The Effect of EU's Common Agricultural Policy at the Regional Level: Distribution, Development and Revenue Stabilisation

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Abstract:
     The aim of this paper is threefold. Firstly, we investigate the regional distribution of support of EU's Common Agricultural Policy (CAP). Secondly, we employ structural data of the regions to calculate average farm revenue and to show how support and income has developed over time. Thirdly, we analyse the stabilisation effect generated by these transfers. This is investigated for the market price support, the first pillar payments and one agri-environmental program. New contributions to the literature are the use of community data and the inclusion of a second-pillar program. The results show that there is an overall stabilisation effect of the EU's CAP but this effect is not equal for all regions.

1 Introduction
     The EU's CAP is characterised by a pool of different instruments to support farmers. Given the heterogeneous conditions both naturally and structurally within agriculture in the EU, individual areas are affected in a very different way. Differences not only exist between countries. Even within the member states and on regional level structures are often very unequal. Hence, the question how support is allocated over regions is a continuous research area. On the side of agricultural policy there are quite different instruments and programs which give support to producers. In recent years the direct payments and environmental programs are heavily emphasised but the market price support still remains an important instrument of support. The question how structurally different regions are affected by the various forms of transfers is a crucial one to evaluate the impact of the CAP at the regional level.
     Given this background the aim of the present paper is to determine the impact of EU's CAP on farmers' revenues. This issue has been investigated in several papers in the last decades. Interestingly, there was no clear empirical evidence on the overall impact of the programs. Buckwell et al. (1998) find a twofold impact of the CAP at a country level. While the agricultural productivity and thereby farm income has increased due to transfers on the one side, payments to preserve the agricultural landscape just go in the opposed direction. The study also analyses at the EU level that some countries benefit more than others notably France and Denmark.
Tarditi and Zanias (2001) find that market price support in regard to income favours on the one hand farms that are already better off by economic and production means – on average bigger and more profitable farms. On the other hand they conclude that market price support hinders structural changes in rural areas, especially in regions which are dominated by small scaled farms and where few off-farm working opportunities exist.
     Harsche (2006) analyses the effect of agricultural support on farm revenues at the NUTS 3 level in Hesse, Germany. He finds evidence that at the NUTS 3 level transfers from the CAP are higher in regions with favourable geographical and climatical conditions. The results also lead to the conclusion that there is a stabilising impact of CAP support for each considered measure.
     This paper has the objective to shed light on the ongoing debate by analysing the development of agricultural support and the instability of farm income at a community level. Therefore the term regions in the present analysis corresponds to the communities in the federal state of Hesse, Germany. To control for the stabilisation effect generated by the different instruments and the overall effect of EU's CAP a panel data set for the period from

2000 to 2006 of 424 regions in Hesse is employed. These localised data of agricultural support, the agricultural structure in the regions and geographical patterns allow for a more detailed analysis than the existing literature. The federal state of Hesse was also under examination of Harsche now is considered in more detailed way by an analysis on the community level. This is done because of the fact that the agricultural landscape is very different in the regions under study. By analysing the NUTS 3 level there will be an appropriate consideration of some communities but there will be an overestimation as well as an underestimation for several communities in each county[1]. Due to this fact the existing study should avoid this weakness by taking much smaller regions into account. The time period from 2000 to 2006 is rather short. Only the effect of the latest CAP reforms are considered in this time horizon, but the data are contemporary and also the latest trends in world market prices are considered in the examination.

The method of investigation is twofold. On the one hand the instability of agricultural revenues is examined in regard to the different forms of support. The considered measures in this study are the Market Price Support (MPS), the direct payments from the first pillar (DP)[2] and the Hessisches Kulturlandschaftsprogramm (HEKUL) a state program of the second pillar regarding the cultural landscape. The data of the latter two are requested from the Hessian Ministry of Agriculture. The data of the MPS are taken from the OECD database of Producer Support Estimates (PSE) in OECD countries in a top-down approach. The OECD database is also used in complementation with data from the Hessisches Statistisches Landesamt (HSL) to calculate the farmers' revenues at world market prices for the reference scenario with no transfers to agriculture. Instability is then calculated by comparing farmers' revenues at world market prices to different scenarios of support. These scenarios are support to revenues due to MPS, DP, HEKUL or the sum of all support – the CAP[3]. The measurement of instability follows the concept of Harsche (2006). On the other hand the investigation will link the transfers to the agricultural structure in the different regions. The regions are divided in three clusters in regard to their geographical height.

The paper is organised as follows. The next section gives an overview how on average agricultural support is allocated in Hesse, how the regions in the different clusters are located and how the level of support varies in regard to the indicators of support. In the third section we describe how the overall support and the support from single measures developed over the last seven years in the individual regions. This development is analysed for different indicators and for the different types of regions as well. In the fourth section we calculate an index of instability for the measures of support and the effect of the different measures on farmers' revenues to control for the stabilisation generated by the different measures of support. The last section concludes.

