Deliverable no. 10

Adaptation of the agent-based model AgriPoliS to 11 study regions in the enlarged European Union

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1 Introduction

This report refers to project deliverable 10 of work package 4 of the IDEMA-project. An important part of the IDEMA project is the use of modelling to study the impact of decoupling on the agricultural in selected countries of the enlarged EU. Regarding the policy impact on structural change, we adapt the agent-based dynamic simulation model AgriPoliS to altogether 11 case study regions. The chosen case study regions represent the great diversity of farming in Europe with regard to factors such as farming structure, production, factor use, or farm size.

When we talk about "AgriPoliS modelling" we refer to the whole process starting from initial input data collection to the analysis of simulation output. Basically, the process of "AgriPoliS modelling" consists of three steps or parts, the input part, the modelling and simulation part, and the policy analysis part (Figure 1).

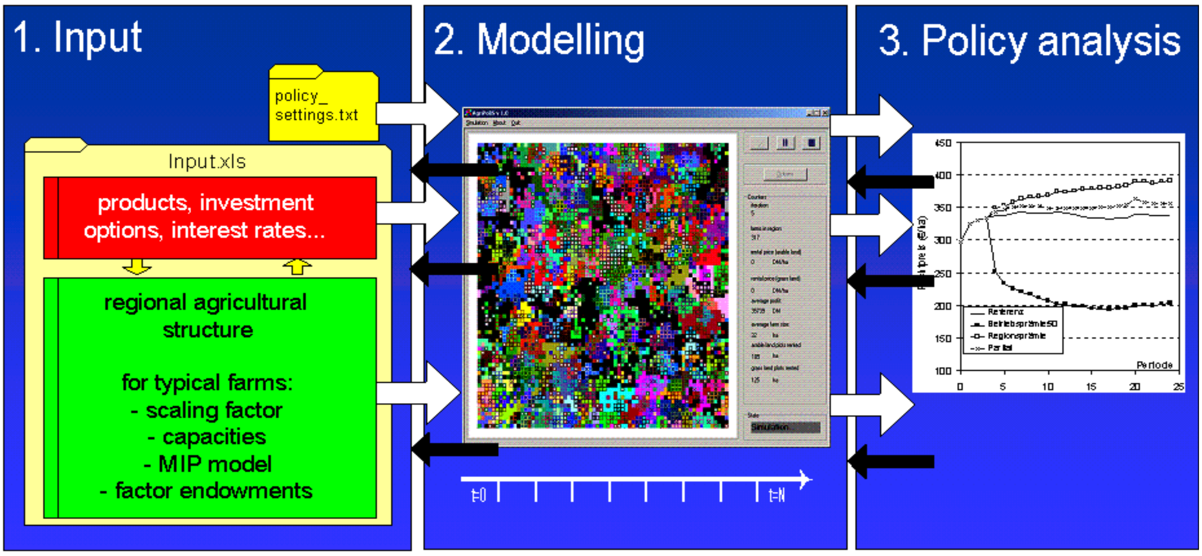

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Figure 1: Three main steps of adapting AgriPoliS to a region

The order of steps is the same for all case study regions. Following up on the previous deliverable 8, in this report, we provide an extensive overview of the modelling approach, the case study regions, results of selecting typical farms and the representation of typical farms with regard to region-specific production activities and investment options. With the information given in this report, we have established the pre-conditions to run AgriPoliS in all case study areas for a base-line scenario. In more detail, the steps involve:

- *Step 1 - Input*: At first the input data for AgriPoliS has to be collected and compiled in input files for AgriPoliS. To adjust and calibrate AgriPoliS to a region we represent the agricultural structure of that region in a base year based on typical farms, i.e., farms one could typically find in the region. Within IDEMA we have chosen the base year 2000/2001 or 2001/2002, depending on the availability of data and on the representativeness of the year in view of, for example, extreme weather conditions.

- *Step 2 - Modelling*: After the input data are fed into AgriPoliS, the model has to be calibrated and validated with regard to the case study region. During the calibration there is a constant feedback between task 2 and 1, as input data may have to be adjusted to reach a better fit between AgriPoliS and real data. For this we compare a set of model indicators with real indicators in the base year. Indicators are total production of crops, and livestock, and farm exit. Moreover, this step also involves the further development of AgriPoliS with regard to specific conditions in certain case study areas (project deliverable D16).

- *Step 3 - Policy analysis*: When the model has been calibrated to the respective regions, policy simulations are carried out regarding different decoupling options. Also at this stage, there is a feedback between this task and the previous task as the implementation of certain policy options may require the adjustment of the model. The documentation of the improved and extended AgriPoliS models will be the content of project deliverable D16 and work package 5.

The objective of this report is twofold. First, the report contains a documentation of AgriPoliS and the methodologies to derive and generate the required input data for AgriPoliS. Second, we report on the input data we have identified and processed for each of the 11 study regions. This part largely refers to step 1 above.

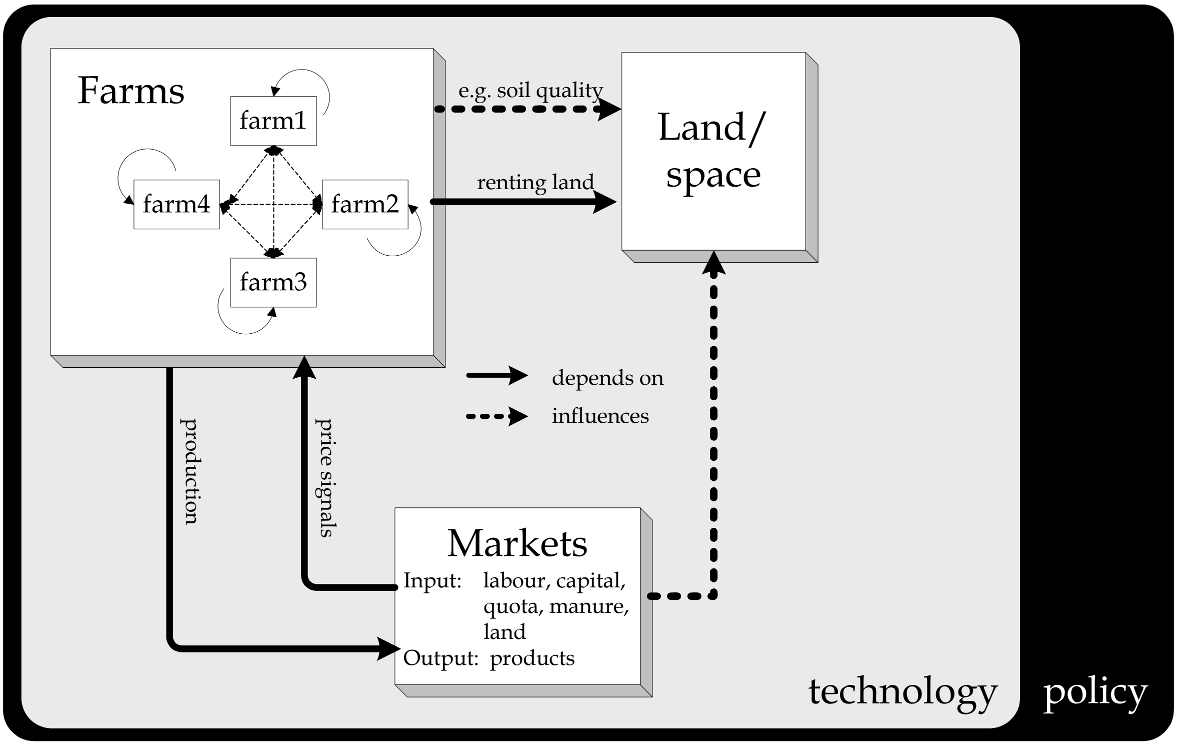
This report is the combined effort of all partners in the project. In general, the data were provided by regional partners and were thus taken from locally accessible data sources, like regional statistics. As for individual farm data, regional partners derived and defined the capacities of typical farms mainly based on locally available FADN data.

This report is structured as follows. Sections 2 and 3 are of methodological nature. We present the base version of AgriPoliS in section 2, and thereafter the methodology to adapt AgriPoliS to a specific regional setting. In section 4, 5, and 6, we provide a detailed report on the tasks carried out to fulfil step 1 in the AgriPoliS modelling process. This includes a detailed description of the selected case study regions in section 4. Section 5 shows results of applying the methodology to adapt AgriPoliS to a case study region presented in section 3. Application of this procedure leads to a set of typical farms and corresponding scaling factors. In section 6 we further elaborate on the representation of individual typical farms. As each typical farm determines its behaviour based on a linear programme, we present the key production activities and investment options identified for each case study region. For sections 5 and 6, we use one case study region as the example in the text. The appendix contains the corresponding tables for the other case study regions.

2 The Agricultural Policy Simulator – AgriPoliS

2.1 Conceptual framework

The core of AgriPoliS is the understanding of a regional agricultural structure as a complex evolving system.[1] This regional agricultural system is shown schematically in Figure 2. The figure shows the interactions between the three central components of agricultural structures: farms, markets, and land.



Source: Own figure.

Figure 2: A static conceptual model of a regional agricultural system

This representation can be considered typical for family-farm dominated regions in Germany where production cannot take place entirely independent of land. A number of individual farms evolve subject to their actual state and to changes in their environment. This environment consists of other farms, factor and product markets, and space, which are again all embedded within the technological and political environment.

Farms, land, and markets either directly depend on each other or they exert influence on each other. A direct dependence implies that one component cannot exist without another. The mutual dependence between farms, land, and markets results from the fact that farms require land

[1] This section is largely based on HAPPE (2004) and HAPPE et al. (2004).

to produce on the on hand. Farm management practices in return influence the state of the land the quality of which is characterised, for example, by soil fertility. On the other hand, the mutual interdependence between farms and markets takes place because farms can purchase production inputs on factor markets and sell products to product markets.

Representing this system using the abstraction of an agent-based system it is appealing to interpret farms as individual agents, not only because the description in Figure 2 suggests this. Also markets – be it product or factor markets, and in particular the land market – can be interpreted as agents that bring together and co-ordinate market activity. Before translating the conceptual model into a computer simulation programme in the following, the core contents will be sketched in more detail along the following questions:

- What are the agents involved and what makes them heterogeneous?
- How do agents behave and what actions are driving the system?
- Which factors comprise the individual agent's spatial, technical, and political environment?
- How do interactions between agents, and agents and the environment take place in the model?

2.1.1 Agents involved

For the purpose of AgriPoliS, an agent is defined as an entity that acts individually, senses parts of its environment and acts upon it.[2] In the context of regional agricultural structures, it is useful to differentiate between two kinds of agents: the farm agent and the market agent.[3] The agents in AgriPoliS are acting entities that actively carry out defined actions.

There are two types of agents in AgriPoliS, farm agents, and market agents. Of the two kinds of agents considered, the farm agent is the most important one. In the context of AgriPoliS, one farm agent corresponds to one farm or agricultural holding. In accordance with the above agent definition, a farm agent is an independently acting entity that decides autonomously on

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[2] See e.g. HAPPE (2004), TESFATSION (2002, 2001) for a more in-depth discussion of agents and agent-based systems.

[3] In fact, there is also a third kind of agent that manages the course of actions of the other agents in the actual simulation programme. This management agent is responsible for initiating the actions carried out be the other two kinds of agents.

its organisation and production to pursue a defined goal (e.g. farm household income maximisation). Furthermore, a farm agent reacts to changes in its environment and its own state by adjusting its organisation in response to available factors endowments and observable actions of other farm agents.

The second kind of agent, the market agent, coordinates the working of markets. It is the responsibility of the market agent to bring together supply and demand of goods (products, production factors) and to determine a price of the good. More specifically, in AgriPoliS, there is a land market agent, the auctioneer, and a product market agent. The market agents can only be considered as very basic agents, whose sole objective is to co-ordinate the actions of farm agents on the markets for products, land, capital and labour.

2.1.2 Farm agent actions and behaviour

Farm agents can produce a selection of goods. In order to produce, farm agents utilise buildings, machinery, and facilities of different types and capacities. With respect to this, AgriPoliS implements economies of size as with increasing size of production, unit investments costs decrease. Moreover, labour is assumed to be used more effectively with increasing size. AgriPoliS also aims to mimic the effect of technological progress. More specifically, it is assumed that with every new investment, unit costs of the product produced with this investment decrease by a certain percentage.

Farms can engage in rental activities for land, production quotas, and manure disposal rights. Labour can be hired on a fixed or on a per-hour basis, vice versa farm family labour can be offered for off-farm employment. To finance farm activities and to balance short-term liquidity shortages, farm agents can take up long-term and/or short-term credit. Liquid assets not used within the farm can be invested with a bank. Farm agents quit production and withdraw from the sector if equity capital is zero, the farm is illiquid, or if opportunity costs of farm-owned production factors are not covered.[4]

Farm agents are assumed to act autonomously and to maximise farm household income. For this, production and investment decisions are made simultaneously based on a recursive linear programme including integer activities (c.f. HAZELL and NORTON 1986). From the solution of the linear programme, shadow prices of production factors can be derived. Farm decision making is myopic or boundedly rational, that is, agents make decisions based on the informa-

[4] As investment costs are assumed to be sunk, only opportunity costs for land and labour are considered.

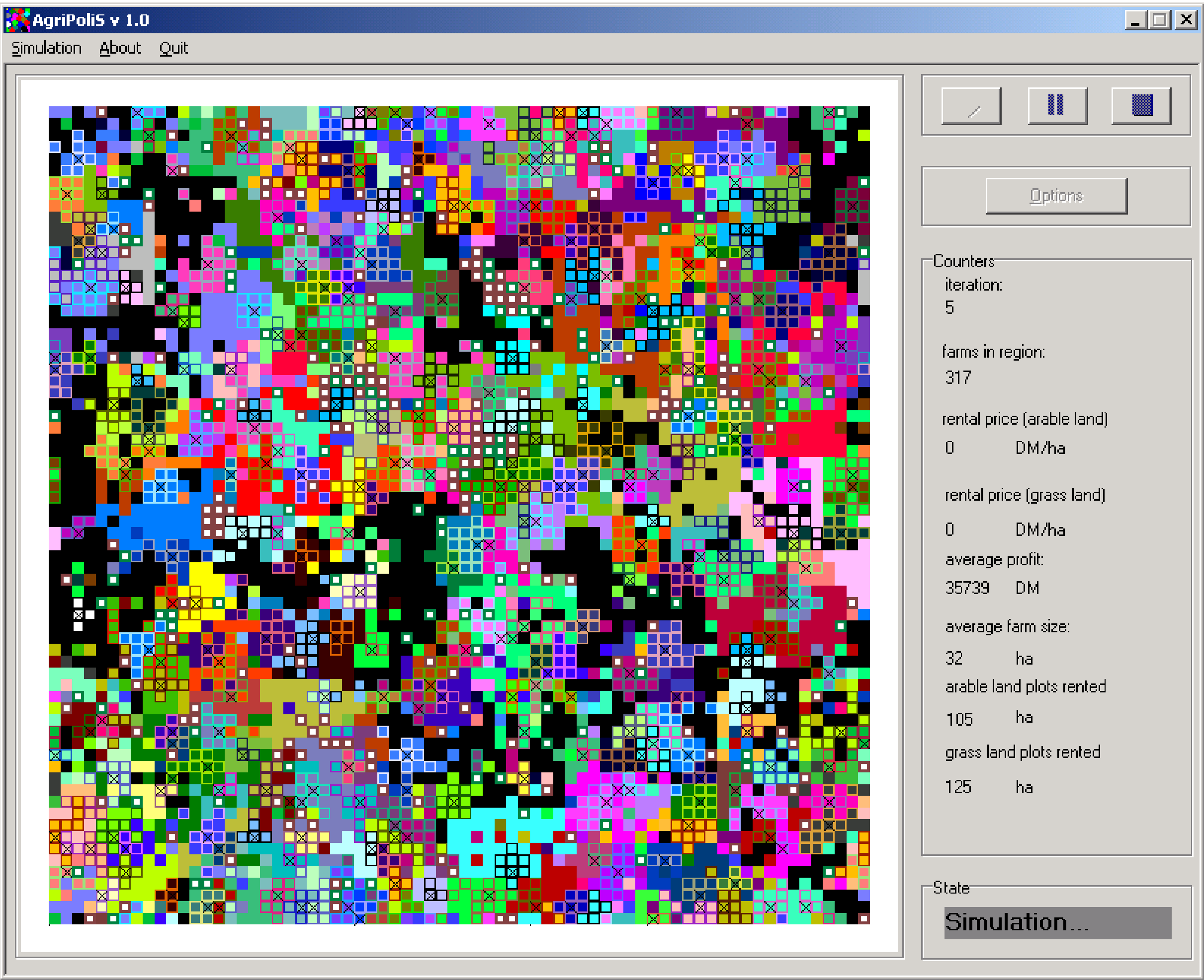
tion available to them, which can possibly even be wrong (SIMON 1955, 1956, 1996). Because of this, the decision problem of the model farms is highly simplified compared to that of real farmers in that strategic aspects are not included. Except for the price information on rents as well as product and input prices, individual farms in AgriPoliS do not know about other farms' production decisions, factor endowments, size, etc. On the contrary, unbounded rationality would imply that farms take account of all interactions between farms, and the technical and political framework conditions now and in future periods and that would include these into the individual decision problem. Farm agents are also boundedly rational with respect to expectations. In the majority of cases, farm agents follow adaptive expectations. Merely policy changes are anticipated one period in advance and included into the decision making process.

New investments affect production capacities for the operating lifetime of the investment. This implies investment costs to be sunk. A farm agent is handed over to the generation after a given number of periods. In case of such a generation change, opportunity costs of labour increase. Accordingly, continuation of farming can be interpreted as an investment into either agricultural or non-agricultural training. Finally, farm agents differ not only with respect to their specialisation, farm size, factor endowment and production technology, but also with respect to the person of the farmer, and with respect to managerial ability.

2.1.3 The spatial, technological and political environment

Land is an essential input for most kinds of agricultural production activities, be it for plant production, as fodder ground, or as manure disposal area. Hence, space is a factor that cannot be neglected if agriculture is concerned. Geographic Information Systems (GIS) provide a way for organising spatial data and assigning certain properties to space. A common way to organise space in GIS is to define a grid of cells. A grid, or layer, categorises land with respect to attributes of the cells. For example, this could be the soil type, ownership, or ecological parameters like the nitrogen load. A GIS-like representation could also be used in the context of an agent-based model of agriculture to achieve an explicit spatial representation as some recent examples show (e.g., BERGER 2001; PARKER et al. 2002). AgriPoliS, follows a more basic approach in that it does not implement a spatially explicit GIS in which the exact location of farms and land as found in a real region is modelled. AgriPoliS models space in a stylistic way to implement some, but not explicit, spatial relationships. In the current version of AgriPoliS, space is represented by a set of cells/plots assembled into a grid to form a kind of cellular automaton (Figure 3).

One individual plot represents a standardised spatial entity of a specific size that can take different states. In this idealised representation, all factors not directly relating to agriculture and land use (roads, rivers, etc.) were eliminated. The coloured cells represent agricultural land that is either grassland or arable land. Plots not used in agriculture are black. On some of the cells, farmsteads are located. They are marked with an X. The total land of a farm agent consists of both owned and rented land. All plots of land belonging to one farm agent are marked with the same colour; cells, which are owned, are surrounded by a box.



Source: Own figure.

Figure 3: An idealised grid representation of an agricultural region

The technological environment is given by technologies of different vintages and technological standards. Over time, technology is assumed to underlie a constant technological progress created in the up-stream sector, but not on the farms themselves. Farm agents are assumed to benefit from technological progress by way of realising additional cost savings when adapting new technologies. The political environment represents the third building block of a farm agent's external environment besides space and technology. Agricultural (and environmental) policies affect the farm at different instances such as prices, stocking density, direct payments, or interest rates.

2.1.4 Agent interactions

The concept of interaction between agents is central to agent-based systems. Interaction takes place when two or more agents are brought into a dynamic relationship through a set of reciprocal actions. Interactions develop out of a series of actions of agents whose consequences in return effect the future behaviour of agents (FERBER 1999). Interactions between agents take place either directly or indirectly, whereby an indirect interaction occurs through another agent.

At this development stage, agents in AgriPoliS interact indirectly by competing on factor and product markets. Interaction is organised by market agents that explicitly coordinate the allocation of scarce resources such as land or the transaction of products. Direct interactions between agents, for example for directly negotiating on rental contracts, are not considered at this stage of the model development.

In AgriPoliS, the land market is the central interaction institution between agents. In reality, the land market is of particular relevance, as farms very often cannot develop independently of land. In the case of Germany, livestock production is directly linked to the provision of land for fodder production or manure disposal. In this sense, land is a central prerequisite for farm growth. In Germany, farms predominantly grow by renting land additional. Because of this, AgriPoliS considers a land rental market, but does exclude a sales market for land. With regard to land, the ownership structure consists of family farms owning some land and external land owners. The latter are not modelled explicitly but farm agents rent their land. When AgriPoliS is run, land available for rent on the rental market stems from two sources: one is farms that have quit production and withdrawn from the sector, the other is land released to the market due to the termination of rental contracts.

In brief, the land allocation process works as follows. To allocate this free land to farms, in AgriPoliS an iterative auction is implemented in which an auctioneer (market agent) allocates free plots to farm agents intending to rent additional plots of land. Farm agents' bids for particular plots of land depend on the shadow price for land, the number of adjacent farm plots and the distance-dependent transport costs between the farmstead and the plot. The auctioneer collects bids, compares them, and allocates free plots to farm agents. The auction terminates when all free land is allocated or if bids are zero. As both arable land and grassland are considered, the auction process alternates between these two land qualities.

2.1.5 Central modelling assumptions

As with every model, AgriPoliS rests on a number of assumptions. Two kinds of assumptions can be differentiated. On the hand, there are assumptions that represent central characteristics of an agricultural system. These form the corner stones of the model. BALMANN (1995) has listed the central characteristics of agricultural systems and structures, which shall be mentioned here again.

- The evolution of agricultural structures follows a dynamic process;
- Agricultural structures are path dependent, i.e. the history of the system determines its present state significantly and certain events are irreversible;
- For the most, decision making follows goal-oriented economic considerations;
- Certain activities, decisions and actions are indivisible;
- There are feedback mechanisms, particularly on the local scale, between the actions of individuals and between the results of individual actions.

On the other hand, there are assumptions that are model specific and are necessary to make the model operational and to keep it tractable and clear. Assumptions in particular concern farm behaviour, expectation formation, the definition of the planning period, and the representation of markets and the interaction with other sectors.

2.2 Implementation of the conceptual model

2.2.1 Object-oriented structure and design

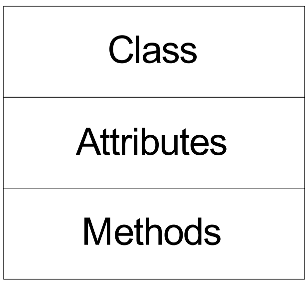
A natural way of transferring the conceptual framework into a computer programme is to use an object-oriented programming language such as C++, Java, or Smalltalk.[5] Object-

[5] This section on object-oriented design is largely based on REISS (1999) who gives an intuitive introduction to object-oriented programming and design.

orientation provides away to break a problem into components. In brief, object-orientation describes a system of entities in terms of elements called *objects*. Objects consist of data (or attributes) and actions (or methods). The data represent the state of the object. The actions operate on an object's data and change it. For example, a farm agent's investment activity (action) changes the agent's capital endowment (data). In other words, an object provides functionality in terms of data and actions.

A programme built using an object-oriented design usually contains a large number of objects, of which many are the same. For example, in an agricultural structure all objects representing farms will be treated in the same way. When designing a computer programme such as AgriPoliS using objects it is therefore sufficient to describe the behaviour of sets of similar farms as a whole. A group of objects with the same data and actions is called a class. Because of this, it is actually more common and useful to define the functionality of classes instead of individual objects in the design of object-oriented computer programmes. To summarise, object-oriented programmes thus consists of a set of classes, he data associated with these classes and the set of actions the classes can be asked to undertake.

