RAALSA

A Regionalised Agricultural Sector Model for Estimation of Structural Change in the Austrian Alps

Diskussionspapier Nr. 89a-W-2002

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Mai 2002

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Abstract

In the course of the research project RAALSA we tried to develop a concept for a sector model, which could simulate income-effects of price changes or political measures both on the farm level and the regional level, and estimate structural change endogenously. The concept was then applied for the territory of the Austrian Alps. The model is based on typical farms and weight-vectors which create a virtual farm structure. This virtual farm structure is supposed to give a good representation of the actual farm structure in the territory. By linear programs we calculate the incomes of the typical farms, and from incomes we derive changes in the weight-vectors by implementing the results of an inquiry. Changed weight-vectors finally allow us to make some statements on structural changes.

1 Introduction

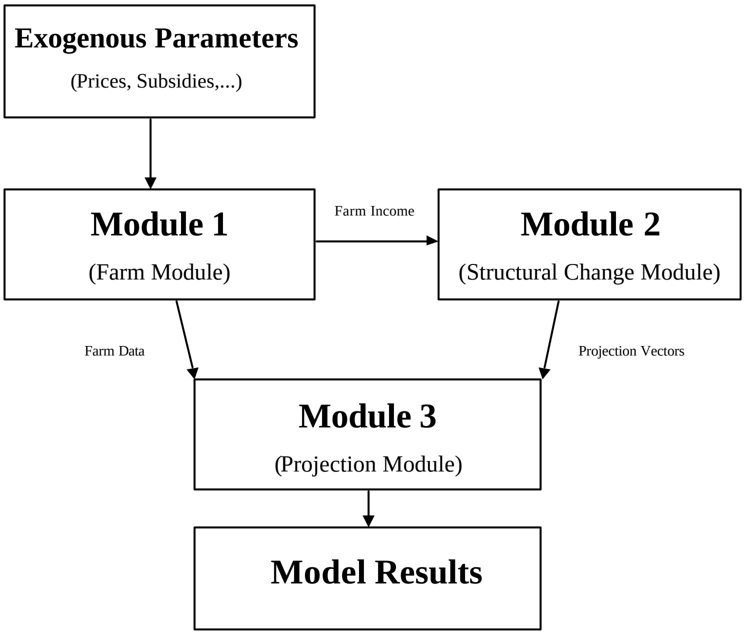
At the latest since the reform of the GAP in 1992 the main emphasis of the agricultural policy has shifted from price and quantity supports towards direct payments. At this production targets no longer exclusively are in the foreground but increasingly structural and environmental objectives like the preservation of a sustainable and full-coverage agriculture gain importance. In connection with the forthcoming eastern expansion of the European union and the coming WTO negotiations this trend will continue. In order to be able to assess the effects of new political instruments or changed basic conditions on agricultural structure and the environment, however, we need regional policy information systems, which depict decision processes already at the farm level. Most available sector models, however, weren't designed for this purpose, and are therefore highly aggregated, short-term- and product quantity orientated in first line. They are therefore neither suitable to simulate the effects of political measures on the farm or regional level, neither to predict changes in the farm or production structure. It was aim of this project to develop a model concept which could help to clear this deficit. Beyond this, the concept should be applied to the example region of the Austrian Alps in a first step. In later projects the model could also be extended to other Austrian regions, however. As a data base we used the farm data of the agricultural census (ÖSTAT, 1999), the INVEKOS data set (INVEKOS, 1999), the farm panel data of the farm accountancy network (LBG, 1999), as well as the actual calculation schedules for farmers (BMLUW, 1999a and 1999b).

2 Model Concept

The model is designed in a rather simple way and is formed by three modules: a farm module (module 1), a structural change module (module 2) and a projection module (module 3). With typical farms and weight vectors (regional weights of those typical farms) the model first depicts the farm structure of eleven alpine regions approximately. The farm module then works with mathematical programming models for all typical farms, which maximise gross margins for given prices, endowments and income supports. For a certain set of exogenous prices and subsidy conditions module 1, therefore, produces a vector of gross margins. In the next step, modules 1 and 2 are connected by deriving the change of weight vectors in module 2 from the vector of gross margins received from module 1. This connection is based on an inquiry of 384 farmers, who were asked about their income expectations and long-term plans.

The result of module 2 is a new regional distribution of typical farms, or in other words, a new weight vector for each region. Finally, module 3 aggregates the data of single farms to the regional and national level via those weight vectors. Information about production, land use and factor use of module 1 can so be connected with information about a changed regional farm structure of module 2. Beyond this, qualitative estimates about structural developments, like the change of farm size structure, process choice (Extensive or intensive production) or pluriactivity, are possible. The basic structure of the model is illustrated in illustration 2.1.

Illustration 2.1: Model structure



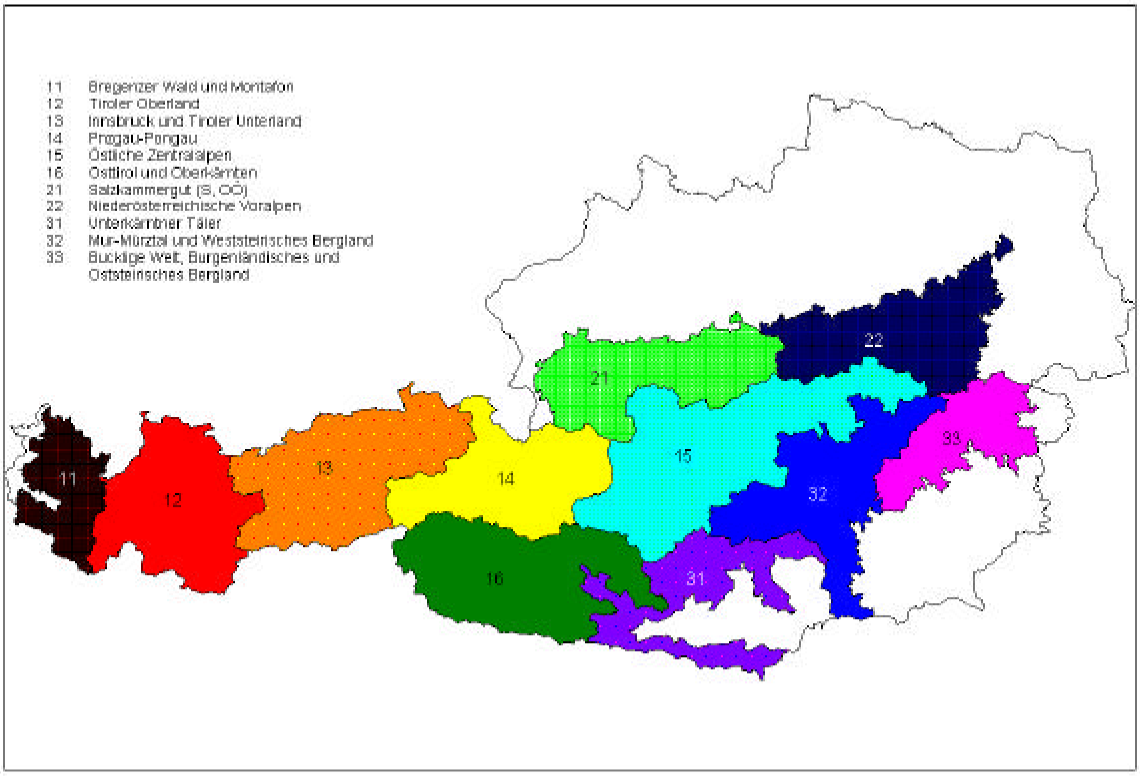
This model concept is different from other sector models in two essential points:

1. Decisions are not modelled at the level of a group farm but at the level of single farms, and the farm models in module 1 are calculated one by one and independently. The information exchange between the farms is depicted in module 2 and changes within farms are projected onto the regions in module 3.
2. The model doesn't show any markets and therefore works with exogenous prices. Therefore, as well, information exchange between farms isn't carried out via classical markets but via a probability distribution of farm decisions (Markov process).

3 Regions and Farm Types

As study area we have chosen the Austrian Alpine region. This includes the following three of eight Austrian agricultural production areas: Zentralalpen, Voralpen and Alpenostrand. Moreover, this area has further been subdivided in eleven sub regions on the base of production similarities, which is shown in Map 3.1.

Map 3.1



All farms in those 11 regions, which were included in the agricultural census 1999, serve as a basis for the model. Altogether this amounts to 80.229 farms, which corresponds to a share of 37% of all farms and 46% of agricultural land in Austria. In order to create the virtual farm structure, 2.566 *farm types* were formed, differentiated by region (11), production emphasis (18), production handicap (3), full-or part-time-farming (3), production method (2)[1] and farm size (7). For example the farm type 13_FUMI_1_B_HE_30-50ha includes all Fodder Growing Farms with emphasis on milk production in region 11, production handicap zone 1[2],

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1 conventional and biological farm management

2 In the model handicap zone 1 corresponds to handicap zones 1 and 2 in the Austrian “Berghöfekataster”, handicap zone 2 corresponds to handicap zones 3 and 4.

bio-production, full time farming[3] and a cultivated area (agricultural land and forest) between 30 and 50 hectares. According to the regional choice the main production emphasis is put on milk, cattle and wood.