2 Regional Agricultural Support in Hesse

In the following section the average agricultural support in Hesse from 2000 to 2006 is analysed. This is firstly calculated for the regional transfers of the different policy measures. In a second step the regional support per farm is calculated and in a third step regional support is calculated per hectare agricultural land.

The basis of the underlying concept of this study is the Producer Support Estimate (PSE) of the OECD. Anders et al. (2004) show a regionalised concept of the PSE-measure,

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[1] Germany consists of 16 federal states, whereby Hesse is one of them. Hesse consists of 26 counties; these are consistent with the EU NUTS 3 regions. The 26 counties in Hesse consist of 426 communities.

[2] The direct payments in this examination refer to the first pillar payments, because the HEKUL is considered as a single measure as well.

[3] CAP refers for this examination to the sum of the three considered measures of support: the MPS, the DP and the HEKUL.

which is a useful tool for analysing the agricultural support and its impact on farmers' revenues at the regional level. The regional support is estimated by multiplying the EU per unit PSE - the monetary transfer value per produced tonne (pse_i^{EU}) - with the quantity (q_{ij}) of the different agricultural products (i) which are produced in region (j). Then, total transfers for a region (PSE_j) is the sum of quantities multiplied by the per unit PSE, (where unit is a tonne of a produced good), for the 10 analysed agricultural products[4]:

$$PSE_j = \sum_i pse_i^{EU} * q_{ij} \tag{1}$$

In this study only the MPS and the farmers' revenues at world market prices are calculated in analogue ways. The MPS per unit (mps_i^{EU}) is multiplied by the production of the good and this is aggregated for the different products in each region. Farmers' revenues are calculated in the same way by multiplying the quantities with the OECD reference price – that is the world market price.[5] So the regional farm revenues and the MPS are estimated through the OECD measures. The transfers of the direct payments and of HEKUL are data requested from the Hessian Ministry of Agriculture. The transfers summed under the term CAP are then the support by direct payments, the MPS and the support of HEKUL.

The regions are divided into 3 clusters in regard to their average geographical height to control for differences arising from the geographical location (see the left map of figure 2a). The 120 regions in cluster I have a geographical height below 200 meters. The 192 regions in cluster II have a height from 200 to 360 meters and the 112 regions in cluster III the have a height of more than 360 meters. It can be seen from the left map in figure 2a that the clusters have a clear geographical orientation. Most regions from Cluster I are located in the south

**Figure 2a: Left map: Geographical location of the regions for the selection of the clusters
Right map: Average total support in the Hessian regions (2000-2006)**
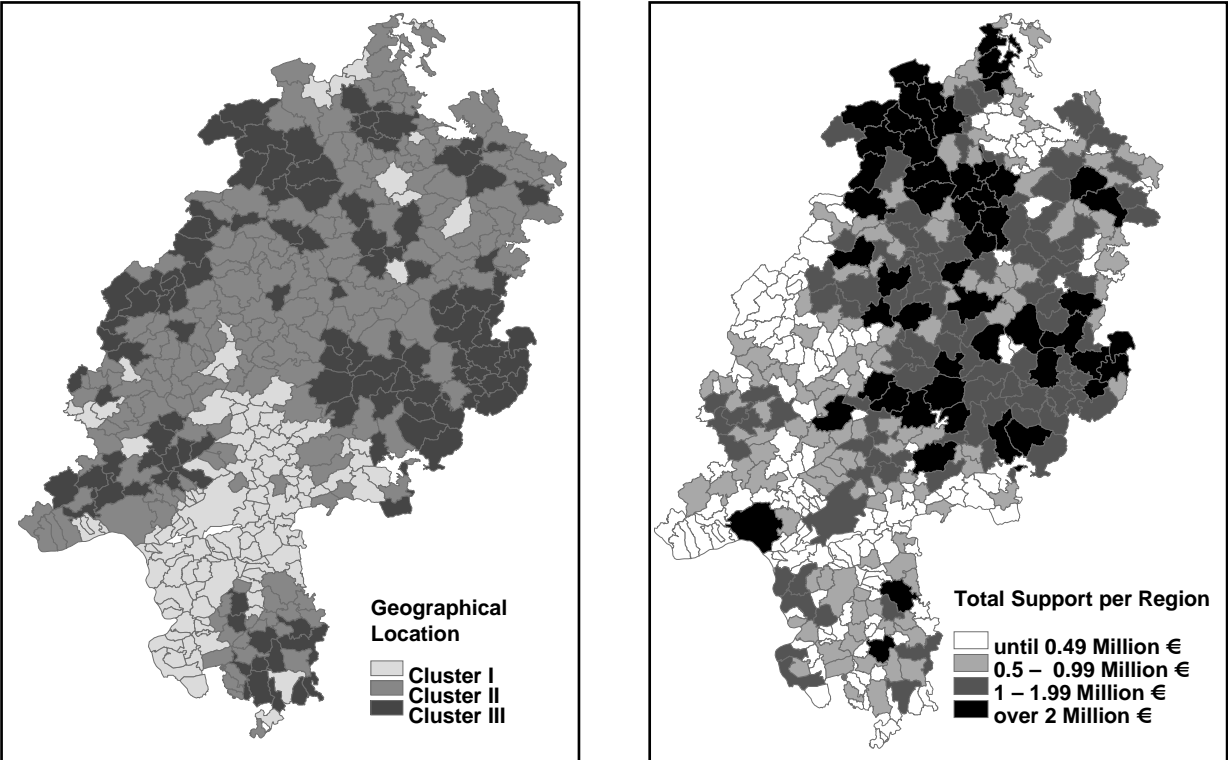
Source: Own illustration