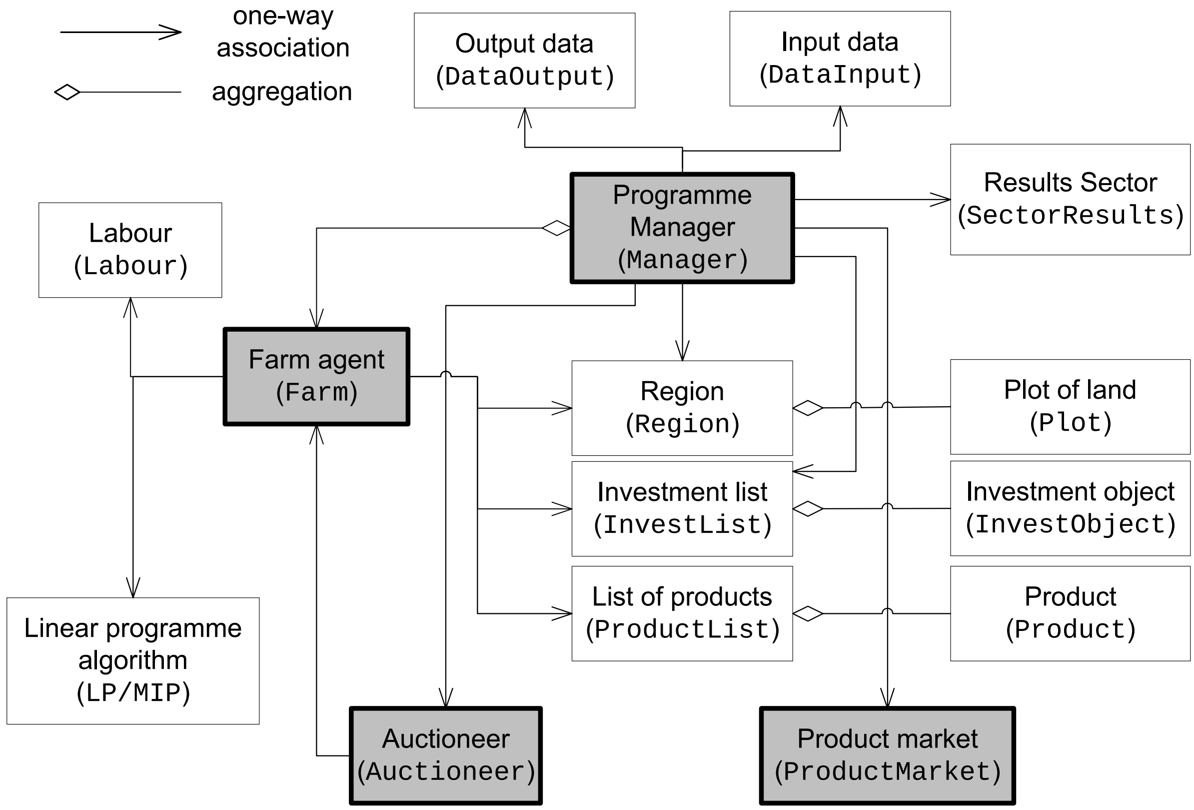
One key to understanding object-oriented design is to view the objects as living, intelligent entities of various types (REISS 1999). They are living in the sense that their properties change over time. Objects are intelligent in that they can undertake actions and know how to perform them. To visualise and document the design of an object-oriented computer programme it is convenient to use a standardised language such as the 'Unified Modeling Language' UML (BOOCH et al. 1999). UML simplifies the representation of complex software design. Accordingly, a representation of a class based on UML is given in Figure 4. The upper part the class representation shows the class name. The middle and lower parts list the attributes and the methods that the class can be asked to undertake.



Source: Own figure.

Figure 4: UML-representation of a class consisting of attributes and methods

When building an object-oriented programme, one is first concerned with identifying the individual classes, then with defining the data and actions of these classes, and finally with describing the connection between classes. Figure 5 shows the object-oriented class design of AgriPoliS. Class names, as used in the C++ programme are in parentheses. The grey shaded classes are agent classes.



Note: Names in brackets denote the class names used AgriPoliS' C++ programme code. For reasons of clarity, the figure does not show attributes and methods. The complete model code can be provided by the author upon request.
Source: Own figure.

Figure 5: Static class-diagram of AgriPoliS

For the model to perform its task, it is not necessary that all classes are related with each other and can invoke each other's methods. In the figure, lines are used to express different kinds of relationships between classes. In general, a line between two classes denotes an *association* relationship. Properties of this line, such as the arrowhead, are used to specify the character of the association further. For example, the relationship between classes `Farm` and `LP/MIP` is implemented as a one-way association by using an arrow. This indicates that a `Farm` object can invoke the methods of the `LP/MIP` object, but not the other way around. Likewise, a `Farm` object determines its location by querying the `Region` object to return the position of the farm in the region, but the reverse is not possible. Another type of association is *aggrega-*

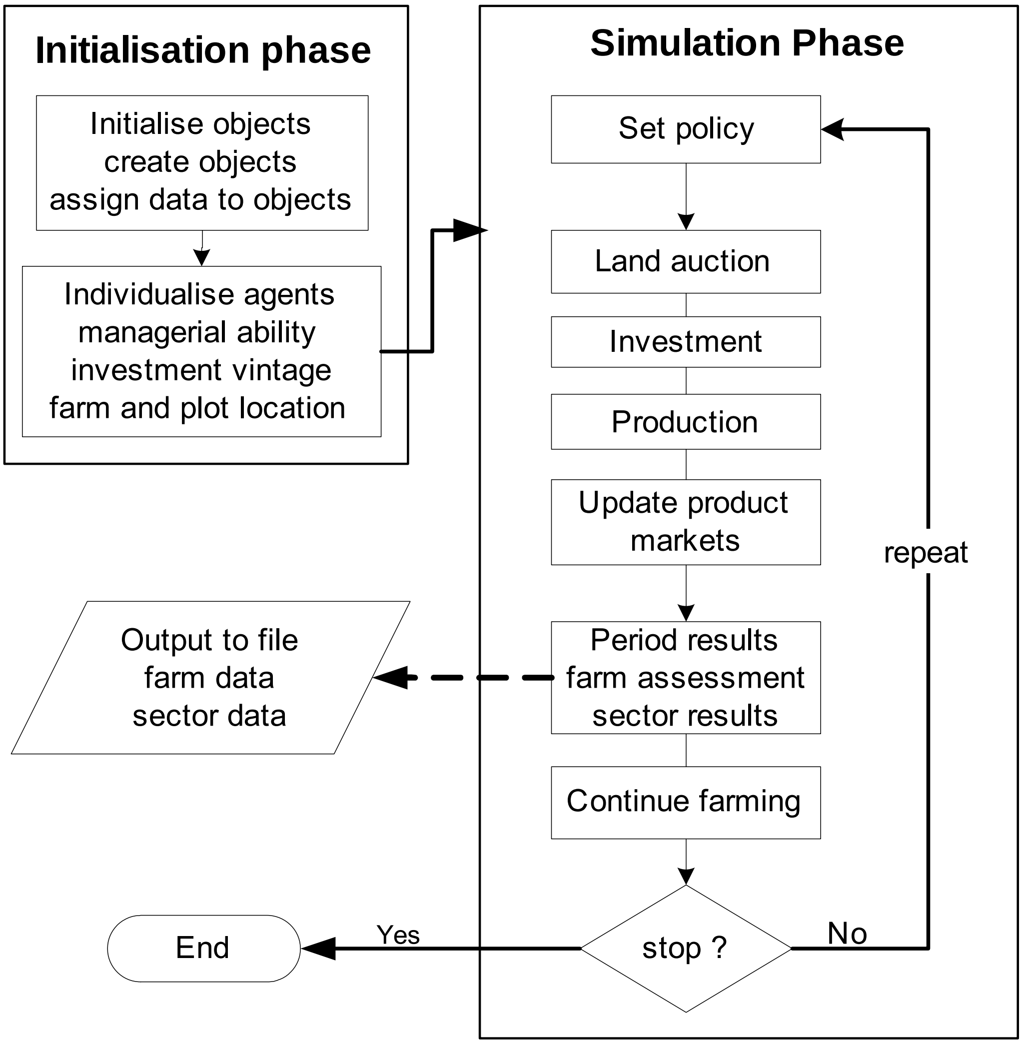
tion, denoted by a diamond. For example, the line from `Region` to `Plot` starts with a diamond, which denotes an aggregation. In this case, the region contains a set of plots. Similarly, each list of production contains a set of products.

From the classes shown in Figure 5, four kinds of objects can be derived: objects representing agents (`Farm, Auctioneer, ProductMarket`), objects representing production inputs and outputs (`Product, ProductList, Labour, InvestObject, InvestList, Plot, Region`), results and data management objects (`SectorResults, DataOutput, DataInput, LP/MIP`) and the `Manager` which controls the programme flow. Accordingly, agent objects use the functionality embodied in input and output objects to achieve their respective goals. Results and data management objects offer some auxiliary functionality in that they provide optimisation methods on the one hand, and functions to summarise farm data on the other hand.

2.2.2 Model dynamics

Whereas Figure 4 presents the static structure of the AgriPoliS model, Figure 6 illustrates the dynamics which are implemented and controlled by the `Manager` objects. As can be seen, the `Manager` essentially includes two model phases, the initialisation phase, and the simulation phase. In the initialisation phase, the model structure is created. This includes the creation of objects based on the class definitions, and assigning values to the respective attributes of the various objects. The initialisation phase ends with further individualising farms with respect to attributes for which empirical data is not available or difficult to obtain.

Following the initialisation phase, the simulation phase starts with setting the political framework conditions that is valid during the subsequent simulation period. Following this, the `Manager` invokes the `Auctioneer` agent to carry out the land auction to allocate unused land to farm agents. After the land auction has finished, farm agents have the possibility to invest in new machinery, buildings, or equipment, and following this to produce using the available production factors. After production, the `Manager` invokes the `Market` agent to bring together production of all farm agents in the respective region and to determine a price for each type of product produced by the farm agents.



Source: Own figure.

Figure 6: Model dynamics implemented in the `Manager` class

At the end of each simulation period, farm agents assess their economic performance during that particular period. Based on this assessment and given prospective policy changes, the farm agents form expectations about the next production period to decide on whether to continue or stop farming. For this decision, farm agents take into account all possible adjustment options such as off-farm labour opportunities, selling excess quota, and terminating land rental contracts. Fixed assets cannot be disinvested due to the mentioned sunk cost assumption. Results for each individual farm agent and the sector as a whole are written to an output file. The simulation terminates when the number of specified simulation periods is reached.

2.3 Input and output objects

In AgriPoliS, input and output objects subsume all those objects that are necessary for agents to transfer inputs into outputs in the case of the farm agents or to organise a market. Each of these will be described in the following. Table 1 lists the AgriPoliS data structure and variable names used in the following.

Table 1: AgriPoliS data structure and variable names

Farm agent (k=1,…,K)		**Farm agent (continued)**	
Z	Utilised agricultural area of farm	TC	Transport costs
LU[a)]	Stocking density per farm	IC	Interest paid
MP	Manpower hours	HW	Wages paid
m	Managerial ability factor	W	Off-farm income
A (l=1,...,L)	Fixed assets	WD	Withdrawal for consumption
$\mathbf{A_{ec}}$(l=1,...,L)	Equity financed share of assets		
n_c	Vintage of asset	WD_{min}	
LA	Land assets	ε	Additional consumption
L	Liquidity		
EC	Equity capital		
BC	Borrowed capital		
MR	Minimum equity capital reserve	**Investment I (h=1,…,H) to produce i**	
Y	Farm household income	d (d=1,…,D)	Investment type
Y^e	Expected farm household income	v	Equity-finance share
GMA	Gross margin agriculture	A	Investment costs
IR	Interest on working capital	AC	Average annual costs
$BID_{y,z}$	Bid for wanted plot $P_{y,z}$	N	Useful life
RE	Rent paid	MC	Maintenance costs p.a.
S	Support payments	l	Technical change factor machinery
MC	Current upkeep (maintenance)		
D	Depreciation	f	Technical change factor buildings and equipment
OV	Farming overheads	LS	Labour substitution
Capital		**Production activities**	
CRF	Capital return factor	**x** (i=1,...,I)	Production activity
i_{ec}	Interest on equity capital	**c** (i=1,...,I)	Variable prod. cost
i_{bc}	Interest on borrowed capital	$\mathbf{c^e}$ (i=1,...,I)	Expected variable costs
i_{bcs}	Interest on short-term borrowed capital	$\mathbf{p^e}$ (i=1,...,I)	Expected product price
Plot $P_{y,z}$	Plot at grid position y,z	γ	Price trend
β	Bid adjustment	**b** (j=1,...,J)	Factor capacities
$R_{y,z}$	Rent paid for plot $P_{y,z}$	**q** (j=1,…,J)	Shadow price of **b**
AP	Average number of adjacent plots per farm	**r** (j=1,...,J)	Factor demands
R	Average rent in region		
$TC_{y,z}$	Transport costs between farmstead and plot		
T	Number of adjacent plots		
$DI_{y,z}$	Distance between plots		

Notes: Bold letters denote vectors; a) 1 LU corresponds to approximately 500 kg alive weight.

2.3.1 Production factors

Production factors in AgriPoliS primarily concern the classical production factors land, labour, and capital, whereby the factor capital includes both money and assets for production.

Land

The spatial representation in AgriPoliS is organised by way of cells (see Figure 3), called plots (class `Plot`) of equal size. Taken together, the plots make up the entire region (class `Region`). Plots differ with respect to three aspects: land quality, usage structure, and ownership. Regarding land quality, AgriPoliS considers two qualities: arable land and grassland. Land of either quality is assumed to be homogeneous. Regarding the usage structure, agricultural utilised area classifies as either managed land or abandoned land. And finally, at the outset of the model, agricultural utilised area is either owned by farm agents or rented. All land not owned by farm agents is assumed to belong to external land owners which are not explicitly modelled. The individual plots in AgriPoliS are characterised by a number of attributes defining the plot's state, its location on the grid of plots, and its location relative to the location of the farm interested in renting the plot or the farm agent managing the plot already. A plot of either land quality can take different states: no agricultural use, abandoned land currently not managed, grassland or arable land, plot rented by farm agent k, plot is farmstead, plot is owned by farm agent k.

Labour

Labour is supplied in three forms (class `Labour`). The first is labour supplied by the farm family. The amount of farm family labour is derived from accountancy data; it is expressed in labour units.[6] Furthermore, farms can hire additional workers either on a fixed contract basis or on an hourly basis. Hiring fixed labour is treated as an investment for a period of one year. The total labour capacity is determined in the mixed-integer programme, where variable labour and fixed labour are activities.

In addition to hiring labour, farms can also offer their own farm family labour on the labour market. This offers the possibility for non-professional farming, on the one hand, and reducing the overall farm labour if necessary on the other. Corresponding to hiring labour, fixed and variable off-farm labour activities are introduced as activities in the mixed-integer programme.

[6] One labour unit corresponds to the annual labour input in hour provided by one worker.

Capital

To produce, a farm agent needs capital both in the form of liquid funds to pay running costs, and in the form of fixed asset capital (investments), which determine a farm agent's productive capacity.

Investments are introduced into AgriPoliS by way of an investment catalogue (class `InvestList`). This catalogue depicts a list of investment objects containing investment possibilities and production technologies typical for the region under investigation. The investment catalogue is available to all farm agents and it provides the basis for investment decisions by the farm agents. The individual objects in the catalogue differ with respect to the type of investment (e.g. dairy, fattening pigs, machinery), as well as the size of the investment reflected in the production capacity. For each type of investment, the catalogue contains a variety of sizes. Differently sized objects affect a farm agent in three ways: First, the effect of a larger scale of production is reflected in lower average annual unit costs compared to an object of the same type, but of smaller size. Second, larger investments are also considered to have lower labour requirements relative to smaller investments.

Third, over time, the technology underlying investment objects is assumed to improve, whereby larger investment objects are assumed to be technologically more advanced. Although technological change is not modelled explicitly by way of changing the technical coefficients of production, AgriPoliS nevertheless aims to mimic two effects of technically more advanced production technologies. On the one hand, AgriPoliS assumes that with every new investment, unit production costs of the product produced with this investment decrease. The extent of this cost-saving effect depends on the technical standard of the investment (see section on cost expectations).

Stated more formally, each investment object $I_{h,i,d}$ (h=1,…,H) to produce product i (i=1,…,I) is defined by the set of attributes in Table 2. In particular this is the investment's type d (d=1,…,D), investment costs, production capacity, maximum useful life, labour substitution in hours, maintenance costs, and a factor representing the impact of technological change.[7] Maintenance costs are expressed as a percentage of total investment costs.

[7] For more clarity subscripts i, and d will be omitted in the following.

Table 2: Investment attributes

Investment attributes
- ID-number
- Type of investment (d)
- Investment costs (€)
- Production capacity (heads or hectares)
- Maximum useful life (periods)
- Labour substitution (hours)
- Maintenance cost (% of investment costs)
- Technological change factor (%)

The maximum time that an investment can be used in production is given by its useful life. Before any investment object has reached its maximum useful life, the object cannot be sold. Accordingly, an object's salvage value at the end of the useful life is zero such that it is non-tradable. This particular assumption has important consequences for the decision making of farm agents because it implies that investment costs are fully sunk once an investment is made. Because of this, depreciations not variable and treated as fixed costs in any case.

Capital required for production and investments is considered in three forms: short-term credit, long-term credit, and liquid equity capital.[8] Short-term credit is taken up by farms in the case of short-term liquidity shortages. The amount of short-term credit is not explicitly limited but interest is higher than for long-term credit, which therefore sets a kind of natural limit for borrowing in the short-term.

Long-term borrowed capital can be used to part-finance investments. It is assumed that a maximum share $(1-v)$ of investment costs is part-financed with borrowed capital with the remaining share v representing the equity financed share. Borrowed capital for investment is supplied by an annuity credit that runs for the entire useful life of the investment. The maximum amount of borrowed capital is also not directly restricted. Nevertheless, it is assumed that a farm only invests if the equity financed share of total investment costs does not exceed a minimum equity reserve threshold MR value given by

$$\sum_{l=1}^{L}(v \cdot A_l) \leq L + 0.7 \cdot LA + 0.3 \cdot \sum_{l=1}^{L} A_{ec,l} \text{ with } L = EC_{t-1} - LA - \sum_{l=1}^{L} A_{ec,l} \text{ .} \quad (1)$$

[8] Liquid equity capital is defined as total equity minus land assets minus equity bound in asset capital.

That is, there is a limit on the maximum equity capital that can be used for investment. The limit is introduced to prevent putting the substance of the farm at risk.[9]

2.3.2 Production activities

Production activities in AgriPoliS are distinguished into livestock production (e.g. fattening pigs, turkeys), plant production activities (e.g. crops, sugar beets, grassland), short-term capital activities (e.g. short-term borrowing), short-term labour activities (e.g. short-term hiring), and 'additional' activities. Most livestock and plant production activities are consist of the production of marketable products. Exceptions are grassland production activities and silage maize, which serve as intermediate products for livestock production. Additional activities relate to those activities besides capital and labour which are needed to balance capacities in the short-run. This includes, for example, manure disposal, machinery contracting, or milk quota lease. Similar to investment objects, each individual production activity is characterised by a set of attributes (Table 3).

In the simulation, products are managed by the farm agents in a product list that keeps track of the total units produced as well as the gross margins associated with each product. Product prices change in response to developments on product markets (see section 2.5.2). Variable unit production costs are affected by technological change, on the one hand, and by the individual managerial ability of a farm agent.

Table 3: Product attributes

Product attributes
ID-number
Production branch (e.g. sows for breeding, dairy production)
Product produced with investment Io of type d
Price (€/unit)
Variable unit production costs (€/unit)
Price flexibility
Price trend (% change per period)
Support payment (direct payment) (€/unit)

[9] This means that 70% of land assets LA and 30% of total equity-financed fixed assets have to be covered by total equity capital EC_{t-1} at all times. The parameters 0.3 and 0.7 produced the most plausible results in a set of try-out simulations with AgriPoliS.

2.4 The farm agent[10]

To characterise the farm agent, it is useful to first describe why farm agents do what they do and based on what. That is, this section will first describe a farm agent's behaviour and the goal of its actions before describing the farm agent's actions.

2.4.1 Behavioural foundation

Farm planning

To model the behaviour of farms it is necessary to make assumptions about goals, expectations, managerial ability, and the variety of actions that a farm agent can pursue. AgriPoliS assumes each farm agent to maximise farm family household income in any one planning period. One planning period corresponds to one financial year. That is, a farm agent aims for maximising the total household income earned by farm family members either on or off the farm.[11] The action space given to farm family members is defined by on-farm factor endowments (land, labour, fixed assets, liquidity), the situation on markets for production factors and products, the vintage of existing fixed assets, technical production conditions, overall economic framework conditions (work opportunities outside the farm, interest rate levels, access to credit), and the political framework conditions.

In order to maximise household income, farm factor endowments, production activities, investment possibilities, and other restrictions need to be brought together and optimised simultaneously. A suitable setting for this is a mixed-integer optimisation problem, the solution to which gives the optimal combination of action possibilities subject to the given framework conditions. Figure 7 shows a matrix of the optimisation problem.

In this scheme, investments and fixed labour are considered non-divisible. They are therefore introduced as integer activities. The set of constraints consists of on-farm production capacities, but some constraints also reflect political framework conditions, such as the set-aside requirement, the limit on livestock density, or the nutrient balance. In more formal terms the mixed-integer optimisation problem is expressed as (abbreviations are given in Table 1)

[10] In this section, subscript k is omitted to increase clarity. All formulae concern one farm agent only.

[11] The assumption of household income maximisation is reasonable in the current version of AgriPoliS as it is applied to a region with only family farms, where the majority of the workload is done by unpaid farm family labour. If other organisational forms such as corporate farms would be considered, this particular assumption would probably need to be reconsidered to reflect potentially different goals of corporate farms.

$$\max Y^e(\mathbf{x},\mathbf{p}^e,\mathbf{c},\mathbf{A},\mathbf{I},\mathbf{r},MP,D,RE,L,BC,IC,\ldots)$$

$$\text{with } Y^e = \mathbf{x}'(\mathbf{p}^e - \mathbf{c}) + IR + S + W - RE - MC - D - OV - TC - IC - HW \qquad (2)$$

$$\text{s.t.} \quad \mathbf{b} \geq \mathbf{x}'\mathbf{r} \quad \text{with} \quad \mathbf{r} = (r_1,\ldots,r_I,\ldots,r_H,\ldots,r_J)$$

$$\mathbf{x} \geq 0$$

This optimisation problem produces the vector q of shadow prices for scarce resources. Particularly the shadow price of land q_{Land} is of interest because it provides the basis for the production of bids in the land auction (see section 2.4.2).

Mixed-integer programme		Short term loans/saving	Buy/sell variable labour	Hire contractor	Plant production	Livestock production	Set-aside land	Buy/sell manure	Buy/sell milk quota	Investment activities	Buy/sell fixed labour
		c	c	c	c	c	c	c	c	i	i
	Objective function	*Gross margin*									
Factor capacities	Liquidity (€)	x		x	x	x	x			x	x
	Min. equity capital reserve (€)				x	x	x			x	x
	Labour (h)		x		x	x	x	x		x	x
	Utilised agricultural area (ha)				x			x			
	Winter fodder (ha)					x					
	Livestock capacities (places)					x				x	
	Machinery (ha)			x	x		x			x	
Other restrictions	Organic N-balance (kg N/ha)				x	x					
	Rape seed max. (% of UAA)				x		x				
	Sugar beet max. (% of UAA)				x						
	Set aside (% of UAA)				x		x				
	Milk quota (litres)					x			x		
	Direct payments (€)				x	x	x				
	Stocking density (LU/ha)				x	x	x				

Notes: c = continuous activities, i = integer activities
Source: Own figure.[12]

Figure 7: Exemplary scheme of a mixed-integer programme matrix

[12] Compared to highly differentiated and detailed farm-based linear programming models, the optimisation model in AgriPoliS is aggregated. In view of a very detailed representation of the farm organisation the chosen aggregation can be considered to be a rather crude simplification compared to the actual planning situation and question faced by real farms. Yet, with respect to the objective of AgriPoliS it is not the specific farming system which is of interest in this study but rather a basic representation of central organisational characteristics as well as financial/economic considerations.

General remarks about expectation formation

Production planning, investment, but also the decision to continue or quit farming is based on expectations about future developments of prices, costs, technologies, investment possibilities, and policies. In AgriPoliS, farm agents can form short-term expectations about the next planning period. However, farm agents are not capable of forming long-term expectations. With respect to all other future periods, they expect prices and costs to remain constant.[13] By doing so, dynamic effects resulting from expectations about the development of markets and demand developments are neglected. Farm agents also follow the same pattern of expectation formation, i.e. there is no differentiation between optimists and pessimists.

Price expectations

Regarding prices, a farm agent follows adaptive expectations defined in terms of the weighted geometric average of actual and expected prices.[14] A farm agent bases all planning decisions on expected prices because actual prices are only determined at the end of a production period as a result of farm activity. The expected price of production activity i in period $t+1$ is determined as

$$p^e_{i,t+1} = (p_{i,t}{}^{\alpha} \cdot p^e_{i,t}{}^{(1-\alpha)}) \cdot \gamma_i{}^{-1} \text{ with } 0 \leq \alpha \leq 1 \text{ and } p > 0 \text{ for } \mathrm{i} = 1, \ldots, \mathrm{I} \tag{3}$$

The coefficient γ controls for a price trend of production activity i, whereby prices increase (decrease) if $\gamma < 1$ ($\gamma > 1$). In AgriPoliS the actual price and the expected price in period t are equally weighted, i.e., $\alpha = 0.5$.

Cost expectations

A farm agent also forms expectations about production costs. With regard to cost expectations, livestock and plant production activities are treated differently from additional production activities.

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[13] This assumption has some implications in particular for investment activity because farm agents make long-term investment decisions on the basis of short-term expectations. If farm agents would be able to articulate medium or long-term expectations, some investments probably would not be made. The introduction of long-term expectations might be desirable but currently it is limited by practical problems. It appears to be particularly difficult to consider short-term and long-term expectations simultaneously. The problem would be even more complex if expectations would also be made with respect to the behaviour of other farm agents.