In the model the farm types are represented by *typical farms*. Those were determined by first creating the average farm for each farm type, and then choosing the most similar existing farm to this artificial average farm as a representative. The farm equipment (land, cattle, milk quotas tourist beds etc.), served as criterion for similarity. For the weight of a farm type within the region (the corresponding element in the weight vector) we used the absolute frequency of the farm type in the base period according to agricultural statistics. If, for example, 25 dairy farms in handicap zone 1, emphasis on part-time-farming, bio-production with 30-50 hectares of cultivated land were observed in region 11 in the base-period, then the typical farm of this farm type has a weight factor of 25 in the base period.

4 Farm Models (Module 1)

The economic behaviour of the 2.566 typical farms has been modelled by linear programs in GAMS (General Algebraic Modelling system). The models maximise farm gross margins at given factor endowments, and reflect the short-term decisions of farmers, who can choose among different products, production processes (e.g.: hay or Silage), production intensities, crop rotations, feed stuff and subsidy options. Moreover, farms with a conventional production method can choose among two levels of intensity, corresponding to several measures within the ÖPUL program. Factor endowments contain land, stable places, usufructs, milk quotas, tourist beds, as well as own and hired workers, while, depending on the endowment, the models offer from few hundreds to several thousand production options in order to react on changes of prices, costs, subsidies or other relevant policy measures. Production costs and –revenues are differentiated by production method, production intensity and production handicap. Finally, the farm models consider both the internal delivery of different production branches (e.g. the delivery of feed stuff or manure) and the acquisition of inputs.

3 Part-time farming means that more than 50% of working time of the farmer couple is spent within the farm

Coefficients have been derived from different sources: So, factor endowment, handicap zone and production method of each typical farm has been determined exogenously on the base of agricultural census data (ÖSTAT, 1999) and the INVEKOS data set (INVEKOS, 1999). Production costs and –revenues were mainly calculated on the base of standard gross margins (BMLF, 1999a and 1999b), while other coefficients, which are necessary for balance equations (e.g.: food and fertiliser balances), are derived from various data and information sources (BMLFUW 2000). Finally, some technical coefficients are calculated endogenously by the model (e.g. milk output).

As already mentioned, the linear programs shall give a good representation of a short-term decision situation of farmers. Since stable places are part of factor endowments they are exogenous to module 1, and so the switch options among different animal types is limited within the linear programs. However, changes in animal production are considered via the change of weight vectors in module 2. In contrast, farms with crops can choose among 17 field crops, either for sale or feeding. The fodder rations are individually adapted to the nutrient need of single animal species, while certain proportions (e.g.: hay, Silage, concentrated feed stuff etc.) cannot be exceeded or remained under. The single concentrated feed stuff mixtures are determined endogenously by the model in order to be able to react to changes in prices or costs. Finally, wood production is calculated with the typical regional composition among beech, spruce and pine-tree, and fruit production among apple, plum, cherry and elder.

A further main emphasis is the modelling of different support systems. Besides the crop premiums and animal premiums the new system of mountain-farm-supports as well as a variety of ÖPUL2000-measures are represented in the model. All possible specific options of both single measures and measure combinations are considered as well as partial or total participation.

Finally, it should be emphasised that the farm module not only delivers information about the gross margins of the farm types, which among other things serve as a decision criterion for the modelling of structural change, but conclusions also can be drawn on internal changes at the farms.

5 *Modelling of Structural Change (Module 2)*

Changes of the farm structure are determined recursively in the model. Therefore, we do not determine a long run optimal farm size, but the changed structure is deduced from the structure of a base year via a Markov process. Beyond this, structural change is exclusively modelled by a change of the weight vectors. A farm in the model, therefore, cannot purchase areas or quotas flexibly, but can merely change over to another farm type (resp. typical farm) and must purchase the equipment. For example, in case a farm type has a weight factor of 25 at the base date, then we can expect that part of those 25 farms will have terminated farming at the forecast date, part of them will have changed production methods or endowments (change the farm type in the model), and part of them will continue farming without substantial changes. The objective of the structural change module is to derive changes of the weight vectors for all 11 regions and for three time intervals (5 years, 10 years, 20 years) from those income data, which have been calculated in module 1.

Be

$$\mathbf{s_{to}} \in \Re^{M}$$

the weight vector for the base period t_0, then we search a transformation matrix

$$\mathbf{D} \in \Re^{M} X \Re^{M}$$

so that

$$\mathbf{s_{t1}} = \mathbf{D'} \mathbf{s_{to}}$$

M = number of the farm types
s_m = weighting factor farm type m
d_{mn} = probability that farm type m changes to farm type n
In order to find the matrix D, two questions have to be answered for each of the 2.566 farm types: Firstly, by which probability the farmer will terminate his farming activities during the investigation period? This question refers to the diagonal elements d_{mm} of the matrix D; secondly, farms will develop in which direction, if they continue farming, or in other words, to which farm types they will switch over? This question refers to the non-diagonal elements d_{mn}. In order to receive information about these questions interviews of 384 farms have been carried out in the study area (see to this: Chapter 6).

In the model, the probability of a typical farm to terminate farming is estimated via its gross margin and the average age of those farmers, who are represented by the typical farm; in order to get the necessary information for the estimation, we derived a log-linear regression from the inquiry data (see Chapter 6) between age and gross margin on the one hand and the supposed exit probability on the other hand, and used the coefficients for the model (assumption: $d_{mm} = p(y_m)$).

The determination of the probability to switch from one farm type m to another one n (d_{mn}) is derived under the following premises:

Firstly, we assume that rearrangements of farms are carried out stochastically and therefore not all farms develop in the same direction. This assumption is incorporated in the model by a positive correlation between the probability to switch and income changes[4].

Secondly, we assume a path dependence submitted to the development, this is said farms only can switch over to such farm types whose endowments do not deviate too much from their own ones. So, a farm with 10 hectares of cultivated area, for example, cannot switch over to a 50 hectares farm type.

Thirdly, we assume that the regional endowments with land, quotas etc. represent an upper barrier for rearrangements. For a switch of smaller to larger farm types, therefore, only those endowments are at disposal, which become free due to the closure of other farms (exit quotas) and the switch of larger farms to smaller farm types (e.g due to the change from full-time to part-time farming). This restriction holds within every region and in case of areas also within each handicap zone.

Finally, the switches are restricted by the results of the inquiry. The probability to switch therefore mustn't be higher than the share of the farmers who indicate to plan a substantial rearrangement of farming in the medium run in the context of the interviews. Moreover, if e.g. only 10% of the full-time farmers indicate a planned switch to part-time farming in the

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[4] Income changes in case of a switch from one farm type to another one consider both gross margins and incomes from non-farm activities as well as the rearrangement costs. Rearrangement costs are deduced from fixed costs, and fixed costs were calculated in the following way: for buildings they were derived from livestock, for machines from the areas and for guest rooms from the number of beds. The rearrangement costs in the model, however, are not simply determined as the differences of the fixed costs, but take into account really possible sales proceeds and sunk-costs.

interviews, this percentage serves as well as an upper limit for this kind of switches in the model.

So, in mathematical terms module 2 works in the following way: via a linear program we search for a matrix D for each region which leads to the maximum regional total farm income under the mentioned restrictions. The method is demonstrated in the subsequent diagram in a simplified way.

Form matrix **A**

$\mathbf{u_{mn}} := (y_n - y_m - c_{mn})/\text{distance-factor}_{mn}$
$\mathbf{a_{mn}} := \mathbf{u_{mn}}$ if $\mathbf{u_{mn}} > 0$
$\mathbf{a_{mn}} := 0$ if $\mathbf{u_{mn}} < 0$

Search $\mathbf{x}, \mathbf{z} \in \Re^M$

So that: $\mathbf{d_{mn}} := (\mathbf{x_m} + \mathbf{z_n}) * \mathbf{a_{mn}}$
Regional agricultural income=max
s.t.c.:
- regional endowment constraints are met
- switch share of the inquiry is not exceeded

The programming of module 2 was carried out by means of VISUAL BASIC FOR APPLICATIONS on the base of EXCEL and under use of the PREMIUM SOLVER PLUS (Frontline systems).

6 Inquiry

The aim of the inquiry was to produce a coherence between income and the probability to terminate farming for 3 time intervals (5 years, 10 years, 20 years). Moreover, we tried to receive information about planned changes within the farms.

In the first part of the questionnaire we asked for the continuance of farming activities that is we asked when the farmer planned to terminate his farming activities and whether a successor existed. The second part deals with planned changes at the farm, and, finally, in the last part we asked for income relevant data. Since farmers tend to be rather unwilling to answer questions of income, which therefore would represent an uncertainty factor in the inquiry, we have chosen a double strategy. On the one hand, farmers were asked to assign their farms to an income group, on the other hand the anonymous questionnaires were connected with data from the INVEKOS data set (supports, livestock, quotas etc.), in order to be able to determine incomes also indirectly.

The parent population for the interviews contains 59204 farms, which corresponds to the number of farms in the INVEKOS data base. The sample contains 384 farms. To get a sufficiently large number of farms for each income class, we didn't chose a representative sample. In contrast, we decided to chose the farms according to criteria which are supposed to correlate with income. We used cultivated land, handicap zone and the share of non-farm activities in terms of working time. Beyond this the sample is representative with regard to the regional distribution.

The following problems must be taken into account for the interpretation of the results. The time horizon of the model on the one hand is relatively long (5-20 years). Therefore, answers must be treated with caution, especially if farms are handed over to a successor within the investigation period. On the other hand information can merely be given about planned changes; to what extent those plans can actually be realised, is unclear at the time of the interviews (availability of additional land, quotas etc.). It has to be expected therefore, that the results of the inquiry will underestimate the exit quota of farms, whereas it will overestimate the changes on farms. Beyond this the estimated incomes are only rough estimates, since great income differences between individual farms, even with similar endowments, are usual.