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[4] The products are: wheat, barley, oats, rye, rape seeds, potatoes, sugar, milk, beef and pig meat.
[5] For a more detailed description see Allanson (2006).

while the regions in cluster II and III are not clearly located in Hesse. This also reflects the geographical landscape in Hesse. It is expected that geographical height is an indicator for natural conditions (Robinson 2004). So, on average regions in cluster I have better natural conditions than those in cluster II and those associated with the poorest natural conditions are in cluster III. The map on the right side of figure 2a shows the allocation of the average total support in the regions from 2000 to 2006 – as they are considered in this study. This first overview seems to show no systematic regional concentration of support - the map is rather variegated. However, as we will see later this high variation is due to the fact that the regions have different structural characteristics in terms of the area of agricultural land and of the average farm size.

Table 2 shows the average support of the three clusters and in Hesse as well as the coefficient of variation between the regions for different measures and for three different indicators. The measures of support are CAP, MPS, DP and HEKUL. The indicators under consideration are the average support per region (PSE), the average support per farm (PSE^N) and the average support per hectare of agricultural land (PSE^A).

Table 2: Average regional support in Hesse (2000-2006)

Transfers	PSE (Mill. €)			
Measure	CAP	MPS	DP	HEKUL
Mean Cluster I	72.77	39.74	31.62	1.41
Cluster II	208.48	112.33	88.53	7.63
Cluster III	135.38	80.31	46.60	8.47
Hesse	416.63	232.38	166.75	17.51
Coefficient of Variation	90.34	101.49	98.19	120.97
Transfers	PSE^N (thousand €)			
Measure	CAP	MPS	DP	HEKUL
Mean Cluster I	16.50	9.00	7.19	0.44
Cluster II	16.47	8.87	7.00	0.62
Cluster III	14.95	8.86	5.15	0.94
Hesse	15.95	8.89	6.39	0.74
Coefficient of Variation	49.11	59.24	69.59	115.96
Transfers	PSE^A (€)			
Measure	CAP	MPS	DP	HEKUL
Mean Cluster I	494.24	269.41	215.28	13.10
Cluster II	551.00	269.86	233.97	20.78
Cluster III	566.87	336.26	216.24	35.61
Hesse	545.03	303.88	218.24	25.19
Coefficient of Variation	35.27	50.91	55.69	106.28

PSE is the arithmetic mean of the regional transfers. PSE^N and PSE^A are weighted arithmetic means. PSE^N is weighted by the number of farms in a region and PSE^A is weighted by the area agricultural land in a region. Hesse indicates the value for all 424 regions. The Coefficient of Variation is given as a percentage measure and calculated in regard to all regions.
Source: Own calculations

In the period 2000 to 2006 Hesse obtained total transfers of 417 million euros per year. 232 million euros came from the MPS and 167 million euros came from the direct payments. A rather smaller part of 17.5 million euros came from the HEKUL. The total transfers are clearly concentrated in cluster II. This is due to the high share of the MPS and the DP which is obtained by this cluster – nearly 50 percent of the support of these two measures are allocated to regions in cluster II. However, one have to bear in mind that cluster II covers much more regions than cluster I and cluster II therefore this quantities are not surprising. For transfers due to HEKUL the picture looks quite different. Almost half of the support of this measure is concentrated in cluster III. Cluster I gets only a rather small part of the transfers

from the HEKUL. So, support from the HEKUL is higher in geographical less favoured regions, this is consistent with the view of the Hessian Ministry of Agriculture (2007).

The transfers per farm are allocated very equally in cluster I and cluster II. In cluster III the transfers from the MPS and the DP are the lowest, this is because of the fact the average farm size in these regions are the lowest as well. In regard to this fact it is remarkable that the per farm transfers from HEKUL are the highest ones in the regions in cluster III. Furthermore, the transfers from HEKUL are much lower in cluster I regions than in cluster II regions. This reflects the fact that HEKUL allocates less transfers to favoured regions like in cluster I and more transfers to disfavoured regions as in cluster III. On a per-farm base the variation of the transfers is much lower than the variation of the overall transfers per region as indicated by the CV for the different measures in table2. With the exception of HEKUL the CVs of all measures dropped substantially.