[14] Unlike the more common definition as the weighted arithmetic mean, the chosen definition tones down expectations for period t+1 if expected prices and actual prices in period t differ (cf. BALMANN 1995).

For the group of additional production activities, a farm agent forms cost expectations in the same way than price expectation, however, without the price trend. Accordingly, expected costs of additional production activities are calculated as the weighted geometric average with equal weights

$$c^{e}_{i,t+1} = c_{i,t}{}^{\alpha} \cdot c^{e}_{i,t}{}^{(1-\alpha)} \text{ with } 0 \le \alpha \le 1 \qquad \text{for i} = 1,\ldots,\text{I}. \tag{4}$$

Cost expectations for livestock and plant production activities are determined in a different way in order to introduce the cost-saving impact of technologically more advanced production technologies (see discussion on technological change). With respect to this, it is necessary to distinguish between plant production activities and livestock production activities.

As mentioned above, it is assumed that the technological standard of production technology improves with time. Thus, with every new investment into livestock production, the expected production costs $c^{e}_{i,t+1}$ of livestock production activity i produced with investment object I are computed as

$$c^{e}_{i,t+1} = c_{i,t} - f_{o,i} \cdot c_{i,t} \text{ with } 0 \le l < 1 \qquad \text{for i} = 1,\ldots,\text{I}, \tag{5}$$

whereby factor f represents the size of the investment. The factor is higher for larger investments.

On the subject of plant production activities, cost savings can only be realised as a combination of larger machinery together with larger field sizes.[15] Expected costs of plant production activities $c^{e}_{i,t+1}$ are thus a function

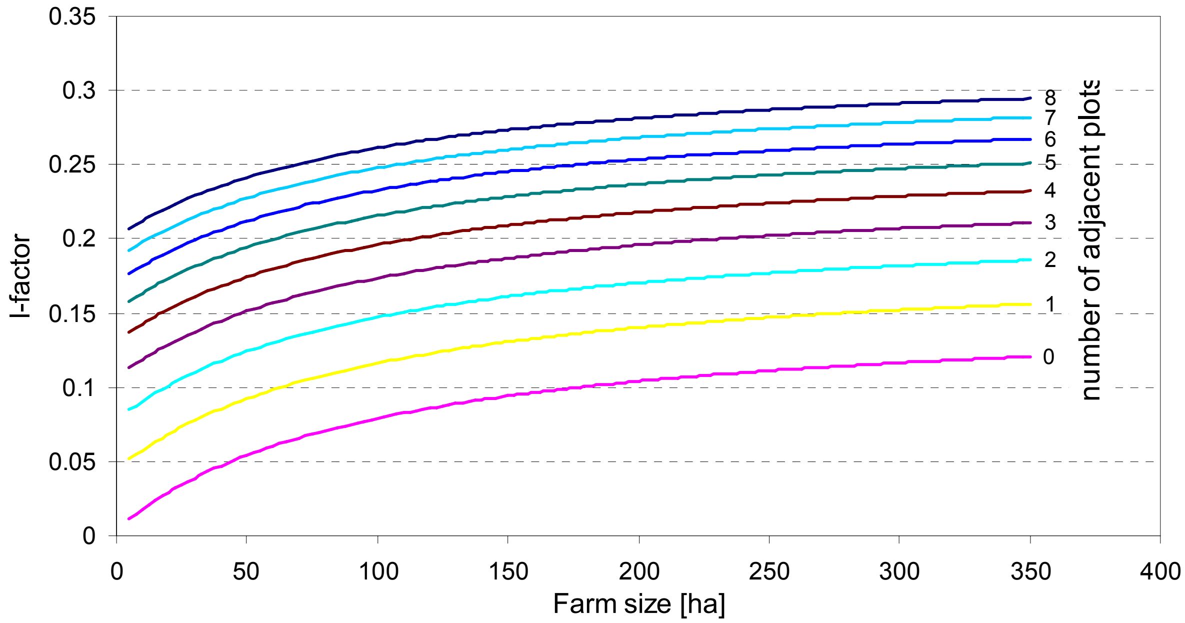
$$c^{e}_{i,t+1} = c_{i,0} - l \cdot c_{i,0} \text{ with } 0 \le l < 1 \qquad \text{for i} = 1,\ldots,\text{I} \tag{6}$$

of costs at the outset of the simulation in period t=0, adjusted by a factor l, which is a function of the average number of adjacent plots and the size of the farm. The factor l thus captures the effect of larger field sizes. It is defined as

[15] KUHLMANN and BERG (2002) quantify the cost difference between a 1 ha plot and one of 60 ha at 250 €/ha which corresponds to about a third of the current revenue for wheat.

$$l_t = \cdot\left[1 - \frac{0.15}{1+100/Z}\right]\cdot\left[1 - \frac{0.45}{1+100/(10\cdot AP_t+1)}\right]. \quad (7)$$

Figure 8 shows values of l for different farm sizes and average numbers of adjacent plots. Accordingly, a farm agent with initially little and scattered land can realise large cost savings if it considerably increase its acreage. The potential cost effect is much lower if a farm agent's acreage is already high and if the plots are in the neighbourhood.



Source: Own figure.

Figure 8: Expected cost savings for machinery investments depending on farm size and the average number of adjacent plots

Expectations about policy changes

When forming expectations about the next planning period, policy changes have to be taken into account as well, particularly if changes are expected to be strong. It is assumed that a farm agent knows about major policy changes one period before the policy becomes effective. This influences decision making primarily when it comes to evaluating the farm agent's profitability at the end of a planning period. In AgriPoliS, no general expectation formation with regard to policy changes is implemented. Rather, depending on the policy setting to be simulated, specific assumptions and expectations have to be formulated and introduced into the model.

Managerial ability

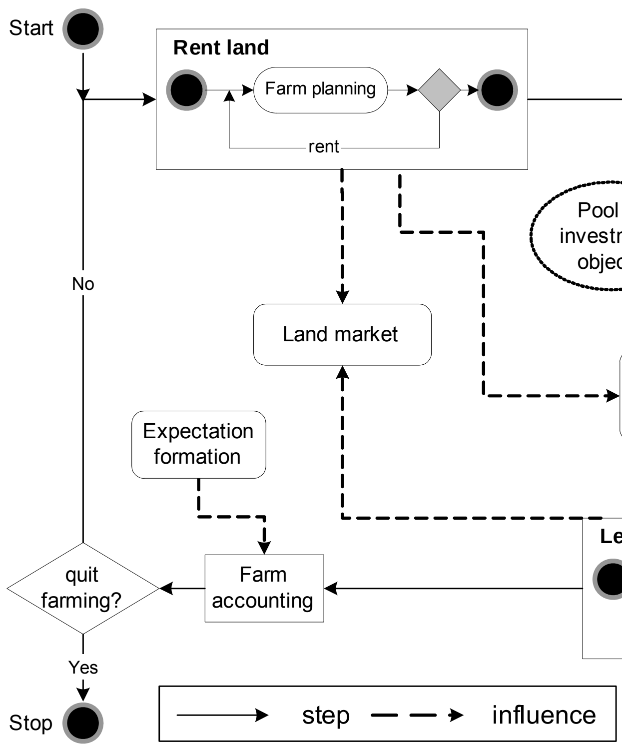
In real world agriculture, the economic performance of farmers can differ substantially even if they operate under more or less the same production conditions using the same production technologies. These differences in the economic performance of farmers are often attributed to differences in the managerial ability of farmers (Nuthall 2001; Rougoor et al. 1998). Managerial ability can be understood as the ability of a farm agent to use its technology to realise all potential cost savings. Accordingly, production costs are lower if managerial ability is higher. In AgriPoliS, the managerial ability of a farm agent is introduced by a factor m, which is drawn randomly from a uniform distribution at start-up. The factor affects production costs of all products in the initial period according to

$$c_{i,0}^{new} = m \cdot c_{i,0} \quad . \tag{8}$$

In the current version of AgriPoliS, farm agents cannot learn to improve managerial ability.

2.4.2 Farm actions

During one planning period, a farm agent passes through a number of steps (Figure 9).



Source: Own figure based on BALMANN (1995).

Figure 9: Course of events in one planning period for one farm agent

Based on the figure, the most important actions undertaken by a farm agent are renting land (renting additional land and disposing of unprofitable land), investment, production, farm accounting, and the decision whether to quit farming or stay in the sector.

Renting land

The land market is of particular relevance. As farms predominantly grow by renting land, AgriPoliS only considers a land rental market. As shown in Figure 3, in AgriPoliS, all farmland is categorised as plots of the same size. Plots are not divisible, and their size is fixed during one simulation run. Accordingly, the size of a plot defines the smallest unit by which farm acreage can change. Initially, each farm agents is endowed with a certain amount of land consisting of owned and rented land. Regarding the duration of a rental contract, no formal contract length is introduced in AgriPoliS. Instead, it is assumed that a farm agent can terminate unprofitable rental contracts at the end of each planning period. Rental contracts for profitable plots remain valid.[16] Accordingly, land is available for rent either because a farm agent withdraws entirely from agriculture or because rental contracts are terminated.

In each period, land available for rent is allocated to farms in an iterative auction. In order to be eligible for renting one additional plot a farm agent is asked by the auctioneer agent to make a bid for a particular plot in the region. Assuming that transport costs and the exploitation of economies of size for machinery (see section 3.5.1) influence the renting behaviour, a farm agent aims at renting a free plot which is closest to the farmstead and next to other plots belonging to the same farm agent. The maximum price, or bid, $BID_{y,z}$ for plot $P_{y,z}$ of either land quality is a function of both transport costs $TC_{y,z}$ between the farmstead and the plot, and the number of adjacent plots T . It is defined as:

$$\begin{aligned} BID_{y,z} &= (q_{Land} - TC_{y,z}) \cdot \beta + T \cdot \delta && \text{for} \quad 2 < T \leq 8 \\ BID_{y,z} &= (q_{Land} - TC_{y,z}) \cdot \beta + \delta && \text{for} \quad 0 < T \leq 2 \\ BID_{y,z} &= (q_{Land} - TC_{y,z}) \cdot \beta - \delta && \text{for} \quad T = 0 \end{aligned} \qquad (9)$$

with $0 < \beta < 1$.

Parameter β reduces the bid to reflect other costs associated with leasing land such as taxes, administrative costs, labour costs and fees as well as the farm agent's additional rent derived

[16] This assumption is quite different from rental contracts in reality, which usually involve a long-term commitment for a number of years.

from renting this plot. Accordingly, β represents the proportion of the shadow price of an additional plot remaining with the farm agent. The higher the value of β – and therefore the higher the bid – the larger the proportion of the shadow price of land that is eventually passed on to the land owner. A higher bid also increases the probability of a farm agent to receive the plot it wishes. In this respect, the difference $q_{Land} - \beta \cdot (q_{Land} - TC_{y,z})$ can also be interpreted as a kind of security mark-up. Moreover, if the desired plot is next to other farm plots, a surcharge δ is added to the bid. If the bid is highest compared to other farms, the farm agent receives the plot.

An obvious problem with this procedure is related to the fact that the shadow price of land is only determined for one additional plot at a time. In fact, because of the indivisibility of investment options, the shadow price for land derived from the optimisation model may potentially change rapidly if calculated for more than one plot at a time. For that reason, it would be reasonable if farm agents could bid for more than one plot at a time. This poses computational difficulties, though, as different bundles of plots would need to be tested to derive the maximum shadow price from a combination of plots. Therefore, in addition to the shadow price for only one plot the average shadow price for renting eight plots at a time is calculated. The maximum shadow price of one additional plot and of eight additional plots is then taken as the basis for the bid.

Similar considerations apply when a farm gives up rented land to increase its overall profitability (see section on farm accounting).[17] In this case, a farm would give up the rented plot $P_{y,z}$ if the shadow price does not cover the plot's costs consisting of the rent $R_{y,z}$ and transport costs $TC_{y,z}$, that is if

$$q_{Land} < \max_{y,z} (R_{y,z} + TC_{y,z}).^{18} \tag{10}$$

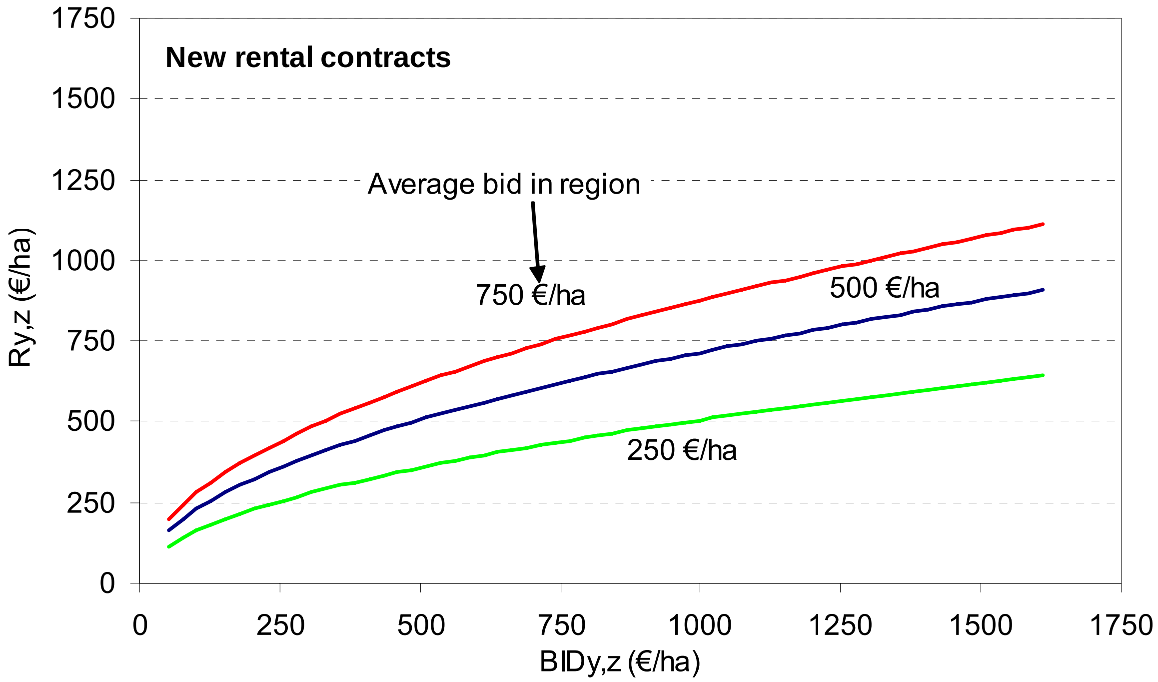
After giving up a plot, the farm recalculates the shadow price of land. The procedure is repeated until the shadow price of land is at least equal to the costs of a plot. Unless a farm agent withdraws from agriculture altogether, it is not possible to let owned land in order to be rented by other farm agent.

[17] Here, the number of adjacent plots is not taken into account.
[18] Adjacent plots are not considered when rental contracts are terminated.

In AgriPoliS, the rent paid for a plot is not equal to the bid given in the land auction. This has two reasons. The first is that shadow prices can vary significantly between farms. Hence, rents would differ significantly between farms, which would affect the farm agent's competitiveness. The second reason is that an equality of bids and rental prices is rather unrealistic. In reality, most new rental contracts include a passage that places rents in the context of an average regional rent. To reflect this, the actual rent paid for a newly rented plot is calculated as

$$R_{y,z} = \sqrt{BID_{y,z} \cdot \overline{R}}\ , \tag{11}$$

i.e., is it derived from the weighted geometric average of the bid $BID_{y,z}$ given in the auction and the average regional rent $\overline{R}$ with equal weights. Figure 10 shows this relationship graphically.



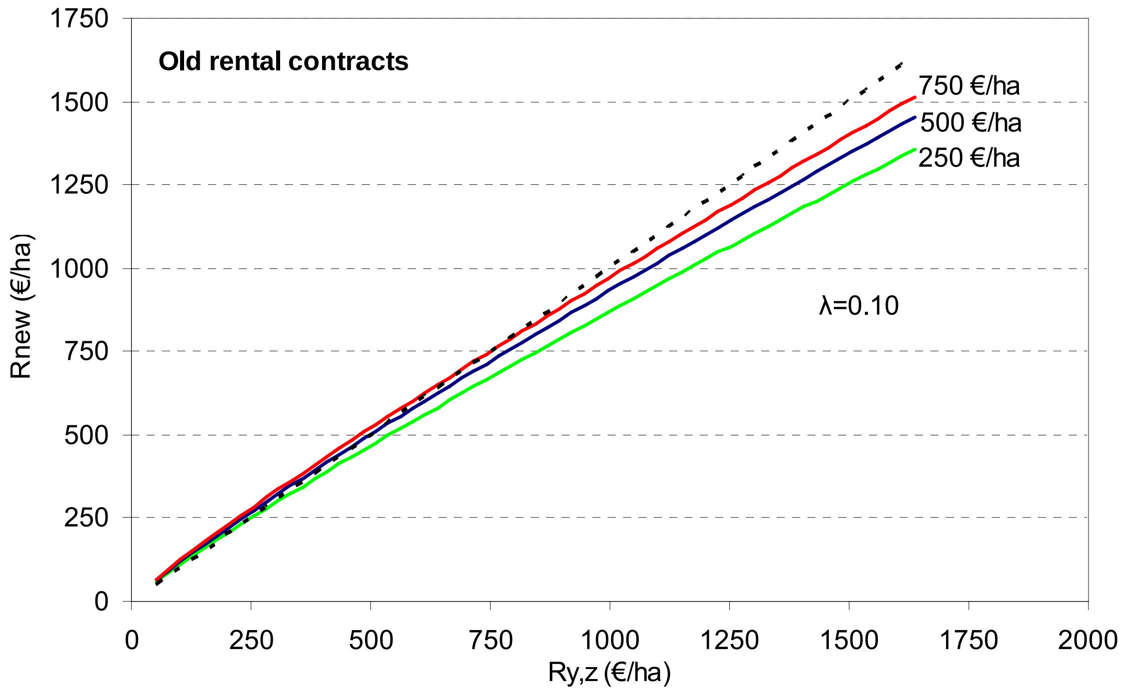
Source: Own figure.

Figure 10: Rent adjustment for new rental contracts

As it is often the case in reality, also the rent fixed in older rental contracts is adjusted. Frequently, such an adjustment is due to strong product price changes, policy changes, or changes in the regional reference rent. In AgriPoliS, the adjusted rent $R_{y,z}^{new}$ for old contracts is the weighted geometric average of the average rent in the region and the previous rent of the plot

$$R_{y,z}^{new} = \overline{R}^{\lambda} \cdot R_{y,z}^{(1-\lambda)}, \qquad (12)$$

whereby the weight λ is given by the share of newly rented land in the entire region. Depending on λ and the average regional rent, the adjusted rent develops close to the initial bid. This is plotted in Figure 11.



Source: Own figure.

Figure 11: Rent adjustment for old rental contracts assuming 10% newly rented plots

Investment

Farm investment activity is typically concerned with the purchase of machinery, buildings, facilities, and equipment. As investment and production are mutually interdependent, they are considered simultaneously in the mixed-integer planning programme.

Investments in AgriPoliS take place in two steps, investment planning and the actual investment. In the first step, the farm carries out planning calculations based on the farm planning problem. During the planning calculations, be it in the context of renting land or for production, a farm agent takes investment opportunities into account. However, during all planning calculations the agent does not invest in real terms but plans 'as if' he invested, i.e. production capacities are not actually changed. The number, kind, and combination of investments are not restricted. In principle, a farm agent only invests in one object or a combination of objects if the expected average return on investment, determined in the farm-planning problem, is positive, i.e. if total household income increases. For investment-planning purposes, all expenditures and payments related to an investment are distributed equally over the investment's useful life and considered in the optimisation. Accordingly, the average annual costs AC_h of investment $I_{h,i}$ considered in the objective function of the farm-planning problem are calculated as

$$AC_h = A_h \left[(1-v) \cdot CRF_{i_{bc},N_h} + \frac{v}{N_h} + MC_h \right]. \tag{13}$$

Maintenance costs MC_h are expressed as a percentage of total investment costs. The average annual opportunity costs of equity capital bound is determined as

$$A_h \cdot v \cdot f, \qquad \text{with} \quad f = \frac{(1+i_{ec})^{N_h}}{(1+i_{ec})^{N_h} - 1} - \frac{1}{N_h \cdot i_{ec}}. \tag{14}$$

Only in the second step, based on the planning calculations, the actual investment activity takes place resulting in a change of production capacities. After investment, depreciation and repayment are determined as shown further down in Table 5.

Production

Each farm agent is assumed to optimise production in any one planning period subject to available production capacities using the planning approach described above. All production activities enter the optimisation as continuous activities. That is to say, products are assumed to be fully divisible.

In addition to fixed assets (buildings, machinery, equipment), production requires liquidity to cover running costs in the short-run. Products produced continuously throughout the year (mostly livestock production) have a constant demand of working capital, which in AgriPoliS is defined as liquid assets. Other products such as crops are seasonal products and therefore require working capital only during parts of the year. To overcome short-term liquidity shortages, farm agents can take up loans to finance working capital.

Farm accounting

The financial year of a farm agent ends with an annual financial statement. This statement produces indicators on incomes and profits, the stability and financial situation of the farm agent, and the remuneration of fixed factors. Table 4 lists central indicators and how they were derived; Table 5 shows a list of selected variables in the financial statement.

Table 4: Indicators calculated in the financial statement

Indicator (end of period t)	Calculation
Profit (farm income) (t) =	Gross margin + Interest on working capital + Subsidies - Rent paid - Current upkeep of machinery and equipment - Depreciation - Farming overheads - Transport costs - Interest paid - Wages paid
Household income (t) =	Profit + Off-farm income
Farm net value added (t) =	Profit + Rent paid + Interest paid + Wages paid
Equity capital (t) =	Equity capital (t-1) + (Household income - Withdrawal)

Change in equity capital is an indicator of a farm agent's economic stability. A farm is economically more stable the higher the equity-debt ratio of the farms, i.e. the higher the share of equity capital in total capital. Consequently, it would be reasonable for a farm to stop farming if equity capital is less than zero. In this case, all own resources, which could be used, for example, as credit security are used up.

Accumulation of equity capital is the result of balancing total farm income with living expenses. In AgriPoliS, the equity capital stock increases because total household income is greater than withdrawals. Regarding withdrawals, it is assumed that each family labour unit working on the farm consumes at least $WD_{\min}$ per year. A share ε of the remaining farm household income after deducting $WD_{\min}$ is consumed in addition to the minimum withdrawal. The remaining share $(1-\varepsilon)\cdot(Y-WD_{\min})$ is then charged to the farm agent's equity capital. Table 5 shows this.

Table 5: Definition of variables used in financial statement (selection)

Variable (at end of period t)	Definition
Equity capital	$EC = EC_{t-1} + Y - WD$
Withdrawal	$WD_{\min} \leq WD \leq (Y - WD_{\min}) \cdot \varepsilon + WD_{\min}$ with $0 < \varepsilon \leq 1$
Gross margin	$GMA = \mathbf{x}'(\mathbf{p} - \mathbf{c})$
Interest on borrowed capital	$IC = \mathrm{f}(BC, i_{BC})$
Repayment	$RP = (1-v)\sum_{c=1}^{S}\left[A_c \cdot (1+i_{bc})^{(n_c-1)} \cdot (CRF_{i_{bc},N_c} - i_{bc})\right]$
Long-term loans	$BC = BC_{t-1} - RP + BC^{new}$
Depreciation	$D = \sum_{c=1}^{S}\left[A_c \cdot (1+i_{bc})^{(n_c-1)} \cdot (CRF_{i_{bc},N_c} - i_{bc})\right] + \sum_{c=1}^{S}\left[A_c \cdot (1+i_{ec})^{(n_c-1)} \cdot (CRF_{i_{ec},N_c} - i_{ec})\right]$
Farming overheads	$OV = \gamma \cdot GMA$ with $\gamma \leq 1$
Current upkeep (maintenance)	$MC = \sum_{c=1}^{S} MC_c$
Rent paid	$RE = \sum_{y}\sum_{z} R_{y,z}$
Transport costs	$TC = \mathrm{f}(DI_{y,z})$
Liquidity[a)]	$L = EC_{t-1} - LA - A_{ec}$
Interest on working capital	$IR = i_{ec} \cdot L$

Notes: a) Liquidity is updated throughout the accounting year whenever the total equity capital stock changes due to investment or disinvestment.

Lasting farm profitability requires that all farm-owned production factors (own land, family labour, liquid equity capital, and quota) receive an adequate payment when used on-farm. To assess farm profitability, all on-farm production factors have to be valued at their opportunity costs (Table 6). Since costs of fixed assets are assumed sunk, they are not considered in this calculation. In the case of handing over the farm to the next generation, opportunity costs of labour are also higher if a farm is handed over to the next generation. This reflects the comparable industrial salary a successor could potentially earn if he/she would not take over the farm. Accordingly, a successor would only take over the farm if the farm were able to generate income that is at least as high as the opportunity costs.

A decision on whether to quit is necessary subject to the expected household income in future periods. As mentioned above, the planning horizon of a farm agent is one period. Hence, the calculation of expected household income takes account of investment possibilities and off-farm employment possibilities in the next period. Moreover, expected household income rests on the assumption that a farm agent's land endowment does not change. The resulting expected household income is contrasted with the opportunity costs of all on-farm production factors.

