the period by one percentage point per year. Direct transfers rose remarkably by 1.2 percentage points annually. The total CAP-induced RPSE remained rather stable over the period. Interregional variation of RPSEs due to price support increased over time, whereas the interregional variation of RPSEs due to direct transfers declined. The impact of price support dominated and, hence, the interregional variation of RPSEs as a consequence of all CAP measures rose by 0.6 percentage points annually.

Table 4: Correlation Coefficients Between Growth Rates of Different Categories of Producer Support

		APSE mio. ECU			apse^F Tsd. ECU			apse^A ECU			RPSE %		
		CAP	Price supp.	Direct transf.	CAP	Price supp.	Direct transf.	CAP	Price supp.	Direct transf.	CAP	Price supp.	Direct transf.
APSE	CAP	1.000											
	Pr. S.	0.165	1.000										
Mio.. ECU	Dir. Tr.	0.198	-0.935***	1.000									
apse^F	CAP	0.160	-0.755**	0.808***	1.000								
	Pr. S.	0.496	-0.401	0.578*	0.664**	1.000							
tsd. ECU	Dir. Tr.	-0.314	-0.568	0.451	0.613*	-0.184	1.000						
apse^A	CAP	0.718**	-0.202	0.460	0.445	0.656*	-0.109	1.000					
	Pr. S.	0.746**	0.127	0.143	0.172	0.661**	-0.472	0.828***	1.000				
ECU	Dir. Tr.	0.046	-0.561*	0.574*	0.500	0.076	0.577*	0.409	-0.174	1.000			
RPSE	CAP	0.494	0.016	0.163	0.201	0.509	-0.274	0.744**	0.695**	0.176	1.000		
	Pr. S.	0.145	-0.247	0.297	0.394	0.371	0.123	0.203	0.249	-0.049	0.092	1.000	
%	Dir. Tr.	0.296	0.180	-0.072	-0.108	0.155	-0.305	0.457	0.386	0.174	0.736**	-0.607*	1.000

*** (**, *) t-test significant at 99,9 %- (99 %- , 95 %-) level.

Source: Authors' computations with data from OECD, various issues, Hessisches Statistisches Landesamt, various issues.

5 Summary

The following major conclusions can be drawn from the presented analysis:

1. A uniform CAP does affect the regions very differently. This result is valid according to four measures of producer support - APSE, apse^F, apse^A and RPSE. Some regions are clearly more favoured than others.

2. Recent reforms of the CAP have not reduced significantly the average level of agricultural support in the federal state of Hesse, Germany, and in 21 of 26 regions of this state. Statistically significant downward trends in absolute producer support due to price support were associated with significant upward trends due to direct payments. In almost all regions, the effects of direct payments on APSE values approximately compensated the opposite effects of price support.

3. The interregional variation in policy impacts of the CAP has increased, if we rely upon APSEs. If we refer to apse^F, apse^A and RPSE, interregional variation of producer support has increased due to price support and decreased due to direct payments. Only for RPSE, this resulted in a significant - upward - trend of interregional variation caused by the impact of all CAP measures.

4. If the CAP is targeted at producer support, it is important to define the measurement concept of support precisely. Absolute and relative PSE measures due to the CAP and price

support are fully uncorrelated with each other. A targeted interregional distribution of $apse^F$, e.g., may induce an arbitrary interregional distribution of RPSE.

This analysis is part of ongoing research. The next step will be to explain interregional differences in agricultural support by varying natural, agricultural and economic conditions across regions and over time.

Notes

1) The names of the 26 regions analyzed in this study are D–Darmstadt, FFM–Frankfurt/Main, OF–Offenbach, WI–Wiesbaden, BERG–Bergstraße, DADIE–Darmstadt-Dieburg, GG–Groß-Gerau, HTK–Hochtaunuskreis, MKK–Main-Kinzig-Kreis, MTK–Main-Taunus-Kreis, OD–Odenwald, OFL–Offenbach-Landkreis, RTK–Rheingau-Taunus-Kreis, WE–Wetterau, GI–Giessen, LDK–Lahn-Dill-Kreis, LM–Limburg-Weilburg, MB–Marburg-Biedenkopf, VB–Vogelsberg, KS–Kassel, FD–Fulda, HR–Hersfeld-Rotenburg, KSL–Kassel-Landkreis, SEK–Schwalm-Eder-Kreis, WF–Waldeck-Frankenberg and WM–Werra-Meißner-Kreis.

   In the context of this study, total PSE is calculated as the sum of price support and direct transfers.

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