For the allocation of the transfers per hectare of agricultural land the picture looks differently. While the overall transfers per hectare are the lowest in the regions in cluster I, they are almost 57 euros higher in cluster II and more than 72 euros per hectare in cluster III. Regions in cluster I obtain the lowest support by all the measures per hectare. Cluster II obtains the highest transfers from the DP per hectare but is below the average support by MPS and HEKUL. Regions in cluster III receive more support by the MPS and by HEKUL per hectare than the other regions. The variation of the measures at a per-hectare level is the lowest in the examination of the average support for the period under study.

Figure 2b: Left map: Average total regional support per farm (2000-20006)
Right map: Average total regional support per hectare (2000-2006)
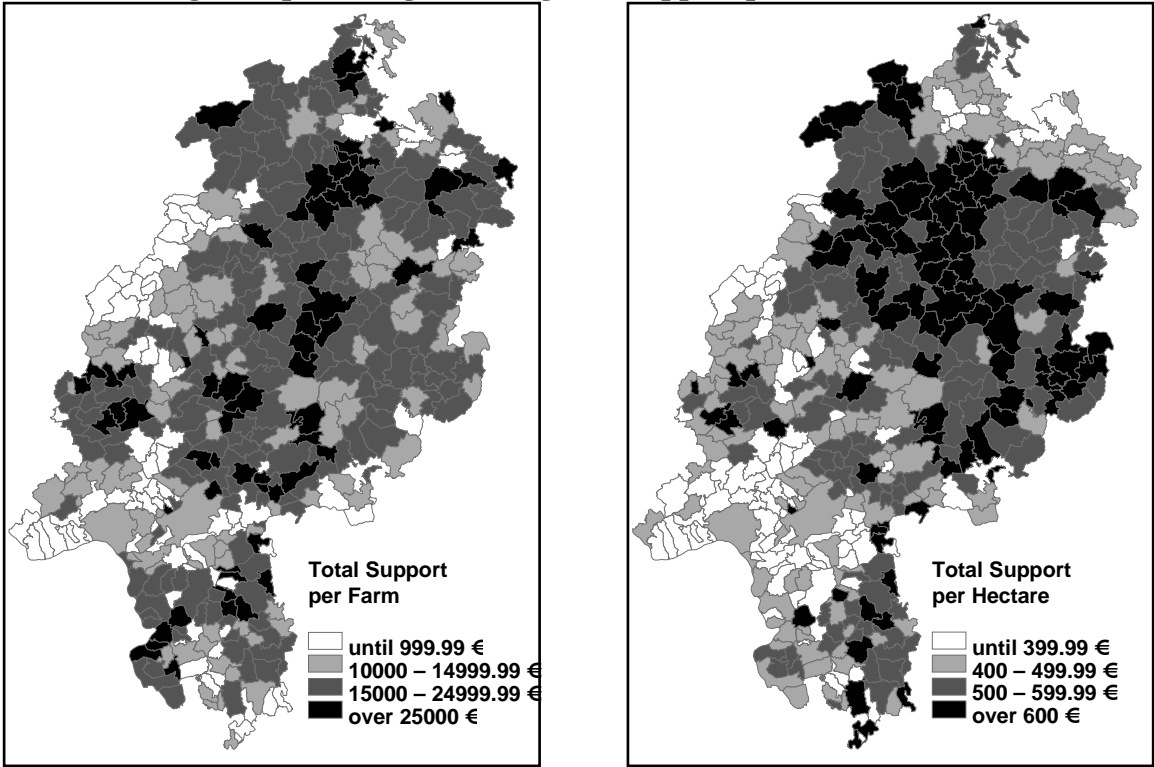
Figure 2b gives an illustration of the allocation of the average total regional support on a per-farm base on the left side and on a per-hectare base on the right side. Transfers on a per-farm base are not geographically concentrated within Hesse. However, there seem to be some peaks in the extent of support (regions obtaining more than 25000 euros per farm) and around these peaks the regions show high transfers per farm as well. The regions with the lowest per farm transfers are located in the west and distributed in the southern part of Hesse. The highest transfers per hectare are concentrated in the northern part of Hesse, where most regions receive more than 500 euros per hectare. Furthermore, the regions which obtain more than 600 euros per hectare are mostly located in the north as well. Like the transfers on per farm base in the regions in the west and the south of Hesse obtain a substantial lower amount of support. The south of Hesse is different to the north as the support per hectare varies by region from under 399.99 euros up to over 600 euros. From this first investigation of the allocation of transfers to the Hessian regions the findings suggest also that the level of support in the regions varies substantially in regard to the indicator used in the examination.