Table 6: Opportunity costs of production factors

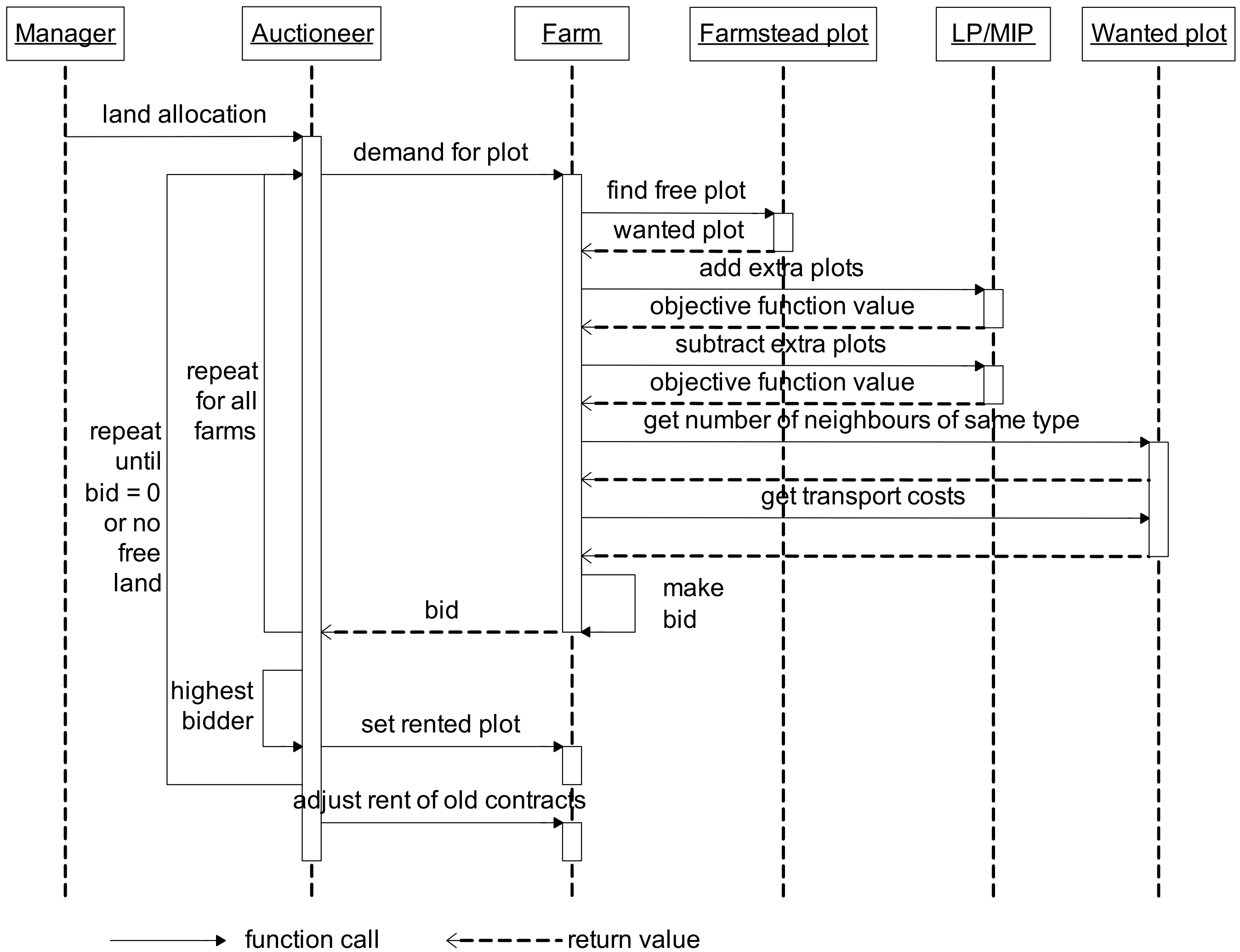
Factor	valued at
Farm family labour	Off-farm income
Labour of farm successor	Comparable industrial salary
Working capital	Long-term savings rate
Owned land	Average regional rent
Milk quota	Quota price

If expected household income does not cover opportunity costs, it is rational for the farm to quit and use all production factors outside the farm. This decision rule defines a clear threshold between quitting and staying. In some instances, it may be reasonable to blur this threshold, for example, by introducing a tolerance margin in which farms stay in business despite of higher opportunity costs.

2.5 Factor market agents

2.5.1 Land auctioneer

Compared to a farm agent, the auctioneer is a very basic kind of agent. The auctioneer to coordinates the auction of free plots by collecting bids from farm agents; it then compares the bids, and finally allocates a free plot to the highest bidder. The auctioneer acts on behalf of land owners who are not engaged in farming, but receive all rent payments. The exact auction process is illustrated in Figure 12 using UML notation.



Source: Own figure.

Figure 12: Sequence diagram of the land auction using UML notation

According to this figure, the order of events is the following: Triggered by the `Manager` class, the auctioneer carries out an iterative auction of free plots. It does so by asking each farm agent intending to rent additional land to produce a bid for one plot. The farm does so by first searching for a free plot closest to the farmstead. It then determines a bid for that plot based on a combination of the shadow price of land, the number of plots adjacent to the desired plot, and transport costs. Following, the auctioneer ranks the bids and allocates the desired plot to the highest bidder. As farm agents can only bid for one plot at a time, the bidding procedure continues until all plots are allocated or the highest bid is zero. In a final step, the auctioneer determines the actual rental price that is to be paid for the plots just allocated. In addition to setting the price for new rental contracts, the auctioneer also initiates the price adjustment of old rental contracts by applying the rent adjustment procedure presented in section 2.4.2. This ends the land allocation procedure.

2.5.2 Product market

The product market agent determines a market price for all produced outputs in any one period. For this, the market agent makes use of a number of price functions. The demand function for agricultural products in AgriPoliS assumes neither a fully elastic nor a fully static demand. In analogy to the function for gross margins developed in Balmann (1995), it is assumed that for most products of products i the price in period t is a function

$$p_{i,t} = p_{i,0} \cdot \gamma_i^{-(t+1)} \cdot \left(\frac{\sum_k X_{k,t}}{\sum_k Z_{k,t}} \right)^{-b_i} \quad \text{with } k = 1, \ldots, K, \qquad (15)$$

where $p_{i,0}$ denotes the initial price of product *i* at the outset of the simulation (period t=0), the coefficient γ_i controls for a price trend over time, and the last term allows for price variation in depending on the cumulative quantities produced by K farm agents. The parameter $b_{i,t}$ represents price flexibility which is equivalent to the inverse demand elasticity (cf. BALMANN 1995).

The price function differs for selected products. In particular this is:

- *Piglet production:* Piglets are assumed to be used as intermediate inputs in fattening pig production. For this reason, the total quantity of piglets produced is reduced by the quantity of piglets used for fattening pig production.[19]

- *Milk quota:* Since the year 2000, prices for milk quota in Germany have been determined in quota auctions. Implementing such an auction would be a complex matter (comparable to the land auction). Regarding quota, AgriPoliS therefore implements a highly simplified quota market in that it reflects only the results of quota auctions. In principle, farms can buy and sell quota indefinitely. But, to keep milk production within realistic limits, the price of quota is related to a regional reference quota.[20] If milk production is above (below) the regional reference level plus a 10% tolerance, the quota price rises (falls) by a given percentage. The quota market as implemented in the model resembles a quota leasing market. To prevent quota from leaving the region, the marginal revenue of selling quota is less than the marginal revenue of buying additional quota.

- *Manure trading:* Regarding manure trading, farm agents generally pay to dispose of excess manure, on the one hand. On the other, farm agents receive payments for taking excess manure up to a given limit. Manure trading is not limited to the region. That is why in the simulation there may be more farms taking up manure than farms disposing of manure and vice versa. Similar to the market for milk quota, the price of disposing manure rises the more excess manure is offered.

2.6 Data input, results preparation and data output

AgriPoliS has an interface to a spreadsheet file that includes data on the regional agricultural structure to be studied to initialise the model (see also Figure 1). On the input side, data – broadly speaking - input consists of farm accountancy data, regional statistics, and stylised data on technical coefficients, prices and costs. On the output side, AgriPoliS compiles aggregate data at the sector level (class `SectorResults`), on the one hand, and individual farm data, on the other hand. More specifically, data output at sector level and at farm level (class `DataOutput`) include data listed in Table 7. Based on these indicators it is possible to draw

[19] At the current development stage, there is no interdependence between the price of piglets and the gross margin of pig fattening.

[20] The regional reference quota is calculated as the total number of dairy cows in the region to be modelled times the average milk yield in that region. A tolerance range of ±10% around the regional reference quota is assumed, so that it does not function as the exact threshold value for price changes.

conclusions with respect to production, economic performance of farms, production intensity, income distribution, and farm structure.

Table 7: Data output at farm and sector level (selection of key data)

Farm level	Unit	Sector level	Unit
Structure		**Production**	
Farm size	ha	Region totals	ha, LU
Economic size	ESU	**Inputs**	
Farm type		Total land input	ha
Main income source	Professional/ non-prof.	Total capital input	€
Owned land	ha	Total labour	h
Rented land	ha	**Investment**	
Production		Investment expenditure	€
Output in quantities	ha, LU		
Output in value	€	Sector totals of farm level data	various units
Costs			
Overheads	€		
Maintenance	€		
Depreciation	€	**Farm level**	**Unit**
Wages paid	€	**Financial situation**	
Rent paid	€	Profit	€
Interest paid	€	Equity capital	€
Annualised average costs of fixed capital	€	Change in equity	€
Variable costs	€/unit	Net investments	€
Subsidies		**Income and labour**	
Direct payments	€	Labour input	h
Land		Family labour	h
Economic land rent	€/ha	Farm net value added	€
Rent paid arable land	€/ha	Total household income	€
Rent paid grassland	€/ha	Off-farm income	€
Balance sheet			
Total assets	€		
Total fixed assets	€		
Total land assets	€		
Liquidity	€		
Borrowed capital	€		
Short-term borrowed capital	€		

3 Adapting AgriPoliS to a case study area

As already mentioned in the Introduction (figure 1) the adaptation of AgriPoliS consists of three main steps. In this section, we describe the first step, which includes the collection and compilation of input files for AgriPoliS. Because we simulate the development of an agricultural region with AgriPoliS, we have to represent this region virtually in a base year. This representation is done in two steps. The first step is to represent the structure of the study region based on a number of farms. The second step is to represent the internal organisation of these farms, that is to say, their specialisation, main production activities, asset and capital endowments. Suitable data sources for the second step are standard farm management norms as provided, for example by KTBL and others.

3.1 Methodology to create the virtual farm structure based on typical farms

To create the initial virtual farm structure based on a set of 15 to 30 typical farms, we use an approach developed by BALMANN (1998) and further developed by KLEINGARN (2002) and SAHRBACHER (2003). This particular approach requires two kinds of data: first, data about the region representing aggregate regional capacities, and, second, data about the organisation as well as economic indicators of individual farms in the region, such as FADN, IACS or expert knowledge, from which to select typical farms.

Following BALMANN et al. (1998), the weighting or up-scaling procedure can be explained in more detail in the following way: *First*, we derive a set of typical farms. By typical we mean single farms which are closely related to empirically observed farms in the region (Balmann et al. 1998). Typical farms for a specific region can be defined according to real farm data, official statistics or expert knowledge (HEMME et al. 1997, BERG et al. 1997). A useful data source for identifying typical farms is the Farm Accountancy Data Network (FADN). *Second*, we define a list of statistical goal criteria, or regional capacities, for the base year which are available from agricultural statistics in the model region, such as the number of farms, farm size distribution, farm specialisation and overall livestock numbers. *Third*, we choose a vector of weights by applying a least squares estimation technique. We minimise the squared deviation between the observed goal criteria from agricultural statistics and the numbers calculated from our own "virtual" farm structure which is defined by the assigned weights to typical farms. As some goal criteria are more important then others, we furthermore prioritise them. Negative weights are ruled out, since the model farm properties are correlated and negative numbers of farms would be unrealistic.

Regarding typical farms there are two principal ways to select them: One is to actually select typical farms in step 1, as described above. This means that they need to be selected 'manually', for example, based on expert opinion, survey data or regional statistics. BALMANN et al. (1998) and KLEINGARN (2002) take this approach. It is preferable where there is no larger source of individual farm data. Depending on the availability of individual farms, the selection of typical farms, can be a tedious undertaking. Because he was facing the problem to select 25 typical farms from a set of 140 farms, SAHRBACHER (2002) chose to 'automate' the selection process and simultaneously select typical farms and derive the weights to scale up farm capacities to the region. This means that the selection of typical farms was included in step 3. As FADN data was available for all IDEMA case study regions, we followed this second approach. But this leads to the situation that the “typical farms” are no longer selected by expert knowledge but by a quadratic programming algorithm as described below. The goal function of this method is to select and weight the farms with which a region could be represented as best as possible. That implies a modification of the definition of typical farms made by BALMANN et al. (1998).

In mathematical terms, the weighting and, in the latter case, the selection procedure can be explained as follows:

Let $\mathbf{b}^k \in \Re^m$ be the vector of *m* farms in region *k* and let $\mathbf{y}^k \in \Re^n$ be the vector of weights for *n* statistical goal criteria in the region. Furthermore, let $v_{i,j}$ be the contribution *j* of farm *i*, and $V \in \Re^{m \cdot n}$ the matrix of contributions of all farms. From this we derive the vector of all goal criteria $\hat{\mathbf{y}}^k$ for the virtual region *k*

$$\hat{\mathbf{y}}^k = \mathbf{b}^\mathbf{k}\mathbf{V}.$$

Now we can construct a normalised matrix $\mathbf{X}^k \in \Re^{m \cdot n}$ with

$$\mathbf{X}^\mathbf{k} = \left[a_j^k \frac{v_{i,j}}{y_j^k} \right]_{\substack{i=1,\dots,m \\ j=1,\dots,n}}$$

and a_j^k as the priority level of criterion *j* in region *k*, or $\mathbf{a}^k \in \Re^m$ as the vector of weights of all criteria in region *k*. The vector of weights $\mathbf{b}^k$ then results from the minimisation problem

$$\min_{\mathbf{b}^k} \left\{ \left(\mathbf{X}^k \mathbf{b}^k - \mathbf{a}^k \right)^T \left(\mathbf{X}^k \mathbf{b}^k - \mathbf{a}^k \right) \right\} \quad \text{with } \mathbf{b}^k \geq \mathbf{0}.$$

This problem can be solved with a quadratic programming algorithm. All farms with $b_i^k > \mathbf{0}$, are then considered to represent the region. These farms we call typical farms. All other farm for which $b_i^k = 0$, are not considered any longer and removed from the sample. In this way it is possible to automate the selection of typical farms if more than 25 to 30 farms are in the farm sample.

3.2 Representation of typical farms

After the selection of the typical farms with the weighting method the second step is to represent these farms by a mixed-integer programme (MIP) which serves as the basis for farm planning (see section 2.4.1 above). The MIP represents the behaviour and organisation of the individual typical farms and it brings simultaneously together farm factor endowments, production activities, financing activities, alternative labour uses, investment possibilities, and restrictions to the farming activity. Here, we assume typical farms to maximise farm household income. Figure 7 in the previous section showed an exemplary matrix of the optimisation problem.

To build a MIP model, a variety of data is needed to define the activities and restrictions. For this, the weighting delivers data on typical farms. Regional data sources as well as individual farm data furthermore provide information on typical production activities and the typical farms' factor capacities. In addition, we asked regional partners to verify the choice of typical production activities in the respective regions. For the representation of the typical farms additional information is required to describe farm activities and restrictions more closely. In particular, information is required to define:

- *capital restrictions (liquidity)*: equity capital, asset value, land value, depreciation,
- *production activities*: gross margins, variable costs, (coupled) subsidies, technical coefficients on factor use (feeding requirements, liquid capital demand, labour demand, crop rotation, nitrogen production/uptake), average annual milk yield per cow, percentage of variable costs bound during a production period, crop rotation,
- *investment options*: investment costs, typical share of equity bound in investments, size/capacity of the investment, useful life, average work requirement per unit, estimates on maintenance costs,
- *financing activities*: interest rates for long-term and short-term borrowed capital, savings interest,

- *other activities (if specific to regional structure)*: quota lease, manure import/export, regional ceilings, e.g. on livestock density,
- *labour activities*: wages of unqualified farm-labour, wages of unqualified off-farm labour.

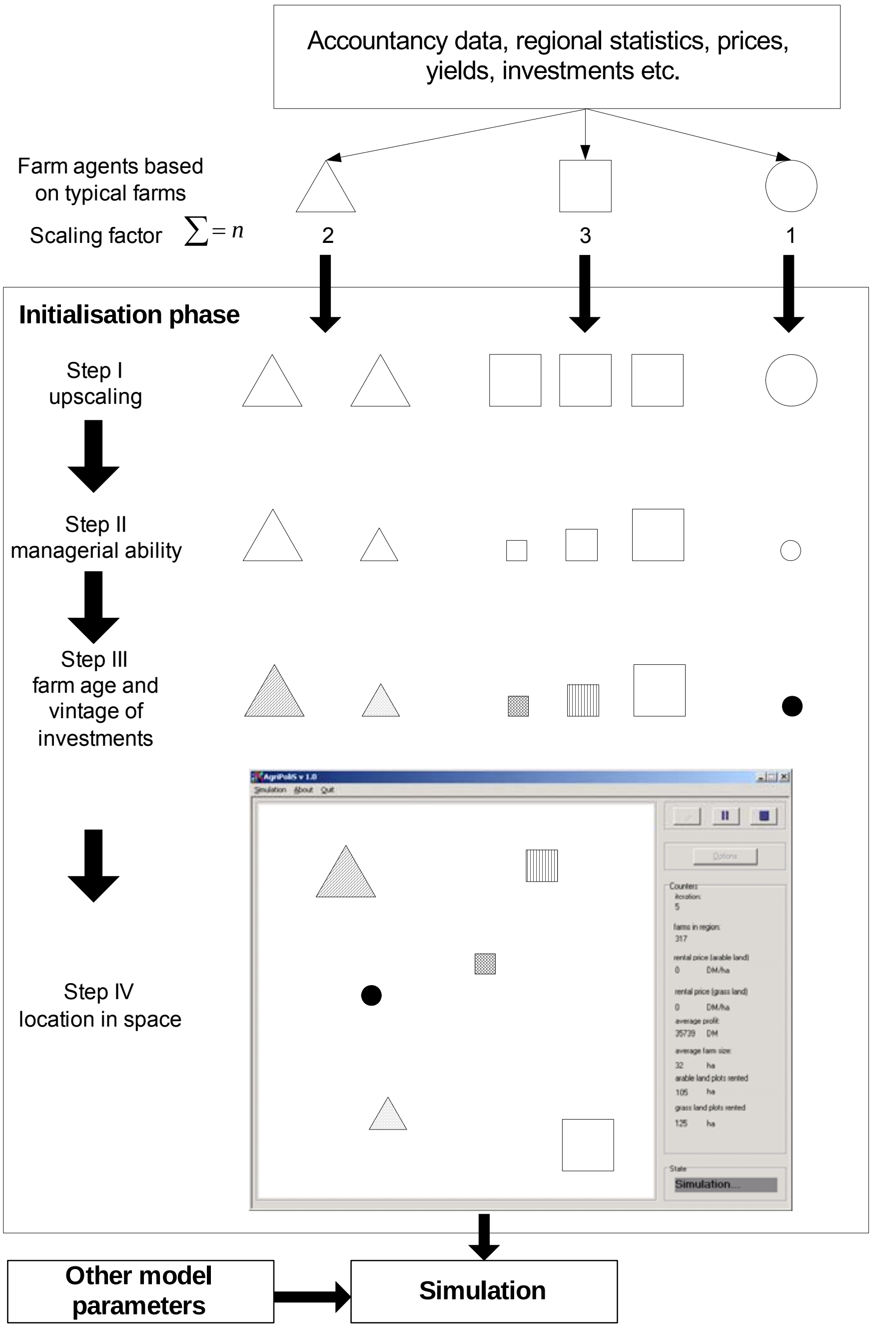
The MIP model is used to fulfil two tasks: Task 1 is to represent and – as much as possible – reproduce the typical farms' observed organisation consisting of production activities, factor endowments, and economic indicators. Task 2 is to provide options for alternative farm organisations, given by investment options, buying and selling of labour, contracting, and savings.

To represent individual typical farms by means of a MIP model we do the following:

- define key production activities
- define key investment options
- assign investment options to typical farms and define a random age for each investment
- identify additional production activities and restrictions
- setup MIP-matrix and compute MIP for capacities of each typical farm
- calibrate MIP parameters with regard to the following criteria
  - map optimised with observed production
  - avoid new investments in the MIP (because this would lead to a large deviation between observed and optimised production)
  - see that capacities are fully used
  - avoid that losses are too large (because this would lead many farms to quit farming quite quickly in AgriPoliS due to negative liquidity)

3.3 Initialising AgriPoliS

Having represented the typical farms in more detail, the next step to create the initial situation for AgriPoliS is to further individualise the typical farms. The initialisation phase is visualised in Figure 13 using the example of a hypothetical region. To simplify things, the figure considers three exemplary typical farms. Of these, farm 1 (triangle) has a weight or scaling factor of two, farm 2 (square) has a scaling factor of three, and farm 3 (circle) has a scaling factor of one.



Source: Own figure.

Figure 13: Details of AgriPoliS initialisation phase

The scaling factors sum up to the total number of farms n in the hypothetical region. The initialisation phase includes four steps: up-scaling, individualising farms with respect to managerial ability, individualising farms with respect to farm age and vintage of investments, and allocating farms in space. With each step, the heterogeneity of farm agents increases.

The process of creating the initial conditions ends by setting of a number of global parameters. They are called global, because they apply to all farms alike. Table 8 lists these for the example of the region Hohenlohe. Where possible, these parameters are based on available standard data sources (e.g., DEUTSCHE BUNDESBANK 2003 and KTBL).

Table 8: Exemplary default values of global model parameters for the region Hohenlohe

Description	Notation a)	Parameter value
Cost saving effect due to technological standard (% of standard variable costs) b)	$f_{k,i}$	
High		1.5%
Moderate		1.25%
Low		1%
Managerial ability (% of standard variable costs) c)		
High managerial ability	m_{min}	95%
Low managerial ability	m_{max}	105%
Interest rate level		
Long-term borrowed capital	i_{bc}	5.5%
Short-term borrowed capital	i_{bcs}	8%
Equity capital interest	i_{ec}	4%
Overhead costs (administration, taxes, professional association etc.) plus current upkeep	MC + OV	150 €/ha
Bid adjustment d)	β	0.75
Surcharge on bid for adjacent plots	∂	10 €/plot
Plot size		2.5 ha
Farm is handed over to next generation		every 25 periods
Minimum withdrawal of farm household labour unit	WDmin	15,300 €/AWU
Opportunity cost increase when generation change		15%
Equity finance share	v	0.5
Milk quota price adjustment		2%
Labour hours of annual work unit (AWU)	h	2,000
Max. permissible stocking density (LU/ha) in region		2.5 LU/ha
Annual transport costs e)	TC	50 €/km

Notes: a) For abbreviations see Table 1; b) Cost saving due to investment differentiated by size of investment; c) Heterogeneity of farms regarding cost structure as deviation from average (value < (>) 100% corresponds to low (high) cost producer); d) Factor determining the share of bid which is actually paid as rent for a plot (see chapter 3); e) based on 10 rides from a farmstead to plot.

Source: Own calculations based on DEUTSCHE BUNDESBANK (2003), KTBL (2001), MLR (2002), BALMANN (1995), KTBL (2003), ALLB BIBERACH (2002).

Nevertheless, small changes in default parameters may be necessary in the further model calibration. Due to a lack of specific data, some parameter values could only be based upon expert knowledge, reasoning, and careful estimation. This applies in particular to the specification of managerial ability, technological change, and the bid adjustment. A formal sensitivity analysis can help to better understand whether certain assumptions about parameter values are reasonable or not (cf. HAPPE 2004). The way in which technological change is introduced was mentioned several times in section 2. According to Table 8, a high, moderate, and low technological standard of an investment object is associated with cost savings of 1.5%, 1.25%, and 1% respectively. On the subject of managerial ability, it is assumed that total production costs of farms with high managerial ability and farms with low managerial ability differ by at most 10%. In AgriPoliS it is assumed that managerial ability remains constant throughout the entire simulation. This means, farm agents cannot improve their ability of managing the farm. Furthermore, managerial ability is also not related to farm size – although this may make a difference in reality. One way to compensate for low managerial ability and realise additional cost savings is to invest in new labour-saving technology.

3.4 Specific assumptions

In the dynamic setting of AgriPoliS, the following assumptions are particularly relevant. Technological change is assumed to affect the model exclusively through the technical standard of investment options, which in return affects production costs (see chapter 3). In fact, lower production costs in arable production could equally be attributed to yield increases through breeding progress instead of better machinery technology. In the current version of AgriPoliS this would be difficult, though, because arable production activities are modelled in a rather aggregate way that does not differentiate between varieties and intensities. Therefore, yields are assumed to remain constant throughout the entire simulation.