Since the actual exit quotas of the interviewed farms is unknown, they had to be estimated. From the questionnaires we know the time when the farmers plan the termination of farming activities. Beyond this we asked for the farm successors and offered 5 answer possibilities to be chosen: Will the court be overtaken by a successor? yes; rather yes; uncertain; rather no; no. Those answer possibilities we assigned numbers between 0 and 1 as rough estimate (0;0.25;0.5;0.75;1). Finally, those estimated probabilities of exit were used as dependent variables in a log-linear regression. As independent variables we have chosen the age of the farmers as well as the gross margins.

Table 6.1: Regression (LOG(Gross margin), age; probability of exit after 5 years)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.326	0.143	2.284	0.023
LOG(GESAMTDB)	-0.029	0.010	-2.9	0.004
ALTERB	0.002	0.001	2.378	0.018
R-squared	0.046	Mean dependent var		0.05
Adjusted R-squared	0.041	S.D. dependent var		0.178
S.E. of regression	0.174	Akaike info criterion		-0.648
Sum squared resid	10.786	Schwarz criterion		-0.615
Log likelihood	118.922	F-statistic		8.574
Durbin-Watson stat	2.064	Prob(F-statistic)		0.0002

The above table shows the results of the regression for a 5-year time horizon. The correlation is confirmed with more than 95% and therefore highly significant. The share of the variance which can be explained with the used independent variables is however 4.6% and therefore rather modest. Significant correlation with other variables such as the share of unemployment or the share of non-farm activities could not be found.

7 Simulation Results

In the context of the project some policy scenarios were simulated in order to illustrate possible application areas of the model:

Base scenario: Average Prices; Current support system
Scenario 1: Price reduction(-10%) milk and beef
Scenario 2: Price reduction(-20%) milk and beef
Scenario 3: Price reduction(-30%) milk and beef
Scenario 4: Reduction of land and animal premiums (-10%)
Scenario 5: Increase of land and animal premiums (+10%)
Scenario 6: Substitution of animal premiums by a grassland premium
Scenario 7: Increase of the ÖPUL measure "biological farming" (+50%)
Scenario 8: Old system of mountain-farming-subsidies

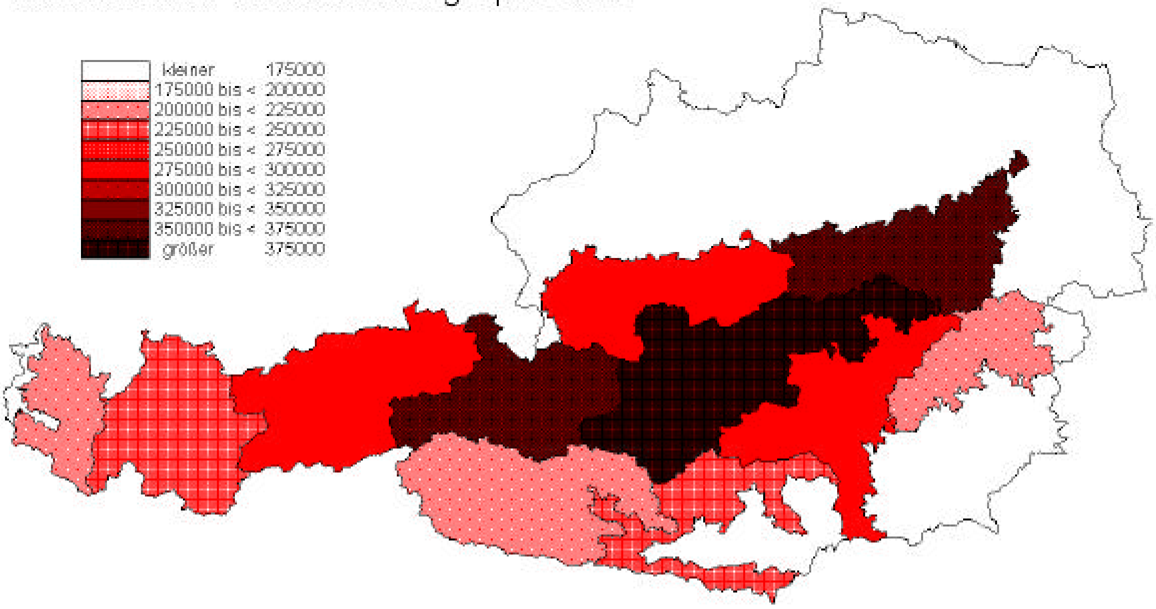
For the base scenario we used the prices of the latest available calculation schedules (BMLF, 1999a and 1999b) and the premiums of the current support system (September 2001). The new system of mountain-farm-subsidies is therefore already integrated into the model. The grassland premium of scenario 6 amounts to 2000 ATS per hectare of standardised agriculturally productive land (RLN) without alpine pasture areas and only for a maximum cattle density of less than 2 GVE/haRLN.

Map 7.1 shows the average total gross margin per farm for the base scenario for the various regions. We can see that the highest gross margins can be found between the regions 14 and 22, which is due to high forest shares and higher shares of larger farms in those regions. In contrast, the lowest gross margins are obtained by farms in the regions 11, 16 and 33. Map 7.2 shows the share of the farm sizes (0-20 hectares, 20-50 hectares, > 50 hectares), while map 7.3 depicts the share of different farm branches (agriculture, forestry, tourism, governmental supports) in terms of the regional agricultural income. Large-scale farms hold the highest share in region 15 and the lowest share in region 11, while small farms hold the highest in region 13 (65%), compared to low 12% in region 15. Forestry is the most essential income source in most regions, followed by farming and public supports. The least contribution of forestry can be found in those regions, which also hold the lowest average gross margins per farm, that is in the outermost east and in the outermost west of Austria. Map 7.4 shows the average gross margins per farm according to different farming emphasises[5]. It can be seen, that the high average gross margins in regions 14, 15 and 22 are caused by pure wood producers and farms with high shares in forestry in first line. In contrast, small farms particularly cause sub-average gross margins for all farm emphasises in the regions 11 and 12.

[5] In the map FUMI lines up farms with emphasis on fodder growing and milk-production, FURI fodder growing farms with emphasis on meat-production, FFMI and FUMI equivalently farms with a considerable share in fodder growing and forestry at the gross margin, F_Alternativ fodder growing farms with main emphasis on sheep or goat production, horse keeping or deer keeping, FO pure wood producers, and REST other emphasises. For a detailed explanation of farm emphasises see Appendix I.