3 Development of the regional support in Hesse

In this section we focus on changes in agricultural support since 2000. The same indicators as in section two are employed to control for development in a time horizon and to control for structural differences in regard to the different geographical conditions of the regions. The latter issue addresses the question how structural different regions are affected by the measures of the European CAP.

While only minor policy reforms took place in the period under study the effect of the increasing agricultural prices is taken into account until the year 2006. The overall development of the transfers is negative. On average each region in Hesse obtained per year 58,000 euros less over the period under examination. This development is statistically

Table 3a: Yearly absolute changes in agricultural support and farmers' revenues in Hesse and the clusters (2000 – 2006)

Development	Transfers (thousand €)			
Measure	**CAP**	**MPS**	**DP**	**HEKUL**
Mean				
Cluster I	-40.91**	-29.87***	-10.96	-0.15
Cluster II	-74.09***	-47.26***	-26.66*	-0.02
Cluster III	-48.71**	-48.19***	-0.59	0.07
Hesse	-58.00***	-42.59***	-15.33*	-0.02
Regional Max	645.74	523.85*	742.62*	48.56*
Regional Min	-830.83*	-723.31*	-645.30	-52.60*

Development	Farmers' Revenues per region (thousand €)				
	Support by				**without**
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	**Support**
Mean					
Cluster I	-4.56	6.48	25.39	44.05*	36.35*
Cluster II	-15.32	11.51	32.11	59.12**	58.77**
Cluster III	13.39	13.91	61.52	62.19*	62.11*
Hesse	-4.69	10.72	37.98**	56.66***	53.31***
Regional Max	1565.20*	1469.64*	1319.91	1215.98*	1220.17*
Regional Min	-1410.16*	-1451.72*	-1933.89*	-1642.32*	-1652.02*

***, (**), (*) indicates statistical significance with a level of 99 %, (95 %), (90 %).
Source: Own calculation

significant and essentially caused by the reduction of the MPS. In contrast farmers' revenues in the scenario with no support increased on average in the same time by 53,310 euros per region and year. From table 3a it can be seen that the reduction of support is different for the

regions under consideration. Regions in cluster I obtained the lowest reduction if all transfers are summed. Regions in cluster II had to face the biggest reduction in view of the overall support - namely 74,090 euros per region and year. The MPS contributed the biggest part of the reduction in agricultural transfers in Hesse, more than 42,000 euros on average. Interestingly, the DP vary much more in regard to natural conditions as the MPS or the HEKUL[6]. The difference between Cluster III, where regions only lost 590 euros DP per region, and Cluster II is about 25,000 euros. The transfers from HEKUL only changed very little. However, it is worth noting that transfers increased in cluster III and decreased in the other ones.

In the same time farmers' revenues developed in the opposite direction. On average the revenues at world market prices increased yearly by 53,310 euros per region – so that an overall reduction in farm revenues with support of the considered measures of 4,690 euros per region and year remain. Regions in cluster I also obtained the smallest increase in the farmers' revenues with 36,350 euros. This development is statistically significant at least at the 90 % level. Table 3a indicates that the regions considered to have the worst naturally conditions have increased there revenues much more than the region in cluster I, which were seen to be favoured.

The comparison of the actual situation with a situation with no policy support controls for the effect that is generated by the CAP and the single measures. Table 3a indicates that the overall impact of the development of the support is negative for the period under study. Without any forms of support farmer's revenues would have developed in much more positive way as they did with support. The effects hold true for all policy measures with the exception of the HEKUL.

Table 3b: Yearly absolute changes in agricultural support and farmers' revenues in Hesse and the clusters on per farm base (2000 – 2006)

Development	Transfers (€)			
Measure	**CAP**	**MPS**	**DP**	**HEKUL**
Mean				
Cluster I	-965.63**	-786.83***	-171.84	-8.17
Cluster II	-1078.43***	-752.23***	-304.49	-11.75
Cluster III	-575.99**	-587.07***	13.31	-2.22
Hesse	-913.78***	-718.39***	-183.00	-8.16
Regional Max	9115.98	4361.71	8827.89	1769.50
Regional Min	-11499.50	-5905.92	-9205.96	-1965.50

Development	Farmers' Revenues per farm(€)				
	Support by				**without**
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	**Support**
Mean					
Cluster I	1.86	180.66	795.65	1074.45**	967.49**
Cluster II	-124.46	201.74	649.48*	927.70***	953.97***
Cluster III	187.78	176.70	777.08*	749.03**	763.77**
Hesse	-6.23	189.16	724.56**	908.09***	907.56***
Regional Max	17714.21	13088.40	16384.50	10694.94	10750.03
Regional Min	-12663.83	-11737.06	-13237.06	-8252.84	-8301.63