As with every model, AgriPoliS rests on a number of assumptions. Two kinds of assumptions can be differentiated. On the hand, there are assumptions that represent central characteristics of an agricultural system. These form the corner stones of the model. Balmann (1995) has listed the central characteristics of agricultural systems and structures, which shall be mentioned here again.

- *Prices and variable costs*: Prices are assumed the same for all farms. Unit costs, however, vary between farms depending on managerial ability and technical change due to farm investment activity. In the case of Hohenlohe, the region is comparatively small and dominated by family farms. It can be expected that farms are price takers.[21] Prices therefore do not change in response to quantities produced. However, a pressure on some output prices was introduced.

- *Price changes*: Where applicable, product prices as well as prices of short-term variable and fixed labour may follow a downwards or upwards trend.
- *Costs of fixed assets*: Once a farm invests, costs of the investment are assumed fully sunk, i.e., opportunity costs are zero throughout the entire useful life of the investment.
- *Education of farm agents*: Farm agents are assumed equally smart with regard to their ability to work off-farm. Moreover, it is assumed that all farmers have the same opportunities to work off-farm, irrespective of age.

[21] This assumption has to be loosened if large scale farms are concerned, as these farms are more in the position to negotiate about prices of inputs as well as about output prices.

4 The IDEMA study regions

The first goal within Workpackage 4: "Model improvement and adaptation to regional characteristics" is the selection of several regions in countries participating in IDEMA. There should be two different types of requirements considered in the selection. On the one hand requirements of the model and on the other hand requirements of the project.

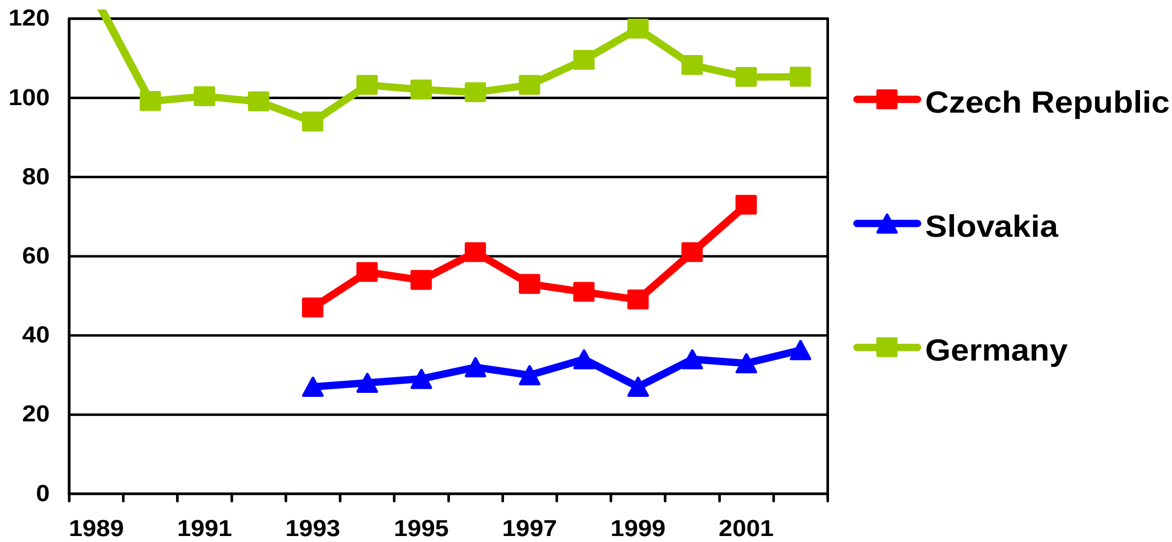
From the modelling point of view, the regions themselves should be homogenous, especially regarding the environmental conditions. Hence it is better if the regions are small. But on the other hand the size of the selected regions depends also on data availability. Therefore the region should be from a modelling point of view as small as possible, to guarantee homogenous conditions, and as big as necessary, to ensure that there will be the necessary data available.

The project requires that the selected regions should cover different conditions: agronomic (North/South), socio-economic (high income/low income regions), mode of operation (intensive/extensive agriculture), scale of farm operation (small/large farm) and legal form (private/corporate). Table 9 gives an overview on the selected regions and on the criteria they fulfil. The agronomic condition South means mediterranean agriculture, which is considered by the two regions from Italy, Marche and Calabria. Vysočina, Šiauliai and Nitra in the New Member States and Marche and Calabria in the Old Member States can be considered as low income regions. We define an intensive region along side high use (labour, fertiliser and assets) and achieving maximum yields. Following this definition, all regions except Vysočina, Šiauliai and Nitra are intensive. Although labour input in the New Member States (NMS) is high, they can not be called intensive, because nitrogen input in the plant production and hence also the yields could be increased in these regions (see Figure 14). The Italian regions can be called intensive, because labour input for perennial crops (wine, olive oil, etc.) is very high. Concerning land use, the two Swedish regions Jönköping and Västerbotten are extensive, because the share of grassland is very high (in Jönköping 32 %) and additionally a lot of arable land is used as temporary grassland.

Table 9: Criteria for the selection of the regions

		Sweden		UK	Germany		Italy		France	Czech	Lithuania	Slovakia
		Jönköping	Västerbotten	Southeast	Hohenlohe	Saxony	Marche	Calabria	Brittany	Vysočina	Šiauliai	Nitra
Agronomic conditions	North	X	X	X	X	X			X	X	X	X
	South						X	X				
Socio-economic	High income	X	X	X	X	X			X			
	Low income						X?	X?		X	X	X
Mode of operation	Intensive			X	X	X	X	X	X			
	Extensive	X	X							X	X	X
Scale of farm operation	Small	X	X		X		X	XX	X	X	XX	X
	large farms			X		X			X	X		X
Legal form	Private	X	X	X	X		X	X	X	X	X	X
	corporate					X			X	X		X
Average farm size	Regional data	35	30	47	25.6	174	8.5	2.7	33	114	12	89
Part of permanent grassland of total UAA		32 %	6 %	42 %	23 %	13 %	2 %	5 %	13 %	21 %	12 %	5 %
Livestock unit (LU)/ha		1.1	0.8	2.0	1.8	0.5	1.6	0.9	1.4	0.8	0.7	0.5
Single farm payments							X	X	X			
Regional payments										X	X	X
Hybrid model		X static	X static	X dyn	X dyn	X dyn						

On the other hand grassilage and pasture on arable land are very intensively produced, because farmers need fodder with a high energy density and quality to achieve a milk yield of 9000 kg per year. Hence fertilizer input must be relatively high and because of the dominant role of milk production, almost 39 % of the farms in Västerbotten are dairy farms and in Jönköping the share of dairy farms is around 60 %, the two Swedish regions could also be called intensive.



Source: FAOSTAT 2004

Figure 14: N-fertilization in kg/ha

Regarding farm structures, three phenomena can be observed. Regions with small farms like Västerbotten, Jönköping, Hohenlohe, Marche, Calabria and Šiauliai. In Southeast England and Saxony large scale farms dominate, whereas in Brittany, Vysočina and Nitra a dual farm structure exists. In Brittany, there are many small family farms and some big cooperations specialized in intensive livestock farming. In Vysočina and Nitra huge mixed or field crop farms exist beside a large number of household and individual farms. The legal form of farms is strongly correlated with the scale of farming in the regions. Saxony is the only region where cooperations dominate. In regions with a dual structure (Brittany, Vysočina and Nitra) cooperations can be found as well as individual farms. In the remaining regions individual farms dominate. Table 9 also shows the average farm size by which the regions are classified in small and large scaled. The share of grassland in total UAA is also characteristic for the regions, but was not considered during the selection of the regions. It should be mentioned that in Västerbotten, Jönköping and Southeast England also a large amount of arable land is used as temporary grassland. Finally at the bottom of Table 9 an overview about which policy will be implemented in the different countries is provided. So this table can be used in the third step of the modelling, the policy analysis, to identify similarities or opposites between the regions.

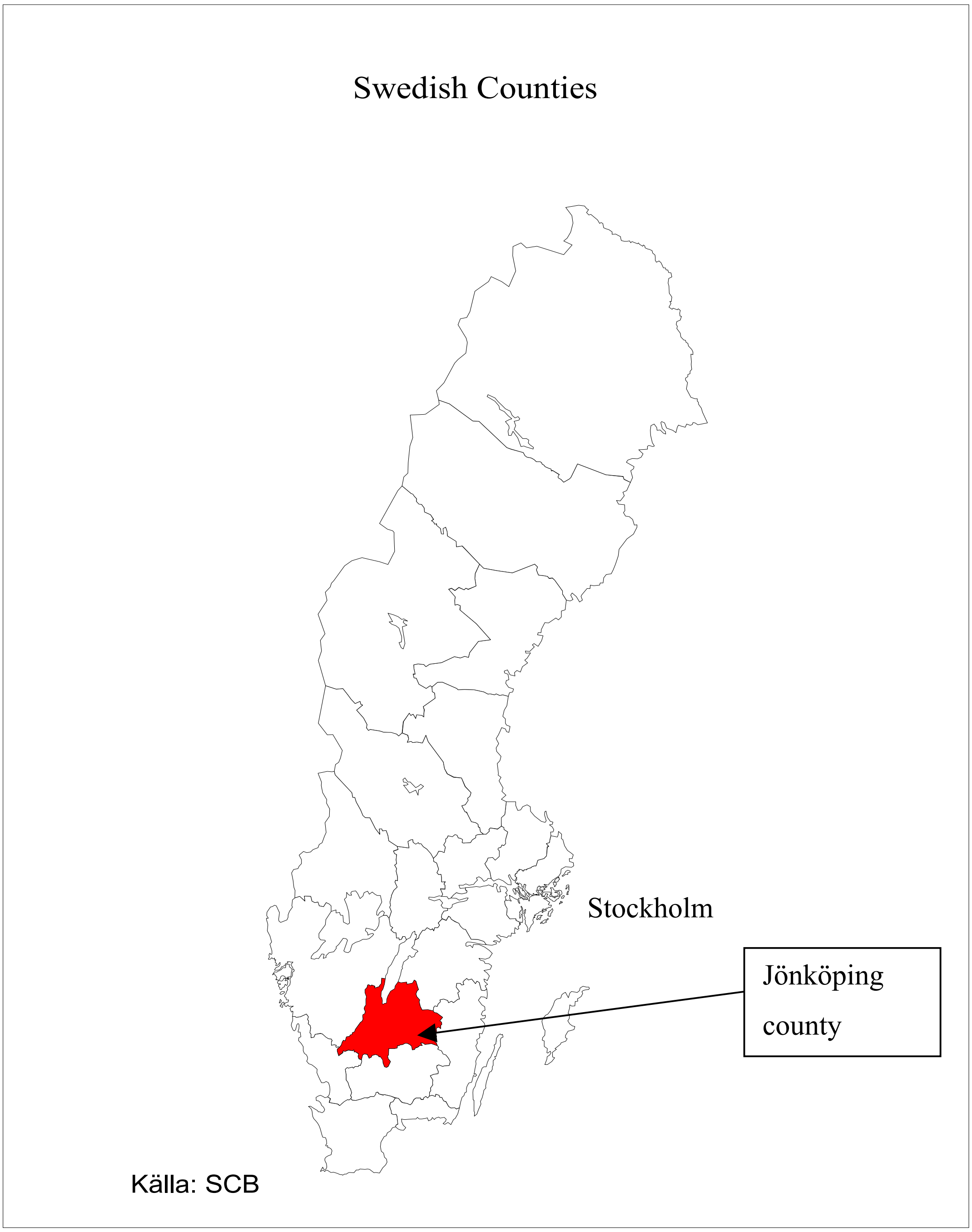
Table 10 gives an overview about the size of the regions, the number of farms which are located in the regions and the regional structure concerning the share of grassland and the average farm size. The number of farms depends on the limit above which farms are counted in the regional statistics, thus this lower limit is shown in Table 10. Brittany is with 1.7 Mio ha the largest region. It was not possible to choose a subregion of Brittany, because data to identify typical farms for the subregions was not available. The smallest region is Calabria in Italy with 29,176 ha and an average farm size of 2.7 ha. Saxony is the region where large scaled farms are most predominating, what can be derived from the average farm size of 174 ha. This is the biggest average farm size of all regions. The region with the highest share of permanent grassland of the total UAA is Southeast England (42 %), but as already mentioned above in Västerbotten and Jönköping the share of grassland is very high, because of a high share of temporary grassland on arable land. In the following sections the regions will be described in more detail.

Table 10: Size and structure of the selected regions

	Total UAA ha	Lower limit in statistics	Number of farms	Average farm size in ha	Part of grassland of total UAA
Jönköping	134,216	2 ha	3,824	35.0	32 %
Västerbotten	74,414	2 ha	2,506	30.0	6 %
Southeast	530,696		11,214	47.0	42 %
Marche	49,082	All farms	5,785	8.5	2 %
Calabria	29,176	All farms	10,626	2.7	5 %
Hohenlohe	73,439	2 ha	2,869	26.0	23 %
Saxony	496,451	2 ha	2,858	174.0	13 %
Brittany	1,701,568	1 ha	51,219	33.0	13 %
Vysočina (Cz)	393,726	1 ha	3,433	114.0	21 %
Šiauliai (Li)	426,504	All farms	35,575	12.0	12 %
Nitra (SR)	414,668	All farms	16,973	24.0	5 %

4.1 Sweden: Jönköping

The "Jönköping" county in central-south Sweden (Map 1) has a size of 10,475 km², whereas only 14 % of this area is agricultural area. With a share of 67 %, forest is the dominating landuse in a natural hilly landscape.



Map 1: The counties of Sweden – Jönköping county

Climate: The region is dominated by a climate, which is marked by a growing season of about 210 days, approximately 700 mm annual rainfall and a mean temperature of 17 °C in July.

Landuse: Altough 32 % of the UAA is used as grassland (Table 11), also parts of arable land are in use as arable grassland, semi-natural grazing lands and meadows to deliver rouphage fodder. Because of the environmental value of this utilisation there are two national additional support schemes: regional and environmental support. Only 25 % of the regional support for arable grass and semi-natural grazing lands are provided by the EU. Environmental subsidies are paid for organic agriculture, for grass grown on arable land and for conserving semi-natural grazing lands. There exist payments for additional quality requirements, too.

Table 11: Use of area in „Jönköping“ (values in ha and percentage shares)

Use of area	Area (in ha)	in %
Arable land	91,369	68.1
Grassland	42,847	31.9
Total (Utilised agricultural area; UAA)	*134,216*	*100.0*

Source: STATISTICS SWEDEN (2003).

Agriculture: Besides grass crops (67 %), barley and oats for feeding (together 19 %) are the most important crops. Due to the fairly poor soil quality, the region has below average yields. E.g. for spring barley, the regional average yield amounts to 3.0 t/ha which presents only 72 % of the national average yield for this line of production. The structure is marked by small and medium farms, mainly family owned. Table 12 shows the farm structure combined with the total arable land managed in different size ranges. In Sweden it is common to measure farm size only in arable land and not in UAA (including grazing land). This point has to be noted. The Jönköping region is characterised by many small farms in the size class of "2 – 10ha" (42 %), but these farms manage only about 10 % of the total arable land. The major part of arable land is located in farms in the size range between 50 and 100 hectares. The average farm size amounts to only 24.0 ha/farm, compared to 37.8 ha/farm for the whole Sweden.

Table 12: Number of farms in different size classes (total number and percentage shares)

Size class	Number	in %	Arable land (in ha)	in %	Ø – Size (in ha)
2 – 10 ha	1,608	42.0	9,012	9.8	5.6
10 – 20 ha	779	20.4	11,127	12.1	14.3
20 – 30 ha	438	11.5	10,844	11.8	24.8
30 – 50 ha	506	13.2	19,692	21.5	38.9
50 – 100 ha	400	10.5	27,077	29.5	67.7
> 100 ha	93	2.4	13,950	15.2	150.0
Total	*3,824*	*100.0*	91,702	*100.0*	*24.0*

Source: STATISTICS SWEDEN (2003).

In view to the `type of farming`[22], dairy farms constitute the most important farm type (62 %) which is rather small to medium scaled. For example, the majority of dairy herds consist of 10-49 cows. However, very small dairy herds below 10 cows are rare (1.5 %). Pork production is a less important agricultural activity in the region. The approximately 5,000 sows and 14,000 pigs are kept in only 4 % of the farms. Whereas the average farm size is with only 63 % clear below the national average, the livestock density in median exceeds the nationwide average of 0.81 LU/ha by representing 134 % (or 1.08 LU/ha) of the country's level. This underlines the regional importance of animal production.

Table 13: Farms according to `Type of farming` (number of farms and percentage shares)

Type of farming	Total number	in %
Field crop farms	306	8.0
Milk	2,371	62.0
Grazing livestock	115	3.0
Mixed	1,032	27.0
Total	*3,824*	*100.0*

Source: REGIONAL DATA (2002).

[22] The EU-typology defines `type of farming` by the main lines of production (two-thirds criteria; cp. EU-COMMISSION (2005) FADN website). The whole spectrum of one farms' activities might disappear behind this `type of farming`. So it is not ensured that the classification by `type of farming′ covers the whole variety of different lines of production in the region.

4.2 Sweden: Västerbotten

Västerbotten is the second largest county in Sweden. The region is located in the far north (Map 2). The landscape is typical for Nordic or far North areas. Agriculture is concentrated to a relative homogeneous coastal belt with an extension in north-south direction of approximately 200 km and 100 km to east-west direction. Unlike fairly good soil qualities the climatic production conditions are less favourable by what the low yield level is caused.

Map 2: The counties of Sweden - Västerbotten

Climate: The climate of Västerbotten can be characterized by 500 mm precipitation, 13 °C mean temperature in July and a growing season of only 145 days.

Landuse / Agriculture: Only 2 % of the total land is utilised as agricultural area (UAA). The average yield of spring barley is 2.3 t/ha and thus only approximately 55 % of the average national yield. The UUA, to 94 % used as arable land (Table 14) is chiefly used by growing grass crops (59 %) and barley/oats (22 %). As in Jönköping region, forest is the most important land cover, but less dominating. Mountainous and swamp areas become more meaningful.

Table 14: Use of area in „Västerbotten" (values in ha and percentage shares)

Use of area	Area (in ha)	in %
Arable land	70,269	94.4
Grassland	4,145	5.6
Total (Utilised agricultural area; UAA)	*74,414*	*100.0*

Source: STATISTICS SWEDEN (2003).

The farm structure of the region is characterised by 39 % livestock farms, 19 % crop farms and 5 % mixed farms (Table 15). An important regional feature is the high share of small farms (37 %) which have an annual working hour input of less than 400 hours and which can be considered as part-time farms. For illustration see also Table 16.

Table 15: Type of farming (number of farms and percentage shares)

Type of farming	Total number	in %
Crop farms	476	19.0
Livestock management	977	39.0
Mixed farming	125	5.0
Small farms	927	37.0
Total	*2,506*	*100.0*

Source: REGIONAL DATA (2002).

40.1 % of the farms manage only 8.3 % of the total arable land due to their small size (between 2 and 10 ha). The main part of arable land is farmed in medium scale farms (50-100 ha), despite a share of only 13.1 % on the total number of farms. Compared to the nationwide average farm size of 37.8 ha/farm, the farms in Västerbotten achieve at mean only 28 ha/farm.

Table 16: Number of farms in different size classes (total number and percentage shares)

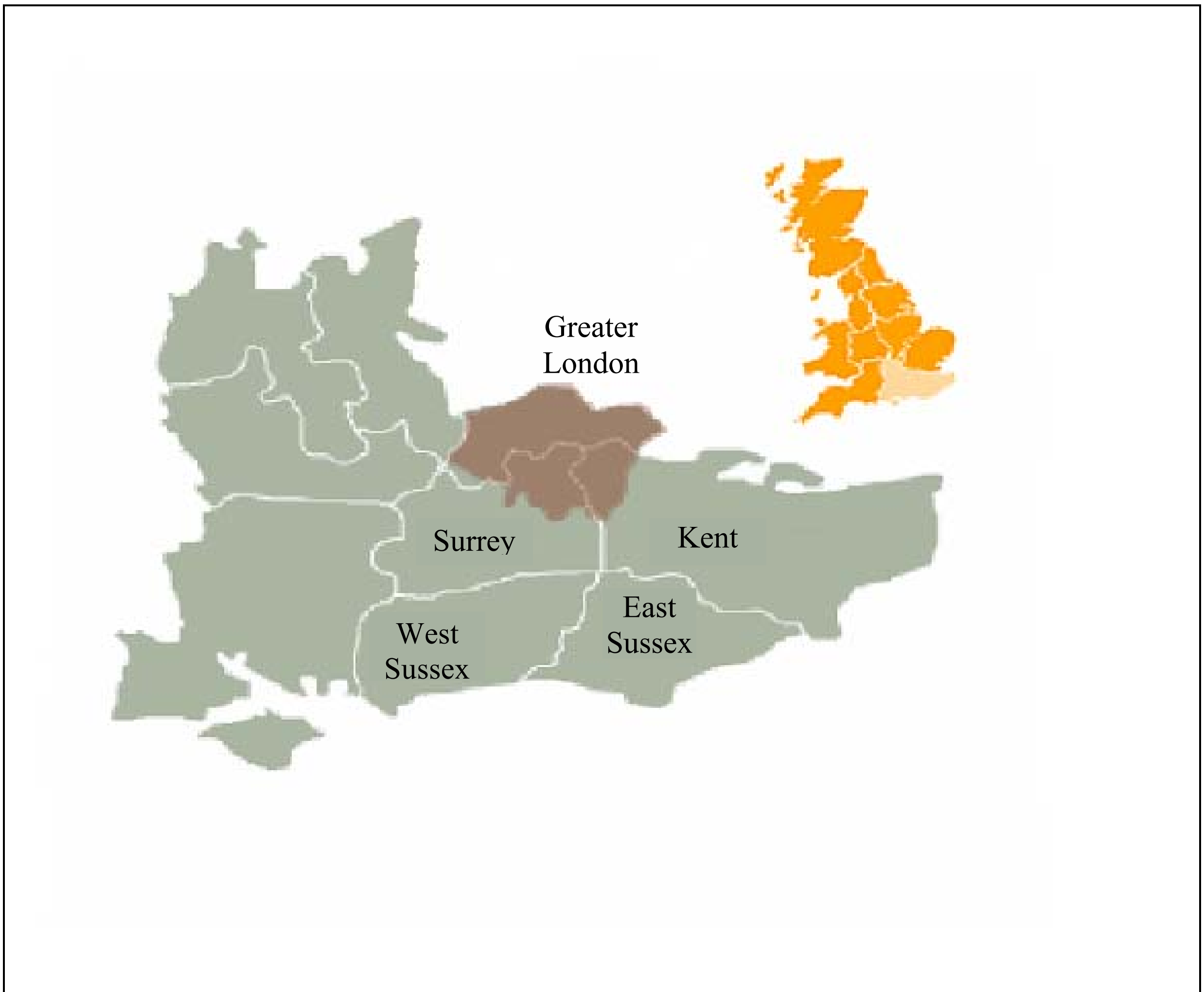
Size class	Number	in %	Arable land (in ha)	in %	Ø – Size (in ha)
2 – 10 ha	1,006	40.1	5,846	8.3	5.8
10 – 20 ha	516	20.6	7,440	10.6	14.4
20 – 30 ha	250	10.0	6,130	8.7	24.5
30 – 50 ha	283	11.3	10,988	15.6	38.8
50 – 100 ha	328	13.1	23,298	33.2	71.0
> 100 ha	123	4.9	16,511	23.5	134.2
Total	*2,506*	*100.0*	*70,213*	*100.0*	*28.0*

Source: STATISTICS SWEDEN (2003).

The natural conditions and the farm sizes cause the importance of livestock production, mainly cattle, dairy and sheep husbandry. Pig production is less significant for the region. The average livestock density per hectare is with 0.84 LU/ha less above the national average of 0.81 LU/ha, but the average farm size is, as pointed out before, significant lower.

4.3 United Kingdom: Southeast England

The region to be modelled is a subregion of the whole "Southeast" region of England (Map 3). It consists of the counties Surrey, Kent, West Sussex and East Sussex in the southeast of the agglomeration around London (Greater London region). It stretches out of approximately 160 km from East to West and 80 km from North to South by reaching a size of 445,973 ha UAA. The number of farms in the region amounts to 11,214. The average farm size results to 39.8 ha/farm, whereas the nationwide average farm size adds up to 70.9 ha/farm[23].



Map 3: Southeast England – Counties of Surrey, Kent, West Sussex and East Sussex

Climate: The climate is of a very maritime character with an average rainfall of around 750 mm/a and moderate warm winters and summers. The average daily maximum temperature varies between 6.5 °C in January and 21.5 °C in August.

[23] All data were taken from DEFRA (2002), data from 2001 and 2002.