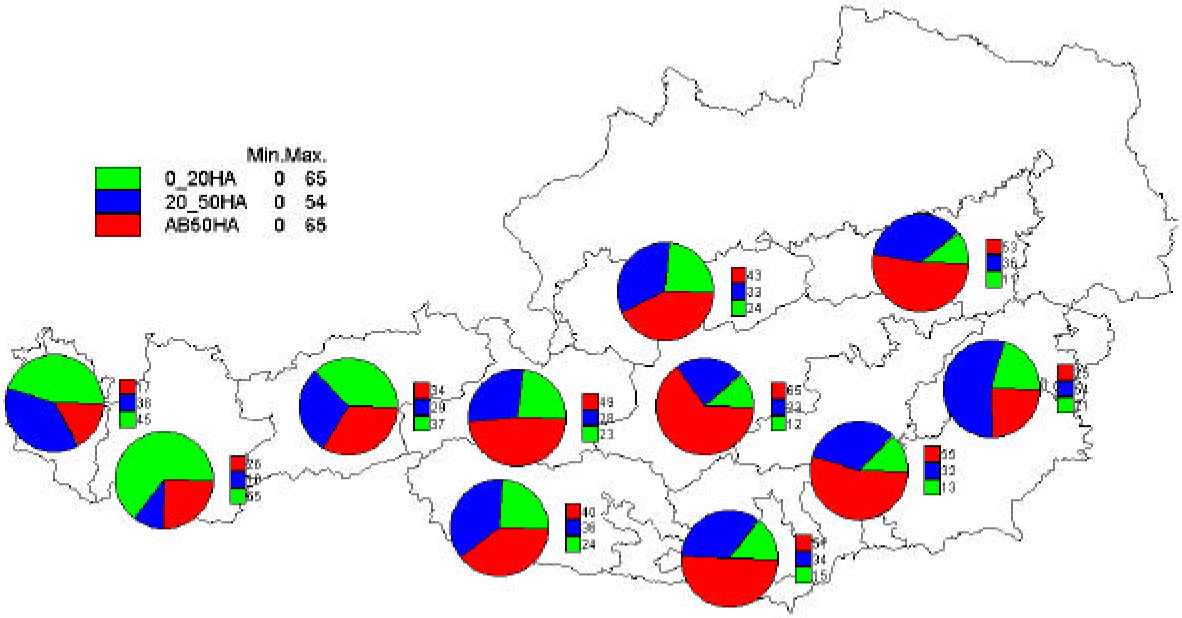
Map 7.1

Base szenario: Total Gross Margin per Farm



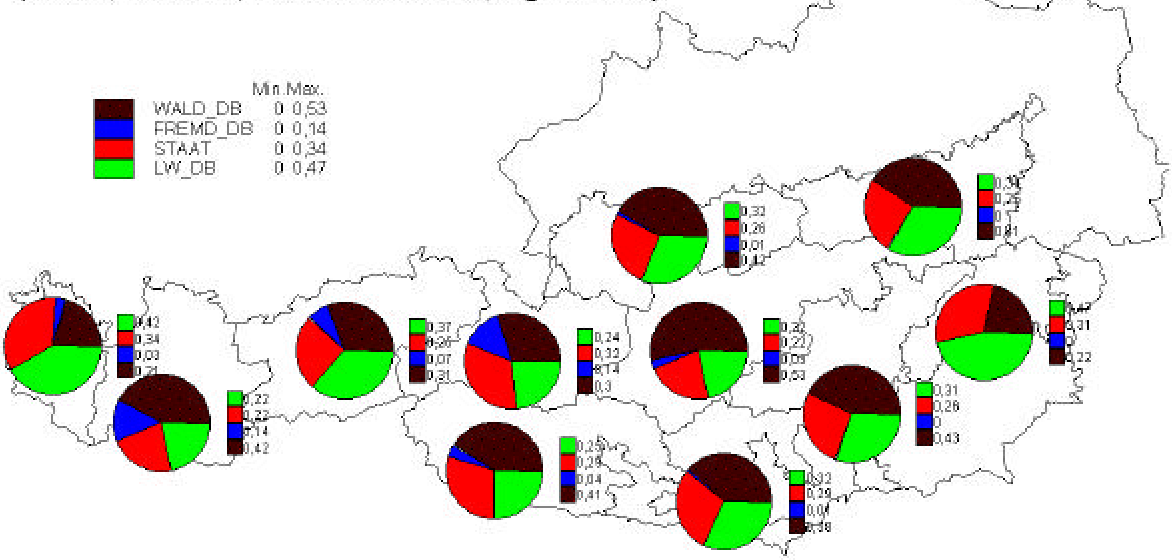
Map 7.2

Relative Contribution of Farm Sizes to Regional Agricultural Income



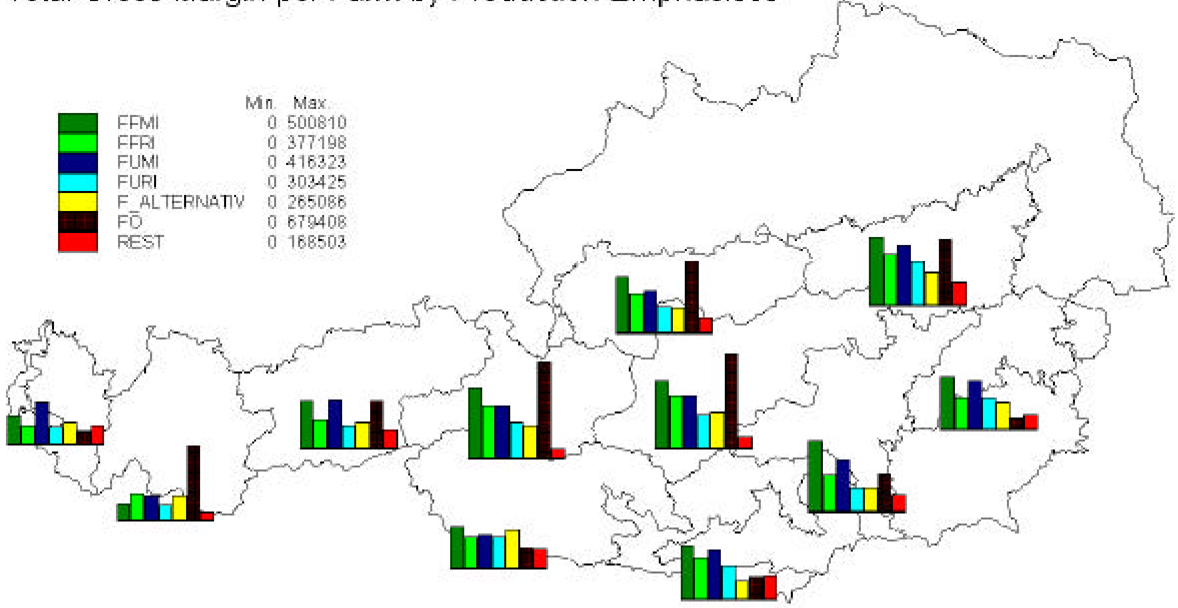
Map 7.3

Relative Contribution of Production Branches to Regional Agricultural Income (Wood, Tourism, Public Subsidies, Agriculture)



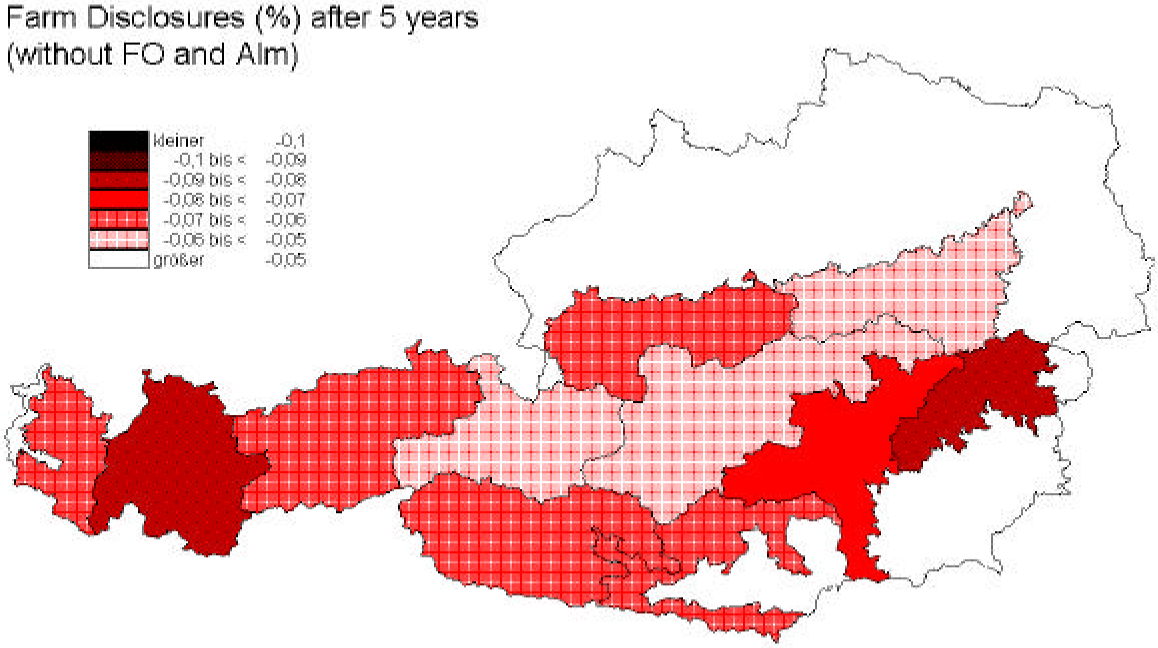
Map 7.4

Total Gross Margin per Farm by Production Emphasises



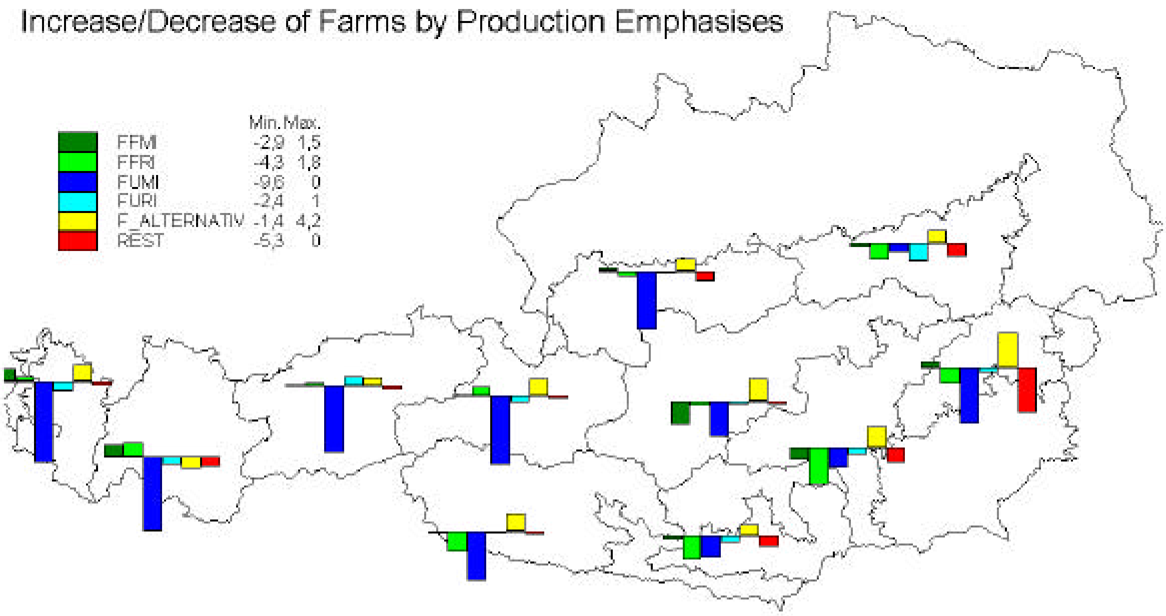
Map 7.5 shows the forecasted exit quota in the base scenario after 5 years. What we have not considered here are pure wood producers and pure alpine pasture farms, since we do not have sufficient information about these farm types from the interviews and the use of results of other farm types is supposed to be problematic. Since in the model the exit quota is primarily deduced from the total gross margins and the age of the farmers it is not very surprising, that the lowest exit quotas of 5% and 6% are forecasted for the regions 14, 15 and 22. The highest exit quotas (8% to 9%), in contrast, can be found in regions 12 and 33, whereby especially in region 12 the high share of farmers above 60 years plays a crucial role. In map 7.6 we can see the development according to farm emphasises. It shows, that more or less all emphasises lose except for the fodder-crop alternatives (sheep, goats, horses and deer). In general the model forecasts more exits of highly specialised fodder growing farms than farms with a substantial share of forest production. Moreover, specialised milk producers are expected to exit more likely than meat producers. It has to be however pointed out that in the graph the changes always refer to all farms, and not only to the farms of the farm emphasis. The high number of exits in case of the FUMI farms are therefore primarily connected with the high share of this production emphasis in all farms. Maps 7.7 and 7.8 show the relative increase/ decrease of farms according to full-time/part-time farming and production method. In those regions, where full-time farmers/ conventional farmers dominate, mainly the eastern regions, the number of part-time farmers/biological farmers will further increase modestly in the coming years. In the western and central regions, however, where part-time farmers and biological farms do already have a high share, those ones will as well decrease in absolute terms, but further gain importance in relative terms