***, (**), (*) indicates statistical significance with a level of 99 %, (95 %), (90 %).
Source: Own calculation

On a per-farm base the development of the support measures is negative as well. Support to farmers on per farm base decreased on average by 914 euros each year. The MPS contributed the major part of this reduction with 718 euros per farm. These developments are

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[6] It has to be borne in mind that for the examination of the development of HEKUL and the revenues supported by HEKUL only those regions are included which received support of HEKUL. So for cluster I 84 regions are considered, for cluster II 184 regions and for cluster III 111 regions.

statistically significant as indicated in table 3b. The transfers from the DP and the HEKUL decreased as well. However, the development for the clusters is twofold. Farms in cluster I and II had to face a reduction of support of around 1,000 euros. In contrast farms in cluster III only obtained a loss of support of 576 euros. Interestingly the MPS to farms in cluster III reduced by 587 euros but in contrast the DP increased by an annual amount of 13 euros. This is remarkable because the DP in cluster II and I decreased by 304 and 172 euros per farm. The farm revenues increased by 907 euros on average, this increase is higher for regions in cluster I and II and lower for the cluster III. The overall development of the revenues supported by the CAP is a reduction of 6 euros per farm. While farms in cluster II regions obtained 124 euros less per year, farms in cluster I regions obtained nearly no change and farms in cluster III regions obtained 188 euros more each year. So the development per farm is quite different for the three clusters considered in this examination.

Table 3c: Yearly absolute changes in agricultural support and farmers' revenues in Hesse and the clusters on per hectare base (2000 – 2006)

Development	Transfers (€)					
Measure	**CAP**	**MPS**	**DP**	**HEKUL**		
Mean						
Cluster I	-29.84***	-20.87***	-8.68	-0.30		
Cluster II	-33.81***	-22.64***	-10.61*	-0.26		
Cluster III	-21.53**	-20.44***	-1.06	-0.03		
Hesse	-29.44***	-21.56***	-7.54*	-0.20		
Regional Max	838.08	239.41	935.49	111.30		
Regional Min	-829.20	-445.52	-700.31	-113.25		
Development	Farmers' Revenues per hectare(€)					
	Support by				**without**	
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	**Support**	
Mean						
Cluster I	-4.82	4.15	16.34	27.53**	25.03**	
Cluster II	-8.27	2.89	14.93	24.82***	25.54***	
Cluster III	3.09	4.18	23.56*	24.29**	24.62**	
Hesse	-4.29	3.59	17.61**	25.27***	25.15***	
Regional Max	1291.87	905.23	1389.29	748.99	751.57	
Regional Min	-777.32	-894.19	-891.60	-505.92	-507.15	

***, (**), (*) indicates statistical significance with a level of 99 %, (95 %), (90 %).
Source: Own calculation

At per hectare base support has decreased by 29 euros per year. The major part of this reduction is caused by the reduction of MPS of 21.56 euros and the reduction of DP of 7.54 euros. On average all measures of support increased on per hectare base in Hesse and in all clusters in the period under study. The results in table 3c indicate that this reduction again has to be separated for regions with a different geographical location. The development was much more emphasised in cluster I and II regions as in the regions of cluster III. While the decrease in the MPS affects all regions more equally – the reduction of the DP per hectare causes the overall difference in the development of support. In contrast to the more scattered reduction in the support the revenues increased clearly about 25.15 euros each year per hectare. The overall development of farmers' revenues per hectare is negative with 4.29 euros per year. This impact varies with the geographical location of the region and is due to reduction of the DP. However, in regions in cluster II the decrease per hectare is 8.27, in regions in cluster I the decrease per hectare is 4.82 and in regions in cluster III there was an increase of 3.09 euros per hectare agricultural land.

The findings in this section indicate that in Hesse the support of agriculture has decreased over the last 7 years. This result is the same for all three considered indicators – the farmers' revenues per region, per farm and per hectare agricultural land. If the geographical

location is taken into account, there is clear evidence that regions are affected in a different way. Regions in cluster II lose much more support than those of cluster III. In contrast to the support the farmers' revenues without any transfers increased for all regions and all clusters. The overall effect of the reduction in support and the increase in revenues is negative for Hesse. In the clusters the picture differs a little in cluster I and especially in cluster II, where the overall effect is negative. In regions in cluster III the overall effect is positive for all indicators. That means that in regions with a geographical favoured location farmers' revenues had developed negative under the support of the CAP, while in disfavoured regions it has not.

4 Instability of farmers' revenues and the impact of EU's CAP

During the last decades farmers in the EU had to face uncertainty from the markets for agricultural products in a minor way. They were only partly affected by changes in world market prices as there was a substantial protection by the different policy measures – in international comparisons this is undoubtedly the case (OECD 2007). However, the extent of the stabilisation generated by the European policy measures is the objective of this section.