Landuse: The landscape of Southeast is characterised by an undulating landscape of chalk ridges and broad valleys, bearing soils varying considerably in depth and potential fertility:

a) The plateau tops (up to around 200m altitude) and upper slopes are generally covered by relatively thin layers of sediment, sometimes only a few centimetres in thickness. Although the basic soil-type here is clay, it often contains quantities of flint pebbles, i.e. vitreous, silicaceous nodules.

b) On the lower slopes, the less acute angle of dip normally allows the retention of deeper layers of sediment, enhancing potential fertility, though often only to a limited degree.

c) In the broad valley bottoms, the chalk bedrock may well be covered by sediments to a depth of one metre or more. Potential fertility here is often very high, particularly where the valley bottom constitutes the flood-plain of a river. The choice of chalkland soils does not imply that all soils in the region necessarily fall into the same mould. Large tracts of riverine deposits exist (in the Thames Valley, for example) and a broad belt of Tertiary deposits, the Weald, dominates the south-eastern counties. There is a good deal of small woodland, but no major forested area.

Due to the mentioned natural conditions, a relatively high share of land is used as grassland (41.8 %). In addition to that, even parts of the arable land are used for purposes of providing rouphage fodder. The area of arable land also contains the utilisation as fallow and temporary grassland (cp. Table 17).

Table 17: Use of area in "Southeast" (values in ha and percentage shares)

Use of area	Area (in ha)	in %
Arable land (Crops, fallow and temporary grassland)	259,485	58.2
Grassland (permanent and rough grazing)	186,488	41.8
Total (UAA)	*445,973*	*100.0*

Source: DEFRA (2002), data from 2001 and 2002.

Agriculture: The agriculture of the region is characterised by variety. There are dairy farms, field crop farms, sheep and beef cattle farms, mixed farms and a number of specialist fruit, vegetables and horticulture farms. Average yields and variability of yields for most crops in the region are regarded as representative for the UK as a whole. The average wheat yield in the region amounts to 7.9 t/ha (8.1 t/ha for the whole country). The average stocking density in southeast (2.0 LU/ha) corresponds to the nationwide average. Table 18 gives an overview to the number of farms and their respective percentage shares with regard to the different kinds of specialisation (Type of farming). Concerning the number of farms, there are only farms greater than 8 ESU taken into account, so this value differs from the above mentioned figure of 11,214 farms in total. ESU stands for "European Size Unit". It is defined as output per ha or farm animal minus the respective variable costs. The current Standard Gross Margin (SGM) amounts to 1,200 € per ha resp. farm animal and is equivalent to 1.5 ha of wheat (EU-COMMISION (2005), FADN website). The main part of farms is constituted by the group of field crop farms (31.4 %), followed by grazing livestock farms (20.0 %) and mixed farms (12.2 %). The remaining groups are a few in number, but in view to their economical importance and regional employment impacts, these farms should not be disregarded.

Table 18: Number of farms (> 8 ESU) by `Type of farming` (total number and percentage shares)

Type of farming	Number of farms	in %
Field crop	1,111	31.4
Specialist fruit	294	8.3
Specialist glass	269	7.6
Other horticulture	195	5.5
Specialist Hardy Nursery Stock	119	3.4
Pigs and poultry	139	3.9
Dairy	276	7.8
Grazing livestock	708	20.0
Mixed	431	12.2
Total	*3,542*	*100.0*

Source: DEFRA (2002), data from 2001 and 2002.

4.4 Italy: Colli Esini (subregion of Marche)

"Colli Esini" constitutes a subregion of the region "Marche" which is located in the middle of Italy at the Adriatic Sea (Map 4).

Map 4: Regions of Italy - Marche

Climate: Even though the region is located next to the Adriatic Sea, the climate has no strongly maritime character but a pronounced Mediterranean. The monthly average temperatures range between 4 °C in January and 23 °C in August. The annual rainfall varies from 600 to 1,000 mm/a of which the main part falls in winter.

Landuse / Agriculture: The landscape is softly hilly with clayey, fertile soils which allow cultivating superior agricultural plants, e.g. wheat[24] and sugar beets. In some places are also the more working intensive commodities like wine, olive oil, fruits and vegetables produced. Table 19 indicates that in addition to Arable land (87.8 %) Wine-growing area (7.8 %) and especially Quality wine area (6.1 %) is the second important kind of landuse. Beside Grassland (2.2 %) plays the area for growing Olive trees (2.2 %) an economically even more relevant role.

[24] All data about wheat in the region refer to the variety *Triticum durum*.

The average wheat yield in the region (4.1 t/ha[25]) exceeds the Italian average wheat yield of 3,3 t/ha (ISTAT 1999).

Table 19: Use of area in “Colli Esini” (values in ha and percentage shares)

Use of area	Area (in ha)	in %
Arable land	42,718	87.8
Wine (overall) *among Wine-growing area:*	3,847	7.8
Table wine	830	1.7
Quality wine	2,985	6.1
Olive oil	1,092	2.2
Grassland	1,052	2.2
Total (Utilised agricultural area; UAA)	*48,677*	*100.0*

Source: ISTAT (2002).

The average size of farms in the region amounts to 8.4 ha/farm by dividing the region’s size of 48,677 ha UAA[26] to the number of farms (5,785). From that point of view the farm structure in “Colli Esini” is above-average in relation to the nationwide average of 6.1 ha/farm. Table 20 gives an overview of the distribution of all farms to the different farm size classes and their respective percentage shares. Approximately one third of all farms are smaller than 2 ha, about two third are smaller than 5 ha. In comparison to “Piana di Sibari” in Calabria it is obvious that “Colli Esini” is not as small scaled in view to the farm size as the other focussed Italian region.

[25] Calculations by A. Lobianco based on FADN-data 2001.

[26] The official statistic offered for UAA in 2000 the values of 48,677 by summing up the area according to `Use of area` (Table 19) and in contrast 49,082 ha by summing up the area according to Table 21.

Table 20: Number of farms in different size classes (total number and percentage shares)

Size class	Total number	in %
Farms without UAA	59	1.0
< 1 ha	1,054	18.2
1 – 2 ha	943	16.3
2 – 5 ha	1,680	29.1
5 – 10 ha	1,008	17.4
10 – 20 ha	555	9.6
20 – 50 ha	357	6.2
50 – 100 ha	77	1.3
> 100 ha	52	0.9
Total	*5,785*	*100.0*
Subtotal: farms < 2 ha	2,056	35.5
Subtotal: farms < 5 ha	3,736	64.6

Source: ISTAT (2002).

With regard to the specialisation of farms there is a relatively limited diversity by classifying farms according to the EU-typology. Field crop farms play a major role in view to their number (67.8 % of all farms) and even more in view to their landuse (77.5 % of UAA) (Table 21). Their average size results to 9.7 ha/farm[27]. Wine-producing farms have an average acreage-size of 2.5 ha/farm and are therefore below the regional average farm size[28]. Mixed farms have an average size (7.3 ha/farm) close to the regional average value.

Table 21: Type of farming (number of farms, landuse and percentage shares)

Type of farming	Total number	in %	UAA (in ha)	in % of UAA	Ø – Size (in ha)
Field crop farms	3,880	67.8	37,465	77.5	9.7
Wine	517	9.0	1,275	2.7	2.5
Fruits	146	-	760	-	5.2
Mixed	1,329	23.2	9,582	19.8	7.2
Total	*5,872*	*100.0*	*49,082*	*100.0*	8.6

Source: Upscaled FADN-data, done by A. Lobianco.

[27] Regarding average values without using statistical evaluation it is naturally not possible to reason any conclusions *inside* one group of `type of farming`.

[28] Naturally, the explanatory power by comparing the acreage-size of wine-growing farms with other farms has to be put into question because wine-growing farms have evidently higher figures on added value and employment intensity per hectare.

4.5 Italy: Piana di Sibari (subregion of Calabria)

The focussed region "Piana di Sibari" is a subregion of "Calabria", a peninsula located in the south of Italy and part of the "Mezzogiorno" (Map 5). The regions' size is measured to 29,176 ha (ISTAT 2000) and constitutes insofar the smallest of all considered study regions in the IDEMA-Project.

Map 5: Regions of Italy - Calabria

Climate: The climate of the region has a pronounced Mediterranean character with strongly warm summers and temperate winters. Calabria is shielded by close mountains which cause low wind and less raining (less than 600 mm/a, mainly in winter).

Landscape: The alluvial, siliceous soils possess a rather tolerable fertility for agricultural purposes. The whole area is dominated by a flat and slight hilly character.

Agriculture: The agricultural area is mainly used for cultivating vegetables, fruits, olive oil and wine (Table 22). The surface area is not only divided into the two common utilisations of arable land (29.5 %) and grassland (4.6 %) but also into area for growing olive trees (33.7 %), fruits (30.2 %), and wine (1.0 %). One third of the region's area can be used by irrigation.

Table 22: Agricultural landuse in "Piana di Sibari" (values in ha and percentage shares)

Use of area	in ha	in %
Olive oil	9,815	34.0
Fruits	8,820	30.6
Arable land	8,614	29.8
Grassland	1,332	4.6
Table wine	282	1.0
(Irrigated UAA)	(9,729)	(33.7)
Total (Utilised agricultural area; UAA)	*28,863*	*100.0*

Source: ISTAT (2002).

The average wheat yield in Calabria (2.3 t/ha) amounts to only 67 % of the average national wheat yield (3.3 t/ha) (ISTAT 1999). In the same way, the average stocking density of Calabria is calculated to 0.6 LU/ha[29] compared to a nationwide value of 1.4 LU/ha. One reason for this very below average value are the natural conditions which are quite hot in summer and do not favour dairy cow and cattle husbandry. Sheep and goat husbandry seems to be a more adequate adaptation to these climatic conditions and these kinds of livestock are therefore traditional widespread. Regarding the specialisation of farms it is obvious that the major part is constituted by fruit producing farms with a share of 44.0 % (Table 23). Although, these enterprises use only 21.7 % of the regional area. Conversely, the Mixed farms with a share of 18.7 % of all farms use 38.0 % of the area. From this it follows that Fruit farms and also Grazing livestock farms by average sizes of 1.4 resp. 1.5 ha/farm are below the regional average farm size of 2.7 ha/farm whereas Mixed farms are particularly above the average farm size with an average size of 5.6 ha. From that point of view, Field crop (3.7 ha), Olive oil (2.7 ha) and Dairy farms (3.7 ha) are just little above the average farm size.

[29] Calculations by A. Lobianco based on ISTAT 2000.

Table 23: Type of farming (number of farms, landuse and percentage shares)

Type of farming	Total number	in %	UAA (in ha)	in % of UAA	Ø – Size (in ha)
Field crop farms	1,665	15.7	5,988	20.5	3.6
Olive oil	1,427	13.4	3,778	13.0	2.7
Fruits	4,679	44.0	6,330	21.7	1.4
Dairy	317	3.0	1,178	4.0	3.7
Grazing livestock	555	5.2	812	2.8	1.5
Mixed	1,983	18.7	11,091	38.0	5.6
Total	*10,626*	*100*	*29,176*	*100*	*2.7*

Source: Upscaled FADN-data, done by A. Lobianco.

Piana di Sibari is a quite small-scaled region in view to the surface design and the common farmsizes. The number of farms located in the region amounts to 10,626 (Table 24). The average size regarding the acreage-size results to 2.7 ha/farm by dividing the region's size to the number of farms. More than 75 % (90 %) of all farms are smaller than 2 ha[30] (5 ha). In contrast, the average farm size in Italy adds up to 6.1 ha/farm (EUROSTAT 2000).

Table 24: Number of farms in different size classes (total number and percentage shares)

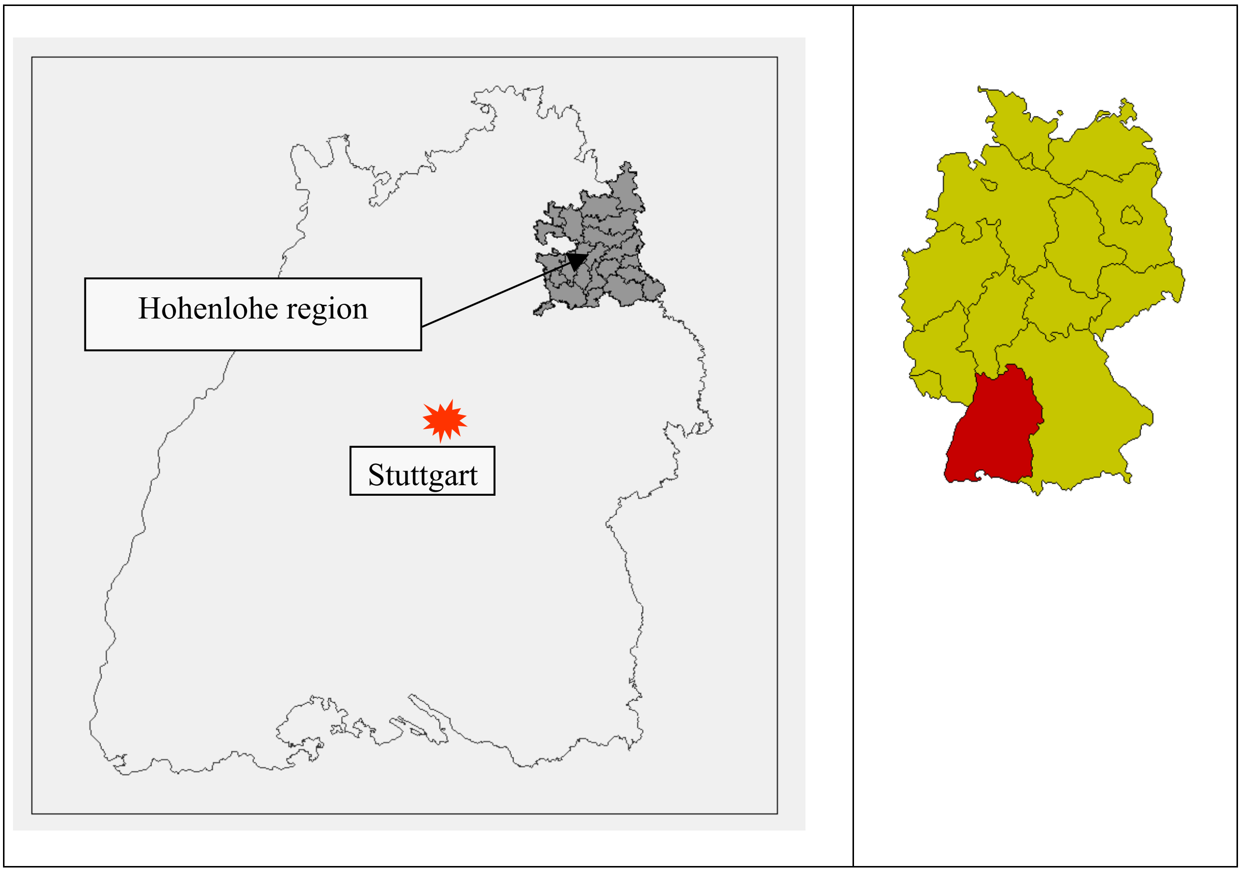
Size class	Total number	in %
Farms without UAA	54	0.5
< 1 ha	5,887	55.4
1 – 2 ha	2,137	20.1
2 – 5 ha	1,647	15.5
5 – 10 ha	482	4.5
10 – 20 ha	210	2.0
20 – 50 ha	146	1.4
50 – 100 ha	33	0.3
> 100 ha	30	0.3
Total	*10,626*	*100*
Subtotal: farms < 2 ha	8,078	76.0
Subtotal: farms < 5 ha	9,725	91.5

Source: ISTAT (2002).

[30] An overview to the lower limit to be considered in the statistics gives Table 44 in section 5. These values have to be seen in connection with the main lines of production in the region.

4.6 Germany: Hohenlohe (subregion of Baden-Württemberg)

The study region Hohenlohe is situated in the federal state Baden-Württemberg in the southwest of Germany. The region is one of 21 "Vergleichsgebiete" which are characterised by almost homogenous natural production conditions (Map 6).



Map 6: Region „Hohenlohe" in the federal state Baden-Württemberg in Southwest Germany

The region proved to be suitable because it is characterised by a diverse agriculture with intensive livestock production (fattening pigs, sows for breeding, and turkeys) on the plains, and dairy and forage production mainly in the valleys (HAPPE, 2004)[31].

Climate: The altitude of Hohenlohe varies between 350 – 500 m. Therefore, the average annual temperature amounts only to 8 °C. There are not these favoured conditions for agricultural purposes like in the next situated Rhine valley with more intensive crop production, e.g. vegetables, fruits, and wine-growing. The soil quality ranges from 30 to 50 points in the standard scale range from 0 to 100 points. Therefore, it can be considered to be a limiting factor.

[31] In addition to this study, the studies of SAHRBACHER (2003) and KLEINGARN (2002) were also focussing on Hohenlohe region.

In contrast, the annual rainfall is sufficient. The average annual precipitation adds up to 650 – 750 mm/a.

Landscape: Simplifying, the landscape of Hohenlohe can be divided into two sections: On the on hand are elevated plateaux with intensive field crop production (cereals, sugar beets[32]). In the past, farms located there, had often invested to pig and poultry production capacities because the growth of the farm by renting in land from surrounding farms was not possible or, in consequence of very high rental prices, too expensive. The way of growth without expanding by acreage-size was assisted by official consulting firms and also by financial support. On the other hand, valleys and slopes are traditionally used by milk and forage producing farms.

Agriculture: In the year 1999, Hohenlohe comprised about 73,439 ha of agricultural area, managed by approximately 2,869 farms (STATISTISCHES LANDESAMT BADEN-WÜRTTEMBERG 1999). Approximately half of the farms were run as professional (full-time) farms, with the remaining farms being non-professional (part-time) farms (cp. Table 25). Professional farms, due to their larger average farm size (average farm size of professional farms 36.9 ha, non-professional farms 12.2 ha), have cultivated 78.1 % of the agricultural area in Hohenlohe. All farms have the legal form of a individual farm.

Table 25: Number of farms in „Hohenlohe“ by different organisational forms

Organisational form	Total number	in %	UAA (in ha)	in %	Ø – Size (in ha)
Full time	1,553	54.1	57,321	78.1	36.9
Part time	1,316	45.9	16,117	21.9	12.2
Total	2,869	100.0	73,438	100.0	25.6

Source: STATISTISCHES LANDESAMT BADEN-WÜRTTEMBERG 1999.

[32] In Hohenlohe 2.4 % of the arable land is used for growing sugar beets. Nevertheless, it is also possible that on the level of each farm might exists shares of 10 % and even more inside the crop rotation. This affects mostly farms situated in rather natural favoured areas.

Table 26 gives an overview to the agricultural structure in Hohenlohe in 1999. The enterprises are differentiated by their type of farming. The average farm size does not vary significantly according to the type of farming[33]. Concluding, it is obvious that in Hohenlohe the differentiation by organisational form of farming is more important than the differentiation by type of farming in view to the farm size[34]. By looking at the number and the land in use, it is obvious that Pig and poultry farms (34.4 % of all farms), followed by Grazing livestock farms (31.6 %) are the most numerous and representative farms in the Hohenlohe region.

Table 26: Type of farming (Total number, landuse and percentage shares)

Type of farming	Total number	in %	UAA (in ha)	in %	Ø – Size (in ha)
Field crop farms	459	16.0	9,569	13.0	20.8
Grazing livestock (Dairy farms included)	906	31.6	21,683	29.5	23.9
Pig and poultry	988	34.4	27,766	37.8	28.1
Mixed	516	18.0	14,421	19.7	27.9
Total	*2869*	*100*	*73,439*	*100*	*25.6*

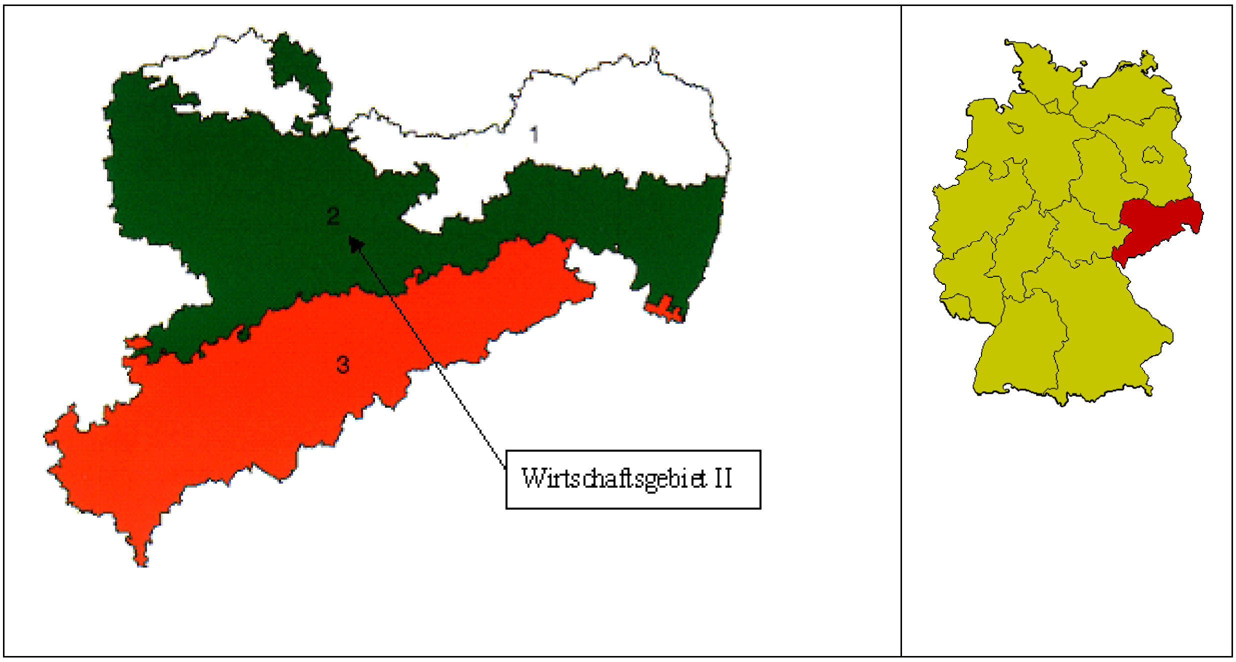
Source: STATISTISCHES LANDESAMT BADEN-WÜRTTEMBERG 1999.

[33] The lowest average farm size can be found in the class of Field crop farms. It can be supposed that this fact is caused by a relatively high share of part-time farms in this group. Part-time farming can be easier managed in extensive crop producing farms whereas animal husbandry tends in general to bound working resources constantly.

[34] In a more narrow analysis it has to be focussed on the point in which class of `type of farming` are possibly significant more or less part time farms because Table 26 includes all farms. There is no differentiation by the organisational form of farming.

4.7 Germany: Wirtschaftsgebiet II (subregion of Saxony)

The second study region for Germany is a subregion inside the federal state "Saxony" (Sachsen) in the southern part of the former GDR. The study region is congruent to a so called "Wirtschaftsgebiet II" which should consist of almost homogenous natural production conditions (Map 7).



Map 7: Federal state „Saxony" subdivided into 3 „Wirtschaftsgebiete"

With a size of 496,451 ha (86 % Arable land and 14 % Grassland), the region ranks among the relative large ones within the IDEMA-Project. The number of farms adds up to 2,858. The average farm size results to 174 ha/farm.

Climate: The climate is characterised by little rainfall of approximately 550 mm/a and an almost continental climate with cold winters and hot summers.

Landscape: The focussed region is also known as “Mittelsächsisches Lößgebiet”, one part of a relatively large wheat belt with very fertile soils (chernozem) which allow the cultivation of all superior plants (e.g. wheat, sugar beets, etc.). A smaller part of the region is constituted by the “Oberlausitz” with higher shares of grassland and less fertile soils in a low mountain range. The favoured natural conditions in the region’s main area are also reflected in high shares of cereals, especially winter wheat, inside the crop rotation (often more than 60 %)[35].

Agriculture: The before mentioned corresponds with high shares of field crop farms (56.9 %) among all types of farming and a high proportion in view to their UAA in use as well (67.3 %; Table 27). I.e. that favoured natural conditions are accompanied by large scaled farm- and plotsize-structures. The average yield of cereals adds up to approximately 7.2 t/ha (LFL SACHSEN 1999) and is therefore above the nationwide average of approximately 6.1 t/ha (BMVEL 2005, 2003). The average farm size is 174 ha/farm and therefore the largest average farm size of all considered study regions. The averages amount to 205 ha/farm in the class of field crop farms respectively 375 ha/farm in the class of mixed farms[36]. In all other classes the average farm size concerning the acreage size is significant lower.

Table 27: Type of farming (number of farms, landuse and percentage shares)

	Number of farms	**in %**	**UAA (in ha)**	**UAA (in %)**	**Ø – Size (in ha)**
Field crop	1,626	56.9	334,103	67.3	205
Grazing livestock (incl. Dairy)	920	32.2	122,930	24.8	134
Granivore	37	1.3	2,223	0.4	60
Mixed	66	2.3	24,735	5.0	375
Others	209	7.3	12,458	2.5	60
Total	*2,858*	*100.0*	*496,449*	*100.0*	*174*

Source: Anträge auf Agrarförderung 2002 (LFL SACHSEN 2002) and own calculations.

[35] The crop rotation share of the most profitable (extensive) crop - sugar beet - is limited by the quota to at most ~ 5 % of the farm’s acreage-size in the eastern parts of Germany. As second profitable crop there is wheat grown, mostly high-quality wheat for food consumption (high-protein wheat of quality class A and E).