Map 7.5



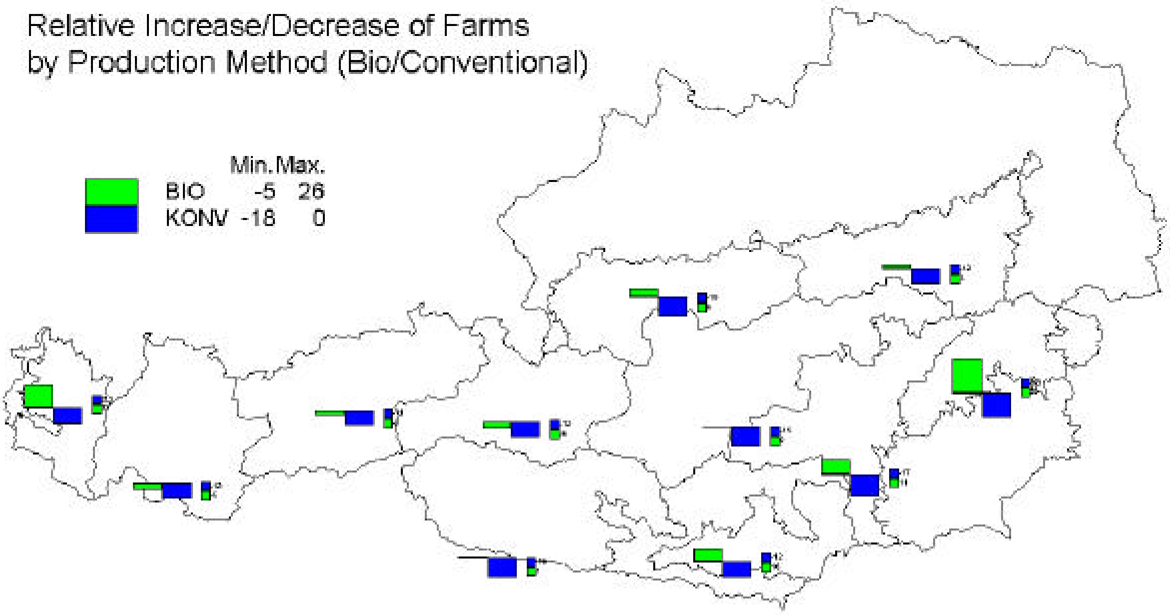
Farm Disclosures (%) after 5 years
(without FO and Alm)
kleiner -0,1
-0,1 bis < -0,09
-0,09 bis < -0,08
-0,08 bis < -0,07
-0,07 bis < -0,06
-0,06 bis < -0,05
größer -0,05

Map 7.6

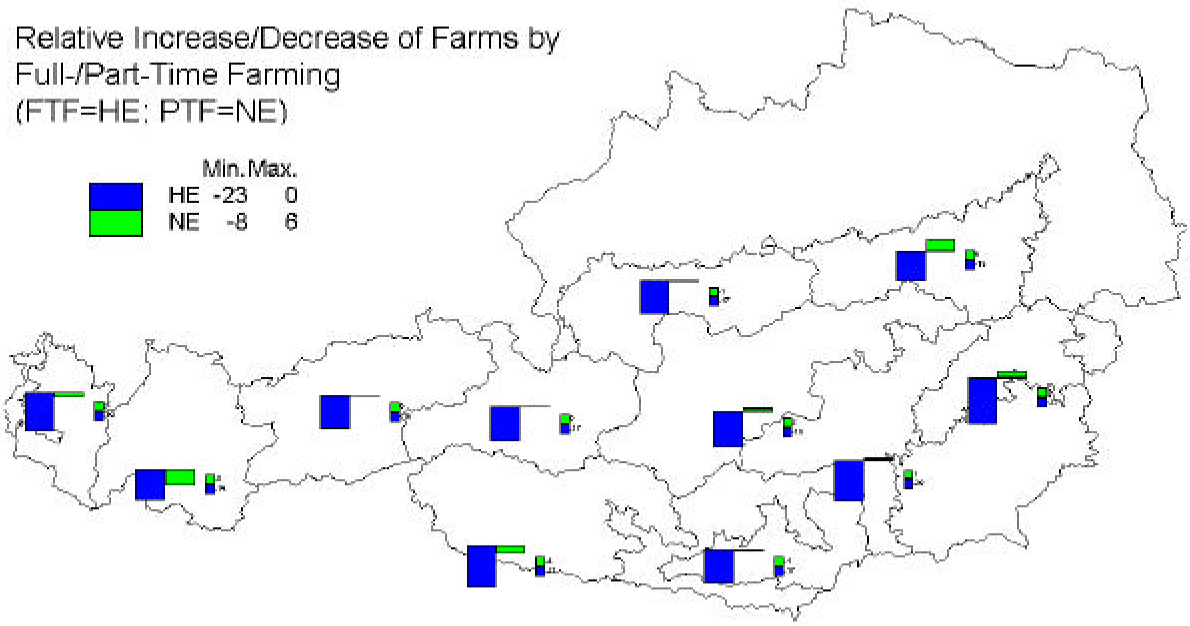


Increase/Decrease of Farms by Production Emphasises
Min. Max.
FFMI -2,9 1,5
FFRI -4,3 1,8
FUMI -9,6 0
FURI -2,4 1
F_ALTERNATIV -1,4 4,2
REST -5,3 0

Map 7.7


Relative Increase/Decrease of Farms
by Production Method (Bio/Conventional)
Min. Max.
BIO -5 26
KONV -18 0

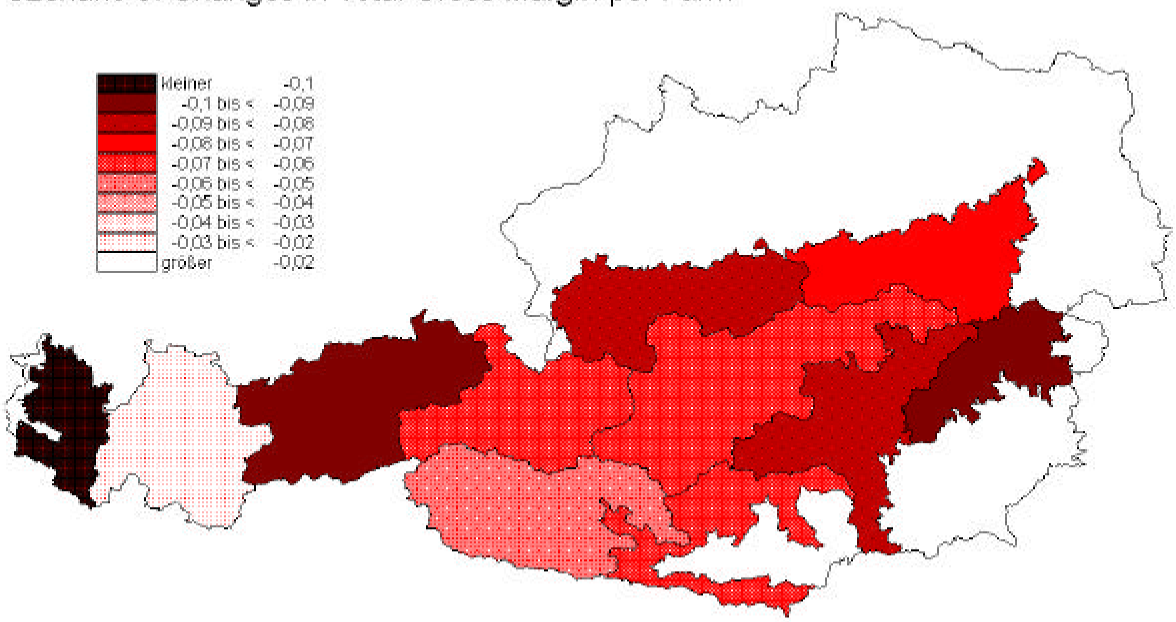
Map 7.8


Relative Increase/Decrease of Farms by
Full-/Part-Time Farming
(FTF=HE; PTF=NE)
Min. Max.
HE -23 0
NE -8 6

Map 7.9 shows the changes of the average gross margins in case of scenario 3, which is a 30% price reduction for milk and beef. The highest losses (>8%) could be observed in the regions 11, 13 and 33, the lowest one (<3%) in region 12. This can be explained with the strong differences in the production intensity between those regions. So, the average livestock density is 1.32 (livestock units per hectare RLN) in region 13, compared to 0.72 in region 12. Moreover, the average milk quota per dairy cow amounts to more than 4000 kg in region 11, but no more than 2200 kg in region 11. Finally, in region 33 the low share of wood production in terms of gross margin is supposed to be responsible for the high losses.