The methodology for this investigation is to calculate the variation in the support measures and the farmers' revenues for the period 2000-2006 on the basis of the coefficient of variation (CV). To control for possible trends in time, the method proposed by Cuddy and Della Valle (1978) is applied as in several other studies (Anders et al. 2004, Harsche 2007). The Cuddy and Della Valle Index (I) is:

$$I = CV \sqrt{1 - \overline{R}^2} \qquad (2)$$

$\overline{R}^2$ is the corrected goodness of fit of a time trend:

$$Measure = \beta_0 + \beta_t + \varepsilon \qquad (3)$$

The Cuddy and Della Valle index is used instead of the CV if the time trend is significant at the 5 % level. The trend (β_t) is calculated for a linear and a log-linear model. If both trends were significant the F-value for the model was used as criteria to choose. Table 4a

Table 4a: Intertemporal CV (in percentage) for agricultural policy measures and farmers' revenues in the regions (2000-2006)

Instability	Transfers per region(€)			
Measure	**CAP**	**MPS**	**DP**	**HEKUL**
Mean				
Cluster I	27.66	36.91	49.63	36.95
Cluster II	18.11	19.61	37.47	26.42
Cluster III	9.43	21.01	40.02	19.93
Hesse	20.05	24.90	41.57	26.58
Regional Max	98.79	136.70	87.51	117.53
Regional Min	4.05	4.53	0.36	2.75

Instability	Farmers' Revenues per region (€)				
	Support by				**without**
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	**Support**
Mean					
Cluster I	13.84	7.97	17.14	12.36	11.75
Cluster II	9.58	7.41	14.07	10.91	11.56
Cluster III	9.45	7.56	16.48	12.05	13.14
Hesse	10.75	7.61	15.58	11.54	12.03
Regional Max	81.88	48.17	64.44	93.52	31.04
Regional Min	2.21	2.11	6.02	5.28	7.02

Source: Own calculation

shows the level of stabilisation generated by the different policy measures on a regional base for the period from 2000 to 2006.

The instability index for the overall agricultural transfers at a regional level is 20.66 %. While the index is little higher for support form the MPS and the HEKUL the index more than doubles for support from the DP, with 41.57 %. Within the different clusters there are substantial differences for the instability index. The findings in Table 4a indicate that the more favoured regions have a higher instability in support. This holds true for a comparison between cluster I and III for all three single measures of support and the summed transfers. Also, it holds true for a comparison between all three clusters for the transfers from HEKUL and the summed transfers.

Since the objective of this chapter was to evaluate how the single measures and the overall support from the CAP contribute to the stabilisation of farmers' revenues the lower part of table 4a is the more important one. The results indicate that first of all the summed transfers contribute to a stabilisation of farmers' revenues at the regional level. The instability index decreased from 12.03% to 10.75% for Hesse. A second result is that the lowest instability index referring to the highest degree of stabilisation is generated by the MPS – with 7.61%. This finding is consistent with Harsche (2006) but in opposition with Love et al. (1997). The results lead to the conclusion that the MPS alone generates a higher stabilisation than the sum of all support. While the DP increased the instability in revenues the HEKUL generated a stabilisation effect for regions in cluster II and III. The findings vary in regard to the geographical location. So the regions in cluster I always face more instability when any kind of policy measure is considered than the regions in cluster III. In regions in cluster I there is no stabilising effect of the CAP and the index is higher in the situation under the CAP than without any support. Interestingly, the cluster III regions have the highest instability in revenues if there would not be any policy support. If only the MPS or the DP are considered regions in cluster II are the regions which receive the highest degree of stabilisation.

Table 4b: Intertemporal CV (in percentage) for agricultural policy measures and farmers' revenues on a per-farm base (2000-2006)

Instability	Transfers per farm(€)			
Measure	**CAP**	**MPS**	**DP**	**HEKUL**
Mean				
Cluster I	26.43	34.20	49.44	37.58
Cluster II	15.33	16.04	37.45	28.28
Cluster III	14.14	17.81	41.23	22.17
Hesse	13.48	21.50	41.95	28.24
Regional Max	102.03	145.22	93.02	110.11
Regional Min	3.63	3.51	5.67	5.24

Instability	Farmers' Revenues per farm (€)				
	support by				**without**
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	**support**
Mean					
Cluster I	16.71	11.39	20.66	16.24	16.23
Cluster II	11.73	10.01	17.30	14.91	15.44
Cluster III	12.40	10.07	20.28	16.01	16.68
Hesse	13.36	10.37	18.95	15.53	15.74
Regional Max	99.26	50.65	66.89	57.61	43.02
Regional Min	3.65	3.11	7.61	7.86	7.94

Source: Own calculation

At the per-farm level the instability index is 13.48% for the CAP in Hesse, as indicated in table 4b. This is much lower than the instability on per region examination. Again, the transfers from the MPS are much more stable across regions as the support of the DP and the

support of the HEKUL. Farms in cluster I obtained the most unstable support in regard to the other clusters.