[36] A lot of large companies, mostly in the legal form of co-operatives, were counted as `mixed farms` because this kind of legal form can be characterised by the following - hypothetical and non-generalised - features: These co-operatives exist since collectivisation (~1950ies). Therefore, they are relatively large. They also pursue to ensure their members` employment and that’s a main reason not to quit livestock production although knowing about a (possible) lack of profitability in this production sector. At last, the internal rights of co-determination of each co-operative member sometimes prohibit necessary changes towards a higher degree on specialisation (Inflexibility of management and non-hierarchical decision-making).

Corresponding the fact that „Wirtschaftsgebiet II" is a large scale region, the different size classes are relatively broad and not highly particularised in the range between 0 - 100 ha, especially in comparison to the other regions. The majority of farms can be found in the size class of `< 10 ha` (31.1 %) resp. `10 – 50 ha` (31.6 %). A high share of the farms listed in these size classes can be considered to be part-time farms. 1,478 (or 51.7 %) of all farms are managed as part-time farms, which might be rather found in the less favoured regions in the low mountain ranges. In Saxony – like in all former socialistic countries - the average farm size of full-time farms declined constantly after the Fall of the Wall in the course of re-privatisation farming (e.g. MATHIJS and SWINNEN, 2000)[37].

After German Unification the livestock density in the whole former GDR was in a steady decreasing trend which has not yet stopped. In present, the livestock density consolidates on a relative low level of 0.5 LU/ha compared to 1.3 LU/ha for the whole Germany[38] (BMVEL, 2005).

Table 28: Number of farms in different size classes (total number and percentage shares)

Size class	Total number	in %
< 10 ha	888	31.1
10 – 50 ha	904	31.6
50 – 100 ha	292	10.2
100 – 200 ha	274	9.6
200 – 500 ha	260	9.1
500 – 1,000 ha	111	3.9
1,000 – 2,500 ha	105	3.7
> 2,500 ha	24	0.8
Total	*2,858*	*100.0*

Source: Anträge auf Agrarförderung 2002 (LFL SACHSEN 2002) and own calculations.

[37] This trend has stopped by a cumulative number of farms which consolidate with other enterprises. On the one hand co-operatives unite with other co-operatives or, on the other hand, several private farms unite to a civil law partnership (GbR) to benefit from resulting economies of scale.

[38] Value for full-time farms.

4.8 France: Brittany

Brittany constitutes a peninsula in the north-west of France. The size can be measured by 300 km east-west and 150 km north-south extension to approximately 2.75 mill. ha, whereas circa 1.7 mill. ha (66 %) of this area is in use as agricultural area. Therefore, Brittany is the largest of all regions chosen for the IDEMA-Project. The region consists of 4 subregions (Départements) (Map 8).

Source: EUROPEAN UNION.

Map 8: The four Départements of Brittany (Bretagne)

Climate: The region's climate is of a very pronounced maritime character. That becomes obvious in moderate warm winters as well as in moderate warm summers by a steady wind blowing. The average daily maximum temperature amounts to circa 15 °C, whereas the average daily minimum temperature amounts to around 8 °C. The annual precipitation adds up to more than 900 mm, which also causes a constant high humidity (> 50 %).

Landscape: The topography of the region is flat to softly wavy, with some cuts in the surroundings of small becks and rivers. In general, the soils have a limited fertility because they are quite acidic and usual stony. In contrast, on the north-coast of Brittany there are some very fertile lowlands, where traditionally vegetables were grown. Nevertheless, abundant rainfall ensures sufficiently good conditions for agricultural purposes in the whole region.

Agriculture: The average regional yield for cereals amounts to 7.0 t/ha (AGRESTE BRETAGNE 2003) and can be considered to be slightly above the nationwide average of 6.8 t/ha. In view of a lot of agricultural products, Brittany is the most important region in France. E.g. 21 % of the nationwide milk production, 56 % of pork meat and 46 % of poultry meat originate from that region, therefore it has an exposed position with regard to agricultural production[39], value added and employment (AGRESTE BRETAGNE 2003). But, in the course of intensification the agricultural output, negative (external) effects have arisen as well (nitrogen surplus in the groundwater etc.). According to that, the value of the livestock density is comparatively high (1.4 LU/ha[40]) with problematic peaks in some selective areas. The agricultural area is used for cultivating cereals (30 %), annual fodder on arable land, mainly maize (27 %), perennial fodder on arable land (18 %), set-aside (5 %), potatoes (4 %), protein plants (1 %) and oilseeds (1 %). 14 % of the UAA is used as grassland. The average farm size amounts to 33 ha/farm (AGRESTE BRETAGNE 2003) and is therefore below the nationwide average farm size of 42 ha/farm[41]. Table 29 gives an overview to the number of farms distributed into different farm size classes and the respective percentage shares. The majority of farms (almost 25 %) can be found in the group “< 5 ha”[42]. In the past a steady structural change had taken place by annually quitting approximately 5 % of all farms the agricultural sector[43].

[39] In a historic perspective, the region’s character changed from a cattle breeding (dairy cows and beef cattle) region to a region of fattening pigs and poultry on a high degree of concentration, intensification and integration. Nevertheless, dairy cow and beef cattle husbandry is also in these days still a very important way to get a benefit from light and fairly poor soils.

[40] Own calculation based on the regions’ general characteristics.

[41] In view to the economic size measured by ESU-Units the agricultural farms of Brittany are above the national average by actual 48.7 ESU compared to 44.6 ESU (AGRESTE BRETAGNE 2003).

[42] A high share of these farms can be supposed to be part-time farms which represent a percentage share of 33 % of all farms in 2000 (AGRESTE BRETAGNE (2003).

[43] By assuming that smaller farms rather stop producing than large farms and that no area is not used (fallow), the absolute values and also the percentage shares in the larger farm classes had increased in the past, i.e. the average farm size increases over time.

Table 29: Number of farms in different size classes (total number and percentage shares)

Size class	Number of farms	in %
< 5 ha	12,719	24.8
5 – 20 ha	8,842	17.3
20 – 35 ha	8,140	15.9
35 – 50 ha	8,298	16.2
50 – 75 ha	8,140	15.9
75 – 100 ha	3,138	6.1
100 – 125 ha	1,205	2.3
125 – 150 ha	417	0.8
> 150 ha	320	0.6
Total	*51,219*	*100.0*

Source: AGRESTE BRETAGNE 2003, AGRESTE 2000 and AGRESTE BRETAGNE.

Table 30 gives an overview of the importance of different farm types. The small farms specialised in horticulture, permanent crops, sheep farming and others are noticeably below the average farm size which amounts to 33.2 ha/farm. Eminently above average are dairy and mixed farms with acreage-sizes of 47.3 ha/farm respectively 41.6 ha/farm. These two types of farming are the most important ones. The region's character as a dairy and beef cattle region as well as an intensive livestock region (pigs and poultry production) has already been pointed out. The numerous small number and little area of "Horticulture", "Permanent crop" and "Pig and Poultry" farms should not deceive unnoticed the economic and employment impacts coming from these farms.

Table 30: Type of farming (number of farms, landuse and percentage shares)

Type of farming	Total number	in %	Total UAA	in %	Ø – Size (in ha)
Field crops	7,240	14.1	172,587	10.1	23.8
Horticulture	955	1.8	5,383	0.3	5.6
Permanent crops	522	1.0	3,693	0.2	7.1
Dairy	16,201	31.6	766,096	45.0	47.3
Grazing livestock	5,098	9.9	135,134	7.9	26.5
Sheep farms	4,355	8.5	23,411	1.5	5.4
Pig and Poultry	4,853	9.5	104,708	6.2	21.6
Mixed (crops and livestock)	11,784	23.0	490,506	28.8	41.6
Others	211	0.4	46	~ 0	0.2
Total	*51,219*	*100.0*	*1,701,564*	*100.0*	*33.2*

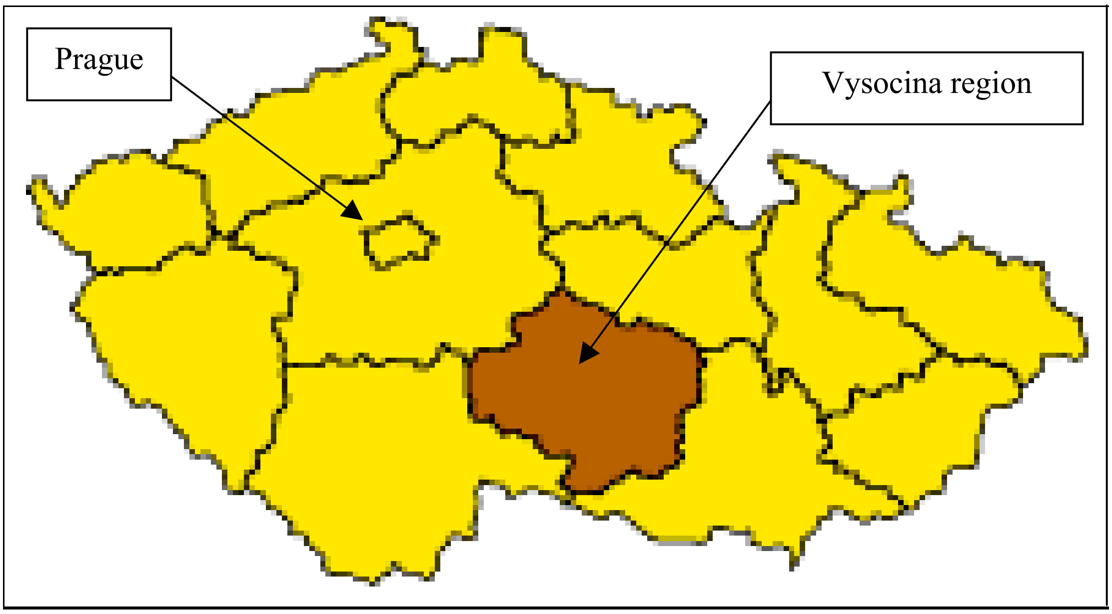
Source: AGRESTE 2000.

4.9 Czech Republic: Vysočina

The Vysocina region is located in the centre of the Czech republic (Map 9), en route between Prague and Vienna. Structural characteristics are substandard population density on the one side, but on the other side unemployment rates are low. The population density averages to 75 citizens per km². Compared with the national value of 130 citizens per km², this are only 58 %. The region is traditionally dominated by agricultural activities. This is highlighted by the share of agricultural employment that partly achieves more than 20 %. Hence, the monthly salary is one of the lowest in the whole Czech Republic.

Climate: Vysocina, like the Czech Republic as a whole, is situated in a changeover area between oceanic and continental conditions. Whereas the climate is mild and arid in lowlands, it is cool and humid with 7° C mean temperature and 640 mm precipitation per year in the focused region.

Landscape: The hilly upland with the highest (lowest) point at 837m (237m) above sea level has an extent of approximately 7,000 km² with around 100 km in east-west and up to 100 km in north-south extension. A characteristic of the region is the long tradition in forestry. Today, nearly 30 % of the area are covered by forests. The soil quality, measured on a scale between 6 to 100 points including most important production features, like soil type, slope, depth and skeleton, is with 30 points below the Czech average of 42 points, which is reflected in substandard soil capability.



Source: WIKIPEDIA.

Map 9: Regions of Czech Republic – Vysocina region

Agriculture: There are 6,293 farms in the region, of which are 45 % households, 50 % private farms and 5 % (274) cooperatives. Altogether there is an agricultural area of 393,726 ha to the farms' disposal, of which 21.3 % is grassland and 78.7 % arable land (Table 31).

Table 31: Use of area in „Vysocina" (in ha and percentage shares)

Use of area	in ha	in %
Arable land	309,913	78.7
Grassland	82,800	21.3
Total (Utilised agricultural area; UAA)	*393,726*	*100.0*

Source: CZECH STATISTICAL OFFICE (2004).

The average size of corporate (individual) farms is 1,621 ha (59 ha). Compared with the national structure the individual farms are smaller and the cooperatives are larger with a relative size of 53 % and 110 % respectively. Only 6 % of the farms manage more than 100 ha (Table 32). Reconsidering the high share of farms which can be considered to be households, the character of a small scale and coeval large scale region is quite obvious[44]. Definitely, the households have to be ranked in the first category `<10 ha` and more detailed information

[44] Althouh there were not yet data available on the share of landuse of each legal form, it can be assumed that Vysocina region has a pronounced dualistic agricultural structure. In view to landuse and plot size structure the region can be considered to be large scaled. One reason - besides of many more - to explain this phenomenon of persistence might be the fact that some of the small farms are managed by farmers which are also employees (and joint-partners) of corporate farms. These farmers use at least their human capital in their professional full-time as well as in their part-time employment. The joint use of machinery even enables to benefit from economies of scale.

about the distribution inside this class of farms < 10 ha and about the total land in the several categories would be helpful, but this additional information was not yet available.

Table 32: Number of farms in different size classes (total number and percentage shares)

Size class	Total number	in %
< 10	4,421	70.3
10 - 50 ha	1,257	20.0
50 - 100 ha	238	3.8
100 - 200 ha	95	1.5
200 - 500 ha	80	1.3
500 - 1000 ha	78	1.2
1000 - 2500 ha	100	1.6
> 2500 ha	24	0.4
Total	*6,293*	*100.0*

Source: CZECH STATISTICAL OFFICE (2004).

Typical production activities are grazing livestock husbandry and production of field crops, particularly rape seed and potatoes due to favourable climatically conditions. Table 33 shows the distribution of farm types over the number of farms. The main specialisations are field crop production (44.5 %) and mixed farming, i.e. crop and livestock production (40.3 %). Hence, it can be supposed that a big part of animal production takes place in these mixed and not (yet) specialised farms. The shares on Dairy (6.0 %), Grazing livestock (4.8 %) and Granivore (4.4 %) farms are relatively low. Furthermore, in Vysocina, the livestock density exceeds with 0.8 LU/ha to 29 % the average of the country of 0.62 LU/ha, whereas the wheat yield is identical (approximately 5 t/ha). For rape seed (about 3 t/ha) and potatoes (24 t/ha) the yields are higher as in the remaining country (2.8 and 18.5 t/ha respectively). As for the legal form, mostly corporate farms perform Dairy milk production whereas individual farms perform meat livestock farming[45].

Table 33: Type of farming (number of farms and percentage shares)

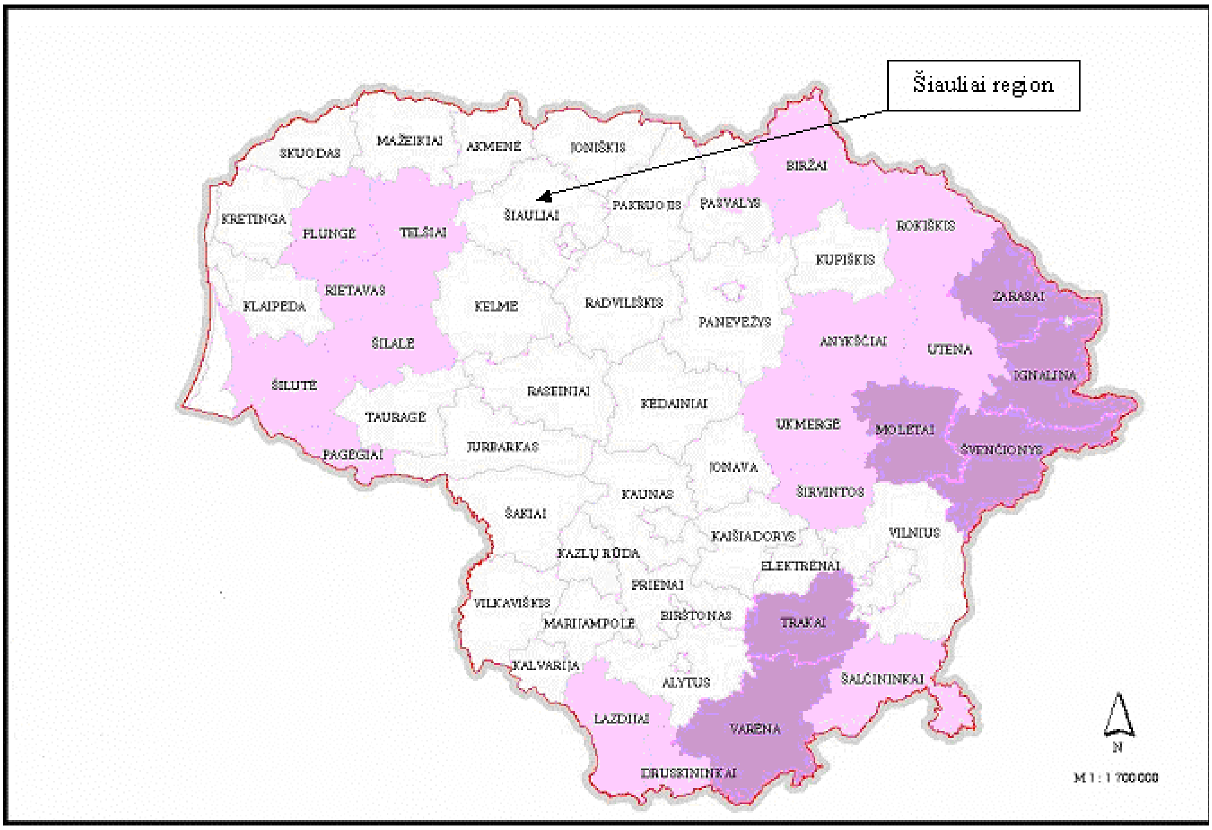
Type of farming	Total number	in %
Field crop	1,336	44.5
Dairy	180	6.0
Grazing livestock	145	4.8
Granivore	132	4.4
Mixed (crops and livestock)	1,208	40.3
Total	*3,001*	*100.0*

Source: CZECH STATISTICAL OFFICE (2004).

[45] Experts` assessments mentioned in the questionnaire about the regions.

4.10 Lithuania: Šiauliai

The size of the Lithuanian study region is measured by 82.5 km east-west extension multiplied by 97.5 km north-south extension. This amounts to approximately 854 thousand ha, whereof 426,504 ha consist of agricultural area (UAA) (Map 10). The 35,575 farms of the region have an average size of 12 ha/farm, which is significantly above the nationwide average of 9.1 ha/farm[46].



Map 10: Districts of Lithuania – Šiauliai region in the North

Climate: The climate is transitive from maritime (Baltic Sea) to a bit less maritime to hinted continental. Therefore, winters and summers are humid and soft. The average temperature in January and February amounts to -3 °C and in July and August to +19 °C.

Landscape: The Šiauliai district belongs to the Middle Lithuanian Lowland-Nemunas Lowstream and to the East Zemaiciai Plateau (according to the agroecological zoning). The part of the land situated in the Middle Lithuania Lowland-Nemunas Lowstream is characterised by flat and downy moraine plains. The soil in this area is of clay, loam and sandy loam but of a fairly fertile nature, especially in comparison to other Lithuanian regions. The part of the land

[46] All data are based on STATISTIKOS CENTRAS (2003a,b).

situated in the East Zemaiciai Plateau region is characterised by sandy loam and loamy soil. There are small and middle-sized hills. The region is quite dissected, nerved by a big river (Dubysa; in the centre of the Šiauliai district) and some medium-sized rivers. There is only one major lake (Rekyvos; near the Siauliai city). The altitude in the area varies from 0 to 150 m. There are some swamps in the south-east of the region. There are some huge forest areas which cover a share of 25.1 % of the region's surface.

Agriculture: In view of their economic size, the farms in the region are relatively large (25.7 ESU/farm). Only in the Marijampoles district, the farm size is with 28.6 ESU/farm predominant. In view to the type of farming crop producing farms play the most important role. The average output amounts to 60,090 €/farm, of which 54,381 €/farm (90 %) is due to crop production and only 4,580 €/farm (8 %) is due to livestock production[47]. By an output-share of 51 % cereals are the most important commodity. The average wheat yield of the region (3.47 t/ha) is almost at the same level as the nationwide average wheat yield of 3.84 t/ha[48].

While crop producing farms are larger farms, the livestock farms are usually smaller, often managed as small-scaled subsistence or semi-subsistence farms. The distribution of different kinds of landuse are given in below-mentioned Table 34.

Table 34: Use of land in Šiauliai region 2002 (values in ha and percentage shares)

Use of land	in ha	in %
Arable land	372,338	83.3
Orchards and berry plantations	4,265	0.9
Grassland	49,901	11.7
*Total (*UAA)	*426,504*	*100.0*

Source: STATISTIKOS CENTRAS (2003a,b).

As for the legal forms of farms, Table 35 gives an impression. Although cooperations are rare to be found[49], they have a certain relevance with regard to the landuse (22 %). Their calculative average size can be measured to 756 ha per cooperation whereas the private farms achieve an average size of only 9.4 ha/farm.

47 The remaining part of 1,411 €/farm (2 %) also accounts to “other crop output”.

48 All data in place are also based on the STATISTIKOS CENTRAS (2003a,b).

49 It has to be in mind, that cooperations (i.e. agricultural cooperative societies) are often regarded as a negative relict of former soviet regime times.

Table 35: Number of farms, landuse and organisational forms of agricultural enterprises in Lithuania (2002)

Organisational form	Number of farms	in %	UAA (in ha)	in %	Ø – Size (in ha)
Partnerships[50] – agricultural companies and enterprises	123	~ 0	92,991	22	756
Individual farms[51]	35,452	> 99	333,513	78	9.4

Source: STATISTIKOS CENTRAS (2003a,b).

The 35,575 farms in the region are distributed to different farm size classes as described in Table 36. The number of farms smaller than 5 ha amounts to 20,001 (56 %), the number of these larger than 5 ha to 15,574 (44 %). In the range from 0 to 10 ha exists a peak in the size classes of "3 - 5 ha" and "5 – 10 ha".

Table 36: Number of farms in different size classes (Total number and percentage share)

Size class	Total number	in %
< 2 ha	4,256	12
2 – 3 ha	7,487	21
3 – 5 ha	8,258	23
5 – 10 ha	8,211	23
10 – 20 ha	4,104	12
20 – 30 ha	1,006	3
30 – 50 ha	655	2
50 – 100 ha	391	1
100 – 200 ha	142	0,4
200 – 300 ha	355	~ 1
300 – 500 ha	355	~ 1
> 500 ha	355	~ 1
Total	*35,575*	*100*
Total (excluded farms < 5 ha)	20,001	56

Source: STATISTIKOS CENTRAS (2003a,b).

[50] More than *one* owner.
[51] Farms with only one owner (usually "Family farms").

4.11 Slovakia: Nitra

The Nitra region is one of the eight districts of the Slovakia. It is located in the southeast of the Slovakia (Map 11). The total UAA of the region adds up to 414,668 ha. This corresponds to 74.1 % of the region's total area. The remaining part of the region's territory is covered by forest areas (15.1 %), surface covered by water (2.5 %), built-up areas (5.8 %) and other areas (2.5 %). The extension from North to South is 102 km, from East to West it is 109 km.

Climate: The Nitra region is in order to the whole Slovakia characterised by a continental climate with a lot of snowfall in winter and warm summers. The average minimum temperature in January is -3 °C whereas the average maximum temperature in July and August amounts to 26 °C. The average rainfall can be calculated to 488 mm/a (increasing in dependence to the altitude).

Landscape: The region is flat, only the north part is a little bit hilly. There are several rivers, the biggest and the most important of them is Danube. The soil types of the region are various; there are mainly chernozem, mollicfluvisoil (similar to the chernozem), haplicluvisoil (brownsoil) and fluvisoil along the rivers. The soil quality of this region is predominantly very good and it provides the best conditions for agricultural activities within Slovakia (this is generally also valid for the West-Slovakia consisting of the regions of Bratislava, Trnava, Trencin and Nitra). These districts possess the most productive agricultural areas. The region is consistent, i.e. it is not dissected in smaller parts.

Map 11: Slovakia, subdivided into 8 districts

Agriculture: The agricultural landuse in Nitra is proportioned as follows shown in Table 37. The major part of the land is used as arable land (86.6 %) whereas the share of grassland (6.6 %) is relatively low compared to all study regions. The demand for other kinds of use like gardens (3.0 %), vineyards (2.6 %) and hop-gardens (0.02 %) is relatively low, but these kinds of use might be important for regional employment impacts (household and subsistence farming) and the general physiognomic appearance of the region.

Table 37: Use of area in the Nitra region (in ha and percentage shares)

Use of area	in ha	in %
Arable land	359,102	86.6
Permanent grassland	27,368	6.6
Garden	12,440	3.0
Vineyards	10,781	2.6
Orchards	4,561	1.1
Hop-gardens	83	0.02
Total (total UAA)	*414,668*	*100.0*

Source: STATISTICAL OFFICE OF THE SLOVAK REPUBLIC (2002).

Taking all farms into account, there are 16,973 farms in the region[52] in the year 2001 (Table 38). 56 % of the farms are smaller than 0.5 ha. The small-scaled and subsistence character of the region is quite obvious. By excluding all farms smaller than 5 ha, the number of farms shrinks to 1,487 and the remaining farms constitute only a share of 8.8 %[53].

[52] The definition of a "farm" in the Census is the following:
The UAA is more than 0.5 ha *or*
the acreage of intensive crops (orchards or vegetable or flowers) is more than 1 500 m^2 *or*
the acreage of vineyard is more than 500 m^2 or 300 pieces of vine-stocks *or*
at least 1 head of cattle or 2 pigs or 4 sheep or 4 goats or 50 poultries *or*
at least 100 fur-bearing animals or 100 rabbits or 5 colonies of bees.