Map 7.9

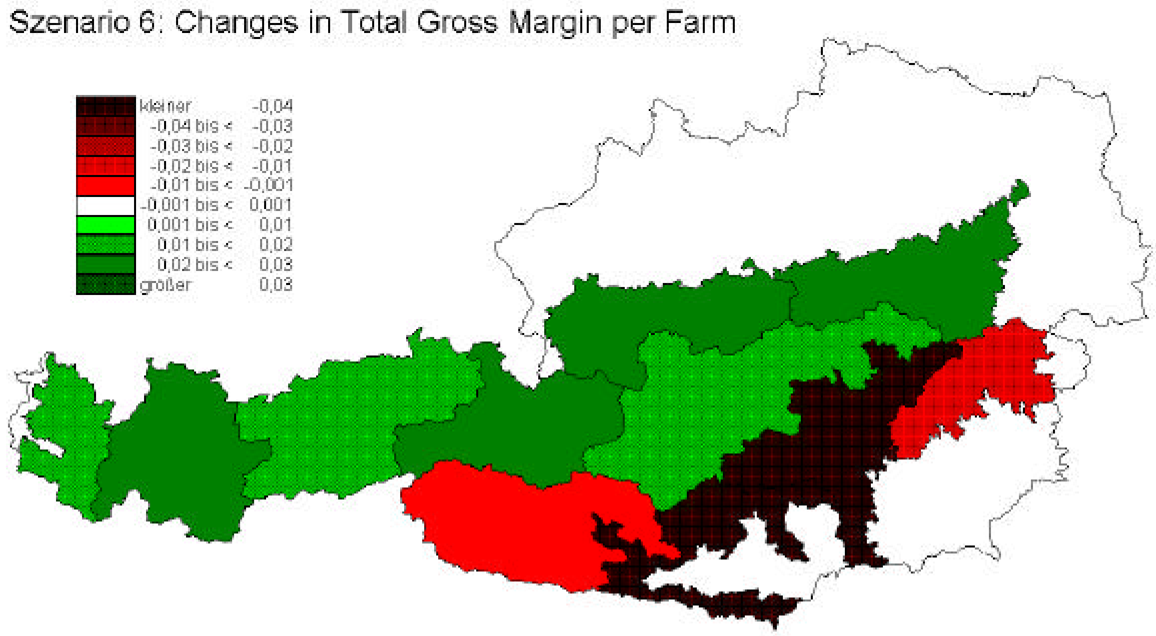
Szenario 3: Changes in Total Gross Margin per Farm



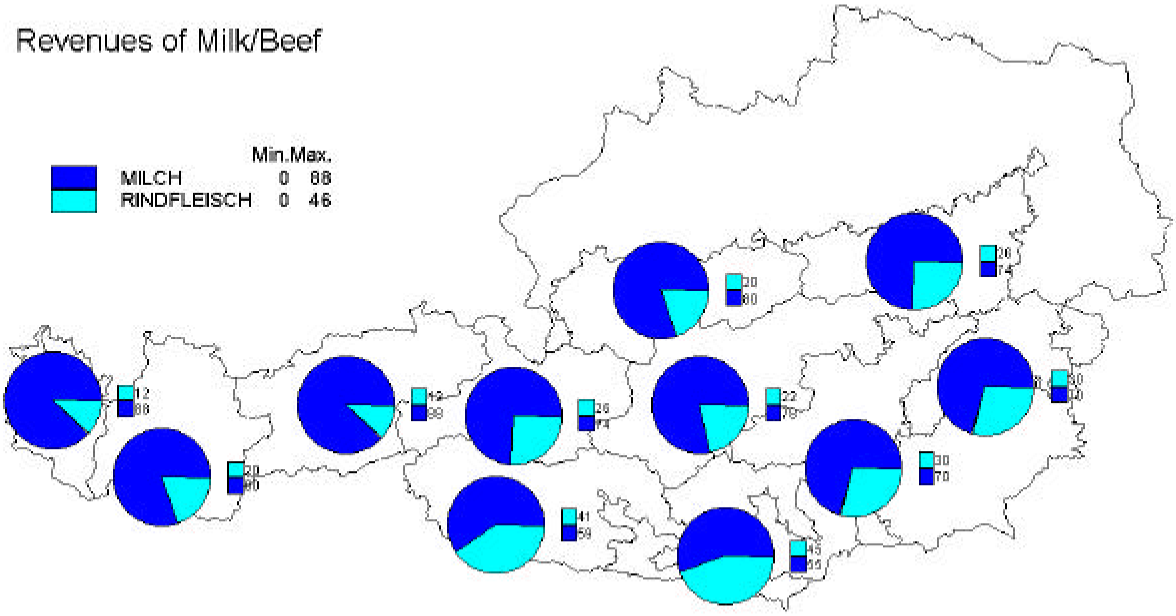
Map 7.10 shows the relative change of the average total gross margin for scenario 6, the grassland premium as a substitute for livestock premiums. As already mentioned, the calculated premium amounts to 2000 ATS/hectare RLN (without alpine pastures) for farms with less than 2 livestock units per hectare RLN. Northern regions would profit by such a measure while the southern regions would be put at a disadvantage. This is not very surprising if one glances at map 7.11, which relates milk and beef in terms of revenues. Regions with high beef shares would have high losses due to foregone livestock premiums, which couldn't be completely compensated by the grassland premium. In contrast, regions with emphasis on milk production would hardly lose by the cancelled livestock premiums, but

gain by the new grassland premium. Moreover, regions with high shares of alpine pastures in terms of grassland, like region 16, would as well be disfavoured by this special form of grassland premium as regions with intensive livestock production (high livestock density). The grassland premium would altogether cost about 17% more than the livestock premium. Map 7.12 demonstrates the effects on different farm emphasises. As can be seen, in the northern regions almost all farm emphasises would gain from the grassland premium while all except for the fodder growing alternatives are expected to lose in the South. The strongest losses, however, would affect the FURI farms, that is the fodder growers with emphasis on beef production and without wood production.