The stabilisation effect generated by the policy support per farm is larger than in the examination at the regional level, with 13.36%. The instability of revenues per farm without support is higher than on the regional base and even not so scattered – on average the index is 15.74%. Again, the stabilisation of revenues generated by the MPS is the highest and the DP could not generate a stabilisation at all. In contrast the support of the DP leads to more unstable revenues. The picture for the clusters differs from the overall results. Regions in cluster I face the highest instability of all clusters for revenues supported by the different measures. The instability for revenues supported by the CAP is the lowest in regions in cluster II. The regions also have a lower instability for all the different scenarios of support.

Table 4c: Intertemporal CV (in percentage) for agricultural policy measures and farmers' revenues on a per-hectare base (2000-2006)

Instability	Transfers per hectare(€)				
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	
Mean					
Cluster I	27.47	45.40	49.80	36.75	
Cluster II	17.44	18.78	37.76	26.60	
Cluster III	15.21	20.39	39.91	20.09	
Hesse	19.74	26.71	41.74	26.68	
Regional Max	98.19	228.46	87.72	115.25	
Regional Min	4.32	2.53	3.41	3.61	
Instability	Farmers' Revenues per hectare (€)				
	Support by				**without**
Measure	**CAP**	**MPS**	**DP**	**HEKUL**	**Support**
Mean					
Cluster I	13.91	7.98	17.13	12.21	11.63
Cluster II	9.73	7.69	14.34	11.18	11.85
Cluster III	9.45	7.33	16.45	11.97	12.96
Hesse	10.84	7.68	15.69	11.62	12.08
Regional Max	81.88	48.47	64.73	93.52	31.95
Regional Min	2.68	2.00	6.12	5.55	5.69

Source: Own calculation

At a per-hectare base the instability in the support measures is the highest in the transfer of the DP with 41.74% on average. Again, the instability in the transfers of the CAP is smaller than those of the MPS or the HEKUL. Regions in cluster I face the highest instability in the overall support per hectare and in all single support measures.

The overall stabilisation effect of the CAP on farmers' revenues is that the instability index decreases from 12.08% to 10.84%. A remarkable comparison is that if only HEKUL is considered as measure of support to revenues the instability index is 11.62%. Like for the two former indicators on per hectare base the stabilisation generated by the MPS is even higher than the effect of the CAP. This implies that farmers' revenues would have been more stable in the scenario where MPS would be the only measure of support as they were under the CAP. Results from table 4c indicate that in all scenarios regions from cluster II and cluster III have a lower instability than regions from cluster I. This finding especially holds true if HEKUL is the only considered measure to stabilise revenues. For all three analysed indicators there is no stabilising effect from HEKUL for the revenues in regions in cluster I but in cluster II and III.

The overall findings from this section are that the DP is the most unstable measure of support on average and in all clusters – meaning for regions with a different geographical location. This is corresponding with the low level of stabilisation generated by the DP, because revenues supported by the DP in all three examinations in this section have the

highest index of instability. The HEKUL generated on average a stabilisation effect for farmers' revenues. The MPS generated the highest stabilisation effect on revenues – even higher than the effect of the overall CAP. This result is valid for all indicators and it is valid for the different clusters. There is no stabilisation effect generated by the CAP in cluster I regions. In addition, results indicate that differences occur in regard to the employed indicator. This is consistent with findings of former studies (Love et al. 1997, Anders et al. 2004; Harsche 2006).

5 Conclusion

In this paper we show that agricultural support in Hesse varies in regard to the location of the regions under study and in regard to the indicator used. Besides, we find clear evidence that agricultural transfers reduced on average over the period from 2000 to 2006 by 58,000 euros per year. In contrast farmers' revenues at world market prices increased by nearly the loss of the support. These findings were significant for all three types of regions and all three indicators employed in this study. All single measures decreased on average and in the clusters as well, with the exception of cluster III – the regions with the highest altitude. These regions obtained an increase in the support of HEKUL per region and in the support of DP per farm.

We furthermore investigated the instability index of the measures of support and their stabilisation effect on farmers' revenues. We find that the regions in cluster I, associated with the best natural conditions, faces the most unstable support as well as the most unstable revenues with the different scenarios of protection. In cluster III regions we found the highest stabilisation – the largest decrease in the instability index – if the situation with no support is compared to the situation under the CAP.

The major conclusions drawn from this study are that first of all the EU's CAP contributes to the stabilisation of farmers' revenues. Secondly, the extent of stabilisation varies in regard to different geographical locations of the regions in Hesse where support for 424 regions at the community level were examined. Thirdly, while the HEKUL, a second-pillar program, and the MPS stabilise farmers revenues, the DP do not. The latter of this findings is valid for all considered indicators and all three clusters.

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