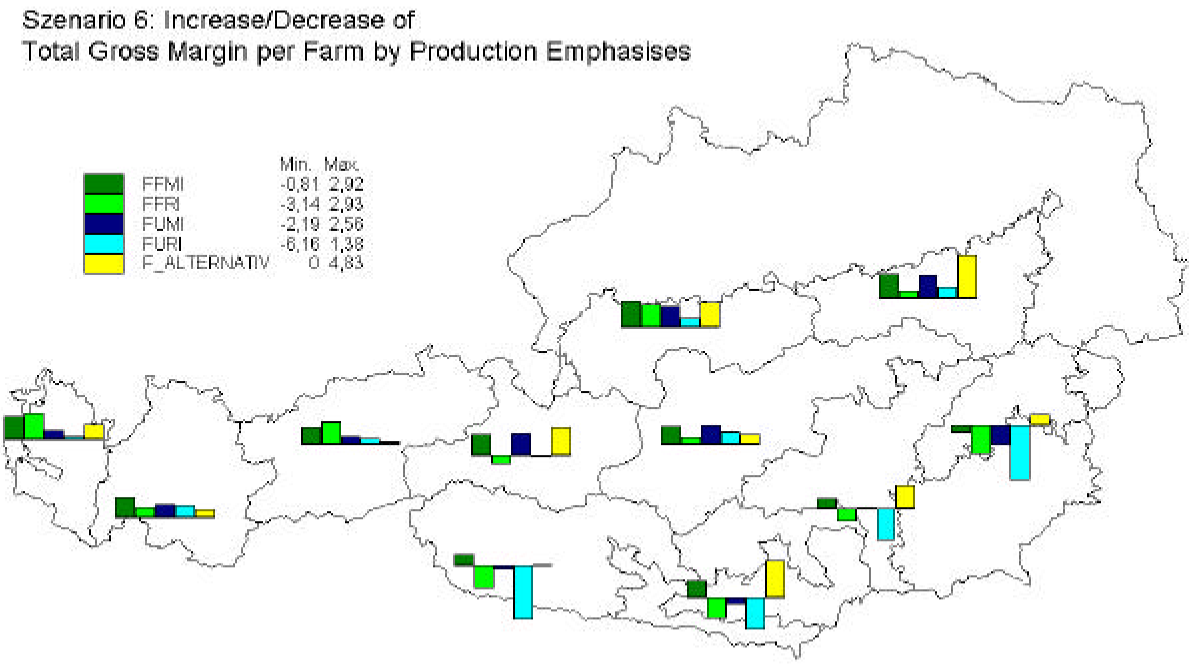
Map 7.10



Map 7.11

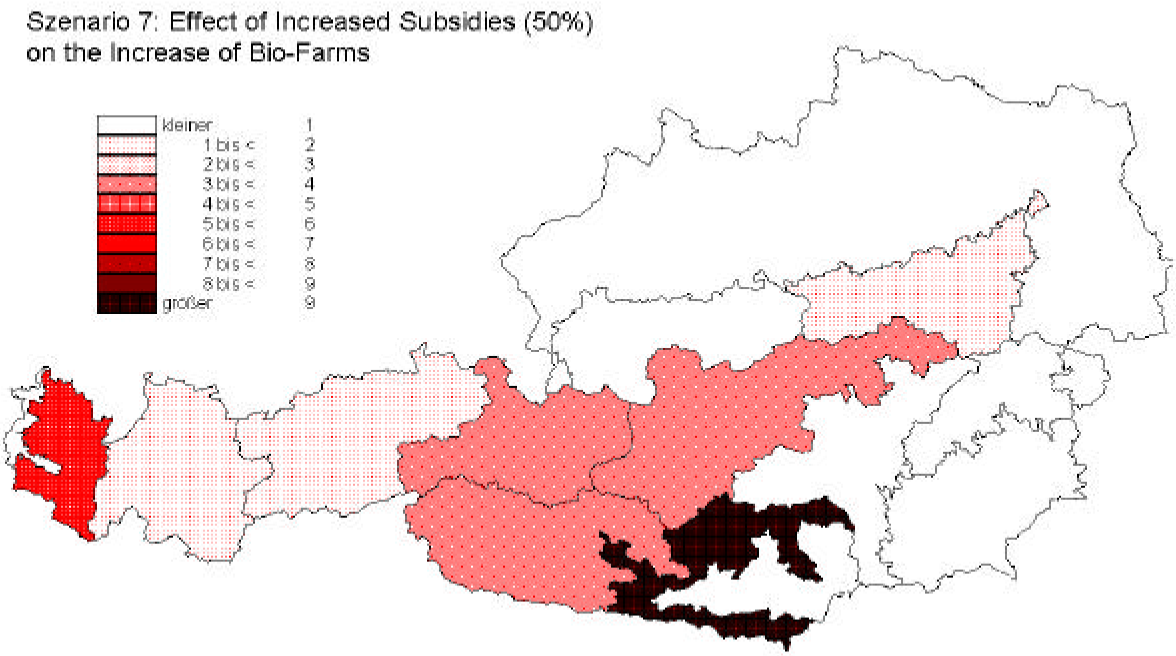


Map 7.12



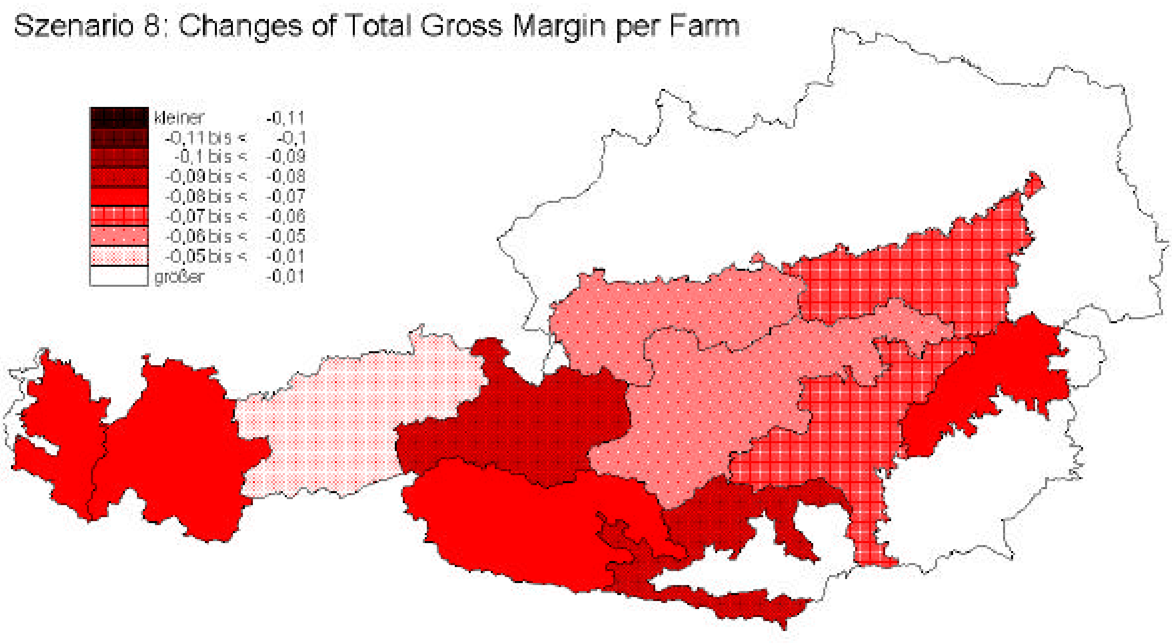
Map 7.13 demonstrates how a specific expansion of the support for biological farming by 50% (scenario 7) would affect the increase of biological farms in a 5-year time horizon. The map shows the relative changes in comparison with the base scenario (map 7.8). One can see that the number of biological farms would increase around 1-3 % stronger. In region 31 the model even forecasts an additional increase around up to 10%, while the measure would hardly affect development in the regions 22, 32 and 33. It is however important to emphasise that the estimates in the model are based on the real income effects of such a measure in first line. In contrast, psychological effects are not considered here.

Map 7.13



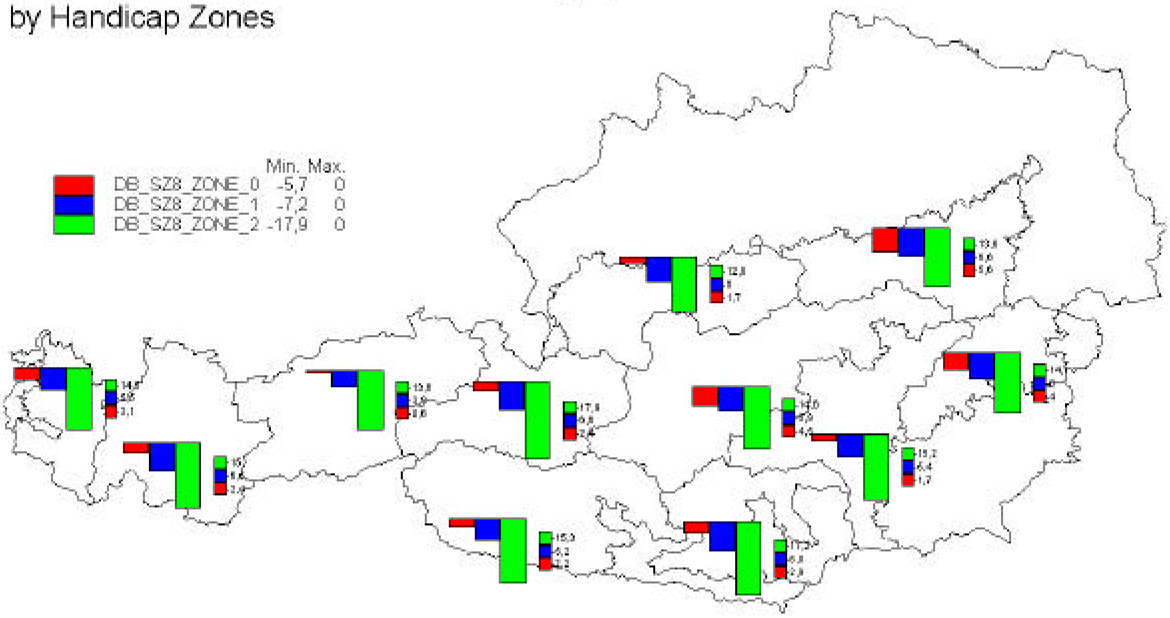
Scenario 8, finally, compares the old system of the mountain-farm subsidies with the new one (new system = base scenario; old system = scenario 8). Altogether the new system grants more money and the farms are classified individually via a system of handicap points, while municipality had been the main criterion in the old system. Moreover, in the new system a base rate favours small farms compared to larger ones. Map 7.14 compares the old and the new system in terms of average total gross margin. It can be seen that all regions gain by the new system. Map 7.15 shows the changes according to handicap zones, 7.16 according to farm sizes. Both maps demonstrate, that the reform meets its objective to favour handicapped and small farms more than larger farms and farms in relatively favoured locations. Most farms, however, more or less profit from the new system. Map 7.17 demonstrates the effects of the new system on the forecasted structural change. So, within a 5-year period around 0.3% less farmers would terminate farming activities compared to the old system. Region 14 gains most from the system change as could be expected due to the higher increases of gross margins.

Map 7.14



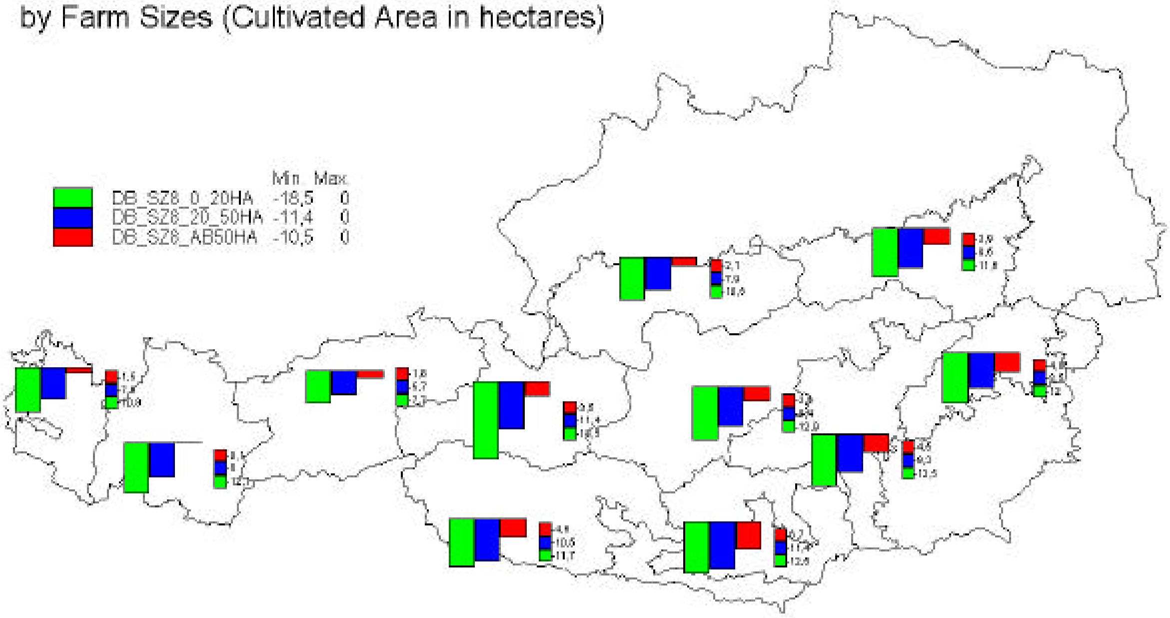
Map 7.15

Szenario 8: Changes of Total Gross Margin per Farm
by Handicap Zones

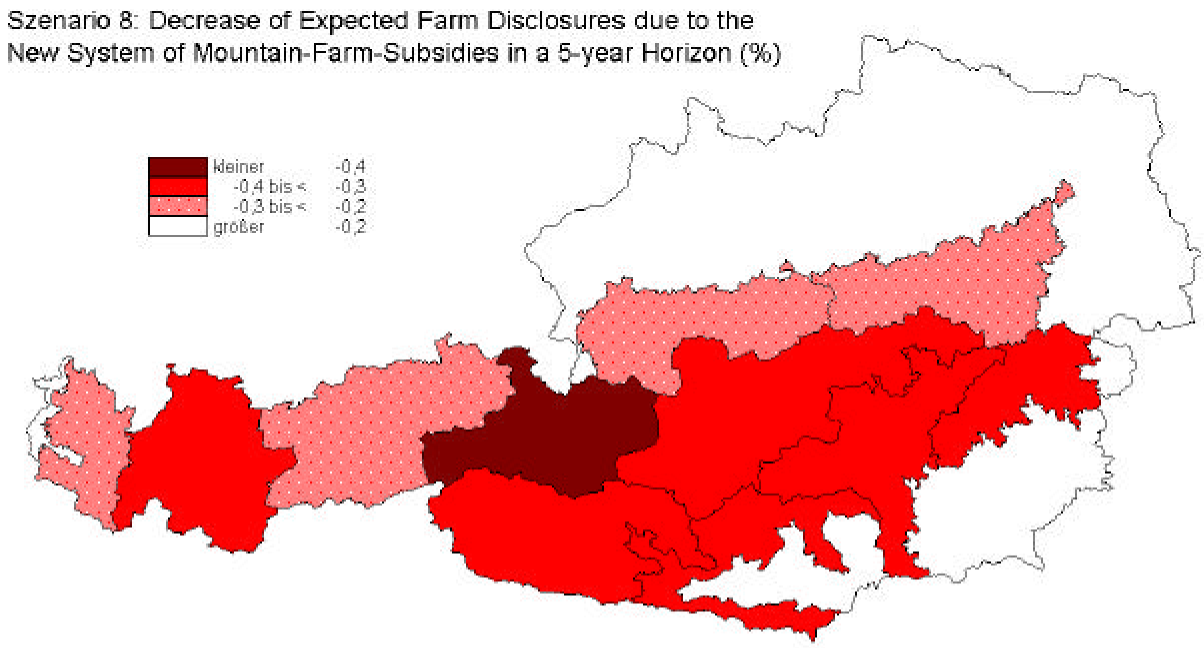


Map 7.16

Szenario 8: Changes of Total Gross Margin per Farm
by Farm Sizes (Cultivated Area in hectares)



Map 7.17

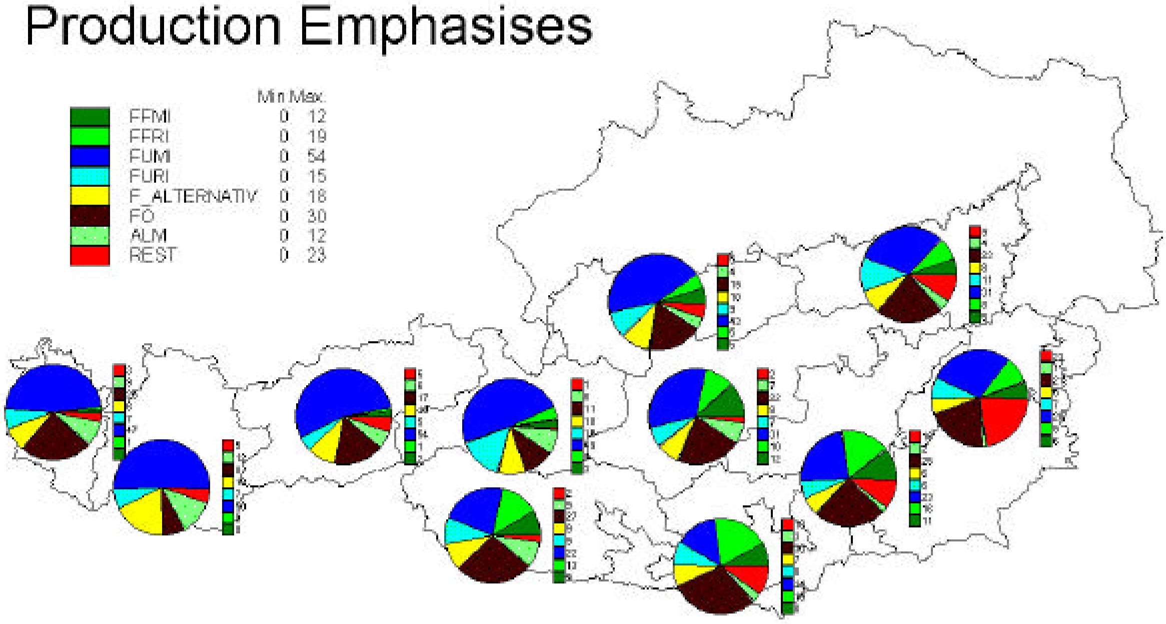


8 Summary and Conclusions

In the research project RAALSA we developed a sector model for the Austrian Alpine region, which depicts decision processes at the farm level and calculates income effects of political measures and price changes at the regional- and the farm level. Beyond this, changes in the farm structure can be assessed endogenously. For the simulation of political scenarios at constant farm structure (module 1) the model produces substantially more detailed information than other available models due to the high number of farm types. The modelling of structural changes (module 2) should be understood, however, only as rough estimate since the results are essentially based on an inquiry of farms, which leaves many uncertainties open. An improvement of the model would be possible, if in some years the data of the next agricultural census will be available. Then the new census could be connected to the census of 1999 (the comparison 95 and 99 is distorted too strongly due to the EU admission), and so the estimates of module 2 could be based on a more solid ground. The presentation of module 2, therefore, should be seen as a proposal for a new methodological approach in order to deal with the complex task of structural change modelling, which, however, demands further research in order to obtain applications with more reliable results.

Annex I: Production Emphasises

	Full Name	Definition (% of GM=Gross Margin)
FURI	Fodder Growing Farm with Emphasis Beef Production	Fodder Crops ≥ 65%, with livestock ; Beef> Milk
FUMI	Fodder Growing Farm with Emphasis Milk Production	Fodder Crops ≥ 65%, with livestock ; Beef< Milk
FFRI	Fodder Growing/Wood Farm with Emphasis Beef Production	Fodder Crops + Wood ≥ 75%; 10% <Fodder Crops <65%, with livestock; Beef > Milk
FFMI	Fodder Growing/Wood Farm with Emphasis Milk Production	Fodder Crops + Wood ≥ 75%; 10% <Fodder Crops <65%, with livestock; Beef < Milk
FSZ	FF or FU with Emphasis Sheep and Goat Production	Fodder Crops + Wood ≥ 75%; 10% <Fodder Crops, with livestock; Livestock Units Sheep and Goats ≥ 50% of Total Livestock Units
FPF	FF or FU with Emphasis Horse Keeping	Fodder Crops + Wood ≥ 75%; 10% <Fodder Crops, with livestock; Livestock Units Horses ≥ 50% of Total Livestock Units
FWI	FF or FU with Emphasis Deer Keeping	Fodder Crops + Wood ≥ 75%; 10% <Fodder Crops, with livestock; Livestock Units Deer ≥ 50% of Total Livestock Units
FGEM	FF or FU without Emphasis	Fodder Crops + Wood ≥ 75%; 10% <Fodder Crops, with livestock; Livestock Units Sheep, Goats, Horses and Deer ≥ 50% Of LU
FO	Forest Farm	Wood =100%
FL	Forest Farm with Agriculture	100%>Wood>65%; Fodder Crops < 10%, with livestock
F	FF or FU	
MF	Cash Crop Farm	Cash Crops ≥ 65%
VB	Intensive Livestock Farm	Intensive Livestock ≥ 65%
GB	Horticulture Farm	Horticulture ≥ 65%
DK	Permanent Crop Farm	Permanent Crops ≥ 65%
MB	Mixed Farm	Others except NKB
GL	Grassland Farm without Livestock	Fodder Crops = 100%, without livestock
WuGL	Forest- and Grassland Farms without livestock	Fodder Crops and Wood = 100%, without livestock
NKB	Unclassified Farms	Without Gross Margin


Production Emphasises
Min Max.
FFMI 0 12
FFRI 0 19
FUMI 0 54
FURI 0 15
F_ALTERNATIV 0 18
FÖ 0 30
ALM 0 12
REST 0 23

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