[53] Unfortunately, there were no data available on the respective areas which are managed by farms in different size classes. It can be supposed that the situation with regard to the area by farm classes is quite inverse, i.e. a few large farms (`companies` by different legal forms) manage the bigger part of the land.

Table 38: Number of farms in different size classes (total number and percentage shares)

Size class	Total number	in %
Farms without UAA	189	1.1
< 0.5 ha	9,395	55.4
0.5 - 1 ha	2,842	16.7
1- 5 ha	3,060	18.0
5 - 10 ha	419	2.5
10 - 50 ha	519	3.1
50 - 100 ha	157	0.9
100 - 500 ha	198	1.2
500 - 1,000 ha	68	0.4
> 1,000 ha	126	0.7
Total	*16,973*	*100.0*
Total (excluded farms < 0.5 ha)	7,389	43.5
Total (excluded farms < 5 ha)	1,487	8.8

Source: STATISTICAL OFFICE OF THE SLOVAK REPUBLIC (2002).

Connected with the distribution into different size classes it is quite obvious that also in Slovakia the farm structure is \`dual\`. On the one hand there are small scale individual subsistence farms and on the other, market-orientated large scale farms, organised in different legal forms (limited liability companies, co-operatives, joint stock companies, etc.). Against the background of the before-mentioned, the indicator \`average farm size\` (24.7 ha/farm in the Nitra region compared to 30.4 ha/farm in the whole Slovakia) has just a limited significance. Table 39 gives an overview of the allocation of farms with respect to their organisational form. Unfortunately, there is no data available to distinguish the area managed by different organisational forms.

Table 39: Organisational form of farms (total number and percentage share)

Organisational form	Total number	in %
Individual farms	16,654	98.1
Partnerships	319	1.9
Total	*16,973*	*100.0*

Source: STATISTICAL OFFICE OF THE SLOVAK REPUBLIC (2002).

The plurality of various production activities is also reflected in different kinds of `Type of farming` (Table 40). With shares of almost 30 % field crop, permanent crop (fruits and nuts) and mixed farms dominating in the region. In view of the number of farms, granivore, horticulture and grazing livestock farms play a secondary role.

Table 40: Number of farms and percentage shares according to `Type of farming`

Type of farming	Total number	in %
Field crop farms	4,614	27.3
Horticulture (vegetables, products of flower nurseries)	925	5.5
Permanent crops (fruits and nuts) farms	4,746	28.1
Grazing livestock farms	246	1.5
Granivore farms	1,357	8.0
Mixed farms	5,005	29.6
Total	*16,893*	*100.0*

Source: STATISTICAL OFFICE OF THE SLOVAK REPUBLIC (2002).

Due to excellent soil qualities, yields in Nitra are above-average. The regional average wheat yield amounts to 4.5 t/ha compared to 4.0 t/ha in the whole Slovakia. The average stocking density of 0.48 LU/ha does not diverge distinctly from the nationwide value of 0.44 LU/ha, within the context of all IDEMA-regions, both values can be considered to be very low.

5 Selection and weighting of typical farms in the study regions

As already mentioned in section 3.1 we represent a region by selecting farms from a farm sample and weighting them to match the regional characteristics. Hence this method delivers two kinds of results for all regions:

1) The farms which are selected and their weighting factor

2) The quality of the representation of the real region by virtual region.

Table 41 gives an overview on farm samples from which we have chosen the typical farms. Moreover the table shows how many typical farms were selected in the different regions from the respective farm samples. In Saxony we have a huge farm sample, because it was possible to use data from IACS[54]. In comparison with Saxony the farm samples of Jönköping, respectively listing 32 and 74 farms, are quite small.

5.1 Selected farms (in Nitra)

Using the selected typical farms of Nitra, Table 42 shows exemplary for all regions which farm indicators we used to run the "upscaling" procedure. The indicators are normally:

- The organisational form (generally individual farms and partnerships)
- The farm type (e.g. field crop farm, dairy farm, mixed farm etc.)
- The area of arable and grassland
- The number of different livestock

Additionally we gave each typical farm a number to identify it in the AgriPoliS-simulations. Beside these data we show in Table 42 the weight which shows how often each selected farm exists in the virtual regions. The selected farms of the other regions are described in Table 62 to Table 71 in the appendix.

[54]Integrated Administration and Control System

Table 41: Description of farm data samples for case study regions

Country	Region	Typical farms	Number of farms in sample	Number of farms per FADN farm type (FADN type number in brackets)							Comments
				FC (13,14,60)	D (41)	GL (42,43,44)	M (71,72,81,82)	G (50)	PC (32,33,34)	Wine (31)	
Sweden	Jönköping	13	63	2	43	12	6				
	Västerbotten	12	32	3	24	1	3	1			
UK	Southeast England	12	74	15	8	12	39				
Italy	Marche	18	159	105			36		4	14	Farm type 60 in M
	Calabria	16	134	21	4	7	25		77		- " -
Germany	Hohenlohe	24	141	30		44*	21	46			
	Saxony WGII	30	1852	1288		526*	17	21			
France	Brittany	28	605	54	256	36	178	81			Farm type 60 in M
Czech Republic	Vysočina	22	144 (250)	56 (+87)	7	6	72 (+19)	2	1		
Lithuania	Siuliai	11	195	160	6		29				
Slovakia	Nitra	20	119	86	3		27	1	2		Farm type 60 in M

Notes: FC – Field crops, D – Dairy, GL – grazing livestock, M – Mixed, G – Granivore, PC – Permanent crops; * Pooled.

Organisational form

According to the FADN-definition of organisational forms we differentiate two organisational forms. **Individual (family) farms**, which are holdings where the economic result covers the compensation for the unpaid labour input and own capital of the holder/manager and her/his family and **partnerships**, which are holdings, where the economic result covers the compensation for the production factors brought into the holding by several partners, of which at least half participate to the work on the farm as unpaid labour (EUROPEAN COMMISSION, 2002).

In Southeast England and Italy no information about the organisational form in the regional statistics was available, hence we cannot consider the organisational form in these two regions to represent them. On the other hand more detailed data about the organisational form were available in Saxony, Hohenlohe and Brittany. In Germany a special differentiation of individual farms exists. Farms whose economic size is smaller than 16 ESU or which have less than 1 AWU are called part time farms, because often the farmers of such farms spend more time for a job outside agriculture. Hence their income is just partially from farming and they are called part time farmers (HESSENAUER, 2002). As part-time-farming is often the first step to quit farming and as it is important in Hohenlohe, because there are just individual farms, we considered this organisational form there and also in Saxony. In Saxony we differentiate the partnerships into two types. The first type has generally few owners (two or three sometimes also more). This kind of partnership is called “Personengesellschaft” in Germany. The other kind of partnerships are corporations or cooperatives, which are called “Juristische Personen” and owned by more people than a “Personengesellschaft”. By law these partnerships are differentiated through the kind of liability. Owners of a “Personengesellschaft” are also liable with their private assets while “Juristischen Personen” are only liable with the assets belonging to the corporation or cooperative. The differentiation between these kinds of partnership is important, because their goals are often different, depending on the number of people which can influence these goals.

Table 42: Selected 'Typical farms' in Nitra, Slovak Republic

Organi-sational Form	Farm No.	Farm type [a]	Weight	Total UAA	Arable land	Grassland	Beef cat-tle [1]	Dairy cows	Sows [2]	Fattened pigs [3]
Individual farms	**1**	FC	341	5	5	-	-	-	-	-
	2	FC	206	20	20	-	-	-	-	< 50
	3	FC	198	40	40	-	-	-	-	-
	4	FC	38	90	90	-	-	-	-	-
	5	FC	214	143	130	13	< 25	-	-	-
	6	FC	14	780	780	-	-	-	-	-
	7	M	32	78	78	-	-	< 50	-	-
Partner-ships	**8**	FC	68	80	80	-	-	-	-	-
	9	FC	11	560	560	-	-	-	50 - 150	200 - 500
	10	FC	12	1,293	1,225	68	-	-	50 - 150	500 - 1,000
	11	FC	12	813	773	40	-	50 - 150	50 - 150	500 – 1,000
	12	FC	39	1,423	1,378	45	-	-	< 50	50 - 200
	13	FC	18	4,963	4,688	275	-	> 500	> 500	> 2,500
	14	M	8	615	615	-	< 25	50 - 150	< 50	200 - 500
	15	M	20	690	690	-	-	150 -250	150 - 250	1,000 – 2,500
	16	M	16	1,200	1,172	28	50 - 100	50 - 150	50 - 150	200 - 500
	17	M	14	1,348	1,340	8	50 - 100	150 - 250	-	200 - 500
	18	M	18	1,823	1,765	58	100 - 200	250 - 500	250 - 500	1,000 - 2,500
	19	M	4	2,588	2,568	20	-	> 500	150 - 250	500 - 1,000
	20	M	9	3,305	2,215	1,090	-	250 - 500	250 - 500	500 –1,000

[a]) FC: Field crop farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Breeding sows of 50 kg or more.

[3]) Fattened pigs of 20 kg or more.

Source: derived of FADN-data by regional partners

In Brittany partnerships are differentiated in the organisational form GAEC (Groupement agricole d'exploitation en commun), which is similar to "Personengesellschaften" in Germany and EARL (L'Exploitation agricole à responsabilité limitée), which is the similar to "Juristische Personen. Individual farms are also differentiated in part and full time farms like in Germany, but as no data about part time farms was no data available, hence it was not possible to consider part-time farming in Brittany.

Farm types

The definition of farm types is also taken from FADN (PUBLICATIONS OFFICE 2003). Below Table 42 is an explanation of the acronyms. In Hohenlohe, Saxony and Vysočina dairy farms and grazing livestock farms are merged together in regional statistics.

Land and Livestock

Because the size of one plot in AgriPoliS is fixed to 0.5 ha (Italy), 2.5 ha (all other regions except Saxony: 5 ha) we show rounded numbers for the land. About the livestock we show only the herd size of the individual farms, because of confidentiality.

5.2 Representation of the regional characteristics (in Nitra)

As mentioned at the beginning of section 5, the upscaling procedure also delivers other results, which show the quality of the representation of the regional characteristics. These results are shown exemplary for the region Nitra in Slovak Republic in Table 43. The results for the other regions are shown in similar tables in the appendix. First it should be mentioned that we differentiate between general characteristics, which describe the regional main features:

- total number of farms
- total utilized agricultural area (UAA)
- total number of livestock

And characteristics, which describe the structure of a region:

- number of farms per farm type and organisational form
- amount of arable and grassland
- number of farms in different size classes
- number of animals in different herd sizes

Hence Table 43 is divided in two parts, the general characteristics and the structural characteristics. The second column shows the value for each characteristic, which we got from re from our partners out of regional statistics. These numbers are real data. As they are from different sources, not all data are always consistent and so we adjusted them for the "upscaling"-procedure.

The adjusted data are bold and can be found in the third column of Table 43. One example for inconsistent data is: it could be that the sum of arable and grassland is not the same as the total UAA. Another reason to adjust the data is that small farms are not considered in AgriPoliS, because it is difficult a) to get data about them and b) to represent small farms with a MIP under the assumption that they maximise their household income. In Nitra we don't consider farms smaller than 5 ha. Hence we have to adjust all data for Nitra. Fortunately in the case of Nitra it was possible to recalculate all characteristics from the statistical data. But this was not possible for all regions, as you can see in the appendix.

The fourth column shows the upscaling results which we derived from weighting the capacities and characteristics of the selected farms. Column five shows the deviation between the considered and adjusted data and the upscaling results. Comparing the deviation of the different regions, it is obvious that they are more or less well represented. This depends on the representativeness of the farms in samples derived from FADN or IACS data. The last column compares the upscaling results with the regional data. In Nitra only 8 % of the farms are represented in the virtual region, but they occupy 90 % of the total UAA. There are also some other differences, but they are mainly caused by the fact that we adjusted the regional data and not by the deviation between the upscaling results and the adjusted data.

Table 43: Upscaling results Nitra, Slovak Republic – part 1

General characteristics	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Representation of the characteristics
Number of farms	16,973	**1,342**	1,292	-4 %	8 %
Utilized agricultural area (UAA; ha)	414,668	**387,909**	372,408	-4 %	90 %
Number of beef cattle older than 1 year	15,336	**8,576**	8,508	-1 %	55 %
Number of dairy cows	36,847	**35,400**	36,551	3 %	99 %
Number of suckler cows	615				
Breeding sows with more than 50 kg	38,691	**36,681**	34,423	-6 %	88 %
Fattening pigs with more than 20 kg	203,085	**168,318**	174,200	3 %	86 %
Structural characteristics					
Area (ha)					
Arable land	381,542	**366,820**	350,268	-5 %	92 %
Grassland	22,182	**21,089**	22,140	5 %	100 %
Total	403,724	**387,909**	372,408		
Organisational form					
Number of individual farms	16,654	**1,090**	1,043	-4 %	6 %
Number of holdings	319	**252**	249	-1 %	78 %
Total	16,973	**1,342**	1,292		
Number of farms specialized in					
Field crop (13, 14)	4,614	**762**	927	22 %	20 %
Horticulture (20)	925				
Permanent Crops (31, 32, 33, 34)	4,746				
Grazing livestock (41, 42, 43, 44)	246				
Pig and poultry (50)	1,357				
Mixed farms (60, 71, 72, 81, 82)	5,005	**580**	365	-37 %	7 %
Total	16,893	**1,342**	1,292		
Number of farms in different size classes					
Farms without UAA	189				
Less than 0,5 ha	9,395				
0,5-1 ha	2,842				
1-5 ha	3,060				
5-10 ha	419	**373**	341	-9 %	81 %
10-50 ha	519	**447**	404	-10 %	78 %
50-100 ha	157	**143**	138	-3 %	88 %
100-500 ha	198	**188**	214	14 %	108 %
500-1000 ha	68	**66**	65	-2 %	96 %
Above 1000 ha	126	**125**	130	4 %	103 %
Total	16,973	**1,342**[1)]	1,292		
Number of dairy cows in different livestock units					
0 - 50	1,304	**662**	672	2 %	52 %
50 - 150	4,749	**4,320**	4,312	0 %	91 %
150 - 250	6,357	**5,981**	6,202	4 %	98 %
250 - 500	10,738	**10,738**	10,899	1 %	101 %
Above 500	13,699	**13,699**	14,466	6 %	106 %
Total	36,847	**35,400**	36,551		

Table 43: Upscaling results Nitra, Slovak Republic – part 2

Structural characteristics	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of breeding sows with more than 50 kg					
0 - 50	2,090	**1,930**	1,877	-3 %	90 %
50 - 150	4,844	**4,786**	4,895	2 %	101 %
150 - 250	3,840	**3,840**	3,792	-1 %	99 %
250 - 500	8,137	**8,137**	8,343	3 %	103 %
Above 500	20,050	**17,988**	15,516	-14 %	77 %
Total	38,691	**36,681**	34,423		
Number of fattened pigs with more than 20 kg					
0 - 50	20,108	**3,924**	3,914	0 %	19 %
50 - 200	5,595	**3,850**	3,987	4 %	71 %
200 - 500	12,010	**11,249**	10,849	-4 %	90 %
500 - 1000	29,840	**29,140**	27,314	-6 %	92 %
1000 - 2500	57,127	**57,127**	57,972	1 %	101 %
Above 2500	78,405	**63,028**	70,164	11 %	89 %
Total	203,085	**168,318**	174,200		

Note: 1) excluded farms with less than 5 ha
Source: STATISTICAL OFFICE OF THE SLOVAK REPUBLIC (2002).

As mentioned above small farms are not considered in the AgriPoliS modelling. Table 44 gives an overview how this affects the representation of the regions. In the first column the minimum farm size for counting farms in the national statistics is listed. The second column shows the minimum size of farms considered in AgriPoliS. For example, in both Swedish regions (Jönköping and Västerbotten) and in Saxony only farms bigger than 10 ha are considered. In Calabria it was not possible to consider farms smaller than 1 ha and bigger than 100 ha, because there were no farms in these size classes in the farm sample of Calabria. In South East England, farms were not classified by farm size in hectare, but in the economic size unit (ESU). Unfortunately, farm types are calculated in UK only for farms bigger than 8 ESU. So it was not possible to consider farms smaller than 8 ESU and it was also not possible to adjust the total UAA to the UAA used by farms bigger than 8 ESU. Thus, how written in the fifth column, 77 % of all farms are not considered in the upscaling. On the right side of Table 44 the area not considered in the virtual region is shown in absolute and relative numbers. It is obvious that except in Calabria and Šiauliai farms above 10 ha use most of the agricultural area. The share of farms which are not considered is in 7 out of 11 regions bigger than 35 %, but these 7 regions are only two in which the share of agricultural land not considered is above 10 %. This shows that regarding the production in the regions it its not a huge problem, when small farms are not considered. The only problematic results came up in Southeast England and Calabria. In Southeast England it was not possible to adjust the area of agricultural land to the number of farms which are considered, because the farm size is measured in ESU and not in hectare.

Table 44: Adjustments in the regional data

Regions	Minimum farm size in statistics	Farms not considered			UAA not considered	
		Criteria	Number	%	Area in ha	%
Jönköping	2 ha	<10 ha	1,006	40	6,382	9
Västerbotten	2 ha	<10 ha	1,608	42	9,012	7
Southeast	-	<8 ESU	8,688	77	0	0
Marche	0 ha	without UAA	59	1	0	0
Calabria	0 ha	<1;>100 ha	5,971	56	8,746	30
Hohenlohe	2 ha	-	0	0	0	0
Saxony	2 ha	<10 ha	1,006	35	17,351	3
Bretagne	1 ha	<5 ha	6,043	12	32,537	2
Vysočina	1 ha	-	0	0	0	0
Šiauliai	0 ha	<5 ha	20,001	56	50,000	12
Nitra	0 ha	<5 ha	15,631	92	26,759	6

6 Representation of typical farms in study regions

As explained in sections 2 and 3, the representation of the selected farms requires on the one hand the capacities of the individual farms, which are shown in Table 42 and on the other hand additional data about:

- *production activities*: gross margins, variable costs, (coupled) subsidies, technical coefficients on factor use (feeding requirements, liquid capital demand, labour demand, crop rotation, nitrogen production/uptake), average annual milk yield per cow, percentage of variable costs bound during a production period, crop rotation

- *investment options*: investment costs, typical share of equity bound in investments, size/capacity of the investment, useful life, average work requirement per unit, estimates on maintenance costs

- *financing activities*: interest rates for long-term and short-term borrowed capital, savings interest,

- *labour activities*: wages of unqualified farm-labour, wages of unqualified off-farm labour

All these data are compiled in tables. Only two production activities are described more detailed in the following section. All other data about production activities are shown in the appendix. The tables about the production activities illustrate yields, prices, costs etc. for all countries. Differences between countries will be discussed but it should not arise the impression that we want to make a competitive comparison between the countries. We aim only to identify some kind of base gross margins for each production activity or base costs for investment options for each region before the accession. Price fluctuations and quality differences are not considered.

6.1 Production activities

In this section data of plant and livestock production activities are shown. Table 45 and . Table 46 give a first overview about the considered plant and livestock production activities in the different regions. The most common crops in all regions are barley, wheat, rape seed and protein plants followed by sugar beets which are planted in Marche, Hohenlohe, Saxony and Šiauliai, the Lithuanian region. Vegetables and all permanent crops, like wine, olives and oranges are special for the Mediterranean regions. For ruminant fodder, mainly permanent grassland is used as pasture or for silage. The most common forage crop on arable land is forage maize, except in Sweden, UK, Brittany, Vysočina and Siaulia. There farmers use arable land also as temporary grassland for silage or even pasture, as in Sweden. This shows that ruminants are very important in Sweden, hence ruminants are regarded more diversified than in the other regions. There we consider beside “classical” beef cattle, three additional cattle production activities like an extensive beef cattle production called “bullock”.

Table 45: Plant production activities in the regions

Plant production	Västerbotten	Jönköping	Southeast	Calabria	Marche	Hohenlohe	Saxony	Brittany	Vysočina	Šiauliai	Nitra
Crops											
Barley	x	x	x	x	x		x	x	x	x	x
Wheat			x	x		x	x	x	x	x	x
Durum Wheat				x	x						
Triticale		x						x			
Oats	x	x	x	x							
Rape seed			x			x	x	x	x	x	x
Potatoes			x						x	x	
Sugar beets					x	x	x			x	
Protein plants			x$^{1)}$		x$^{2)}$	x$^{3)}$	x$^{4)}$	x$^{4)}$		x	
Maize				x	x						
Vegetables				x	x						
Permanent crops											
Table wine				x	x						
Quality wine					x						
Olives				x	x						
Oranges				x							
Ruminant fodder											
Forage maize			x	x	x	x	x	x			x
Arable pasture	x	x	x								
Arable grassilage	x	x						x	x$^{5)}$	x	
Grassland pasture	x	x	x	x	x	x	x	x	x	x	
Grassland grassilage				x	x	x	x	x	x	x	x

Notes: 1) winter beans, 2) sunflower, 3) field beans, 4) peas, 5)fodder crops

Bullocks are fattened longer than young bulls. And there are two activities for fattening calves (“fatbull dairy”) and heifers (“fatbull suckler”). These activities are not listed in Table 46 but they are shown in more details in a special table for beef cattle in Sweden (Table 85 in the appendix).

Another special issue in Sweden are the additional activities for heifers for dairy and suckler cows. In all other regions the recruitment costs for dairy and suckler cows are included in the variable costs.

Table 46: Livestock production activities in the regions

Livestock production	Västerbotten	Jönköping	Southeast	Calabria	Marche	Hohenlohe	Saxony	Brittany	Vysočina	Šiauliai	Nitra
Breeding Sows			x			x	x	x	x	x	x
Fattening pigs			x			x	x	x	x	x	x
Beef cattle	x	x	x	x	x	x	x	x	x	x	x
Suckler cows	x	x	x	x	x	x	x	x	x	x	
Dairy cows	x	x	x	x		x	x	x	x	x	x
Sheep	x	x	x	x							
Poultry chicken								x			
Hens								x			
Turkey						x					

Regarding livestock production, beef cattle, dairy and suckler cows are produced almost in all regions, followed by breeding sows and fattening pigs. Poultry production is important only in Brittany and Hohenlohe. In Brittany, poultry chicken and hens are dominate and in Hohenlohe turkeys. Sheep are kept in the regions with a lot of grassland, like Sweden, Southeast England and also in Marche.

For all these production activities, variable costs, revenues and labour demand were collected by IDEMA-partners. For two examples, barley and breeding sows, the collected data are shown in the text. Data for all other production activities is shown in the appendix (Table 72 to Table 85). Note, that revenues in all tables could not be calculated exactly out of yields and prices, because they often include revenues of additional or joint products (e.g. in livestock production the revenue includes also the revenue from selling the old cow or sow). Table 47 presents data from all regions in which barley is planted. The first column lists the yields in tones per hectare. It is obvious that there are some unfavourable field crop regions like Västerbotten and Jönköping in Sweden and Marche in Italy with a yield of 2.3 to 4.1 t/ha.

The other regions are more favourable with regard to field crops, but it is not obvious for all of them. For example, yields in Vysočina and Nitra are not as high as in Southeast England or Saxony, but this is caused by transition conditions for example lower education and lack of capital. The lack of capital leads to a lower factor input, e.g. less plant protection or nitrogen input compared to the other regions, as shown in Figure 14 in section 4.

The price of one ton of barley is more or less around 100 Euro, except in Marche (141 Euro) and Nitra (119 Euro). These two factors (price and yield) determine the revenue per hectare barley, which varies from 227 Euro/ha in Västerbotten to 953 Euro/ha in Calabria.

Table 47: Barley

	Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Västerbotten	2.3	99	227	321	-94	273
Jönköping	3.5	99	346	275	71	186
Southeast	6.4	101	648	286	362	355
Marche	4.1	141	750	149	468	289
Calabria			953	214	739	289
Saxony	7.0	91	616	380	257	392
Brittany	7.5	100	750	344	406	355
Vysočina	5.2	90	490	296	194	
Šiauliai			355	142	214	12/0 1)
Nitra	4.1	119	444	238	206	

Note: no value, means we didn’t receive data from our partners
1) in 2002 and in 2003
Source: See Table 72

Costs per hectare barley increase from around 140 Euro/ha in Nitra (Slovak Republic) and Marche (Italy) to 344 Euro/ha in Brittany and 380 Euro/ha in Saxony, which are at the same time the most intensive field crop regions. The low gross margins in Västerbotten and Jönköping can be compensated by premiums, which include also national payments.

For livestock production, the same data as for plant production are presented, but the yields are shown more detailed. A quite simple example are breeding sows, where only the number of piglets and the price per piglet is shown (see Table 48), but for the fattening of sows (Table 79 in the appendix) or beef cattle (Table 84) the starting weight, the weight at the end, the number of fattening days and the carcass weight is shown. Additionally, the daily weight gain is calculated, so that the activities could be compared against each other. Revenues, variable costs and gross margins of all livestock activities are calculated for one year. Except the table for breeding sows the tables for all other livestock activities are shown in the appendix. As regards to breeding sows Table 48, shows that the number of piglets per year varies from 15.3 in Vysočina and Nitra to 21 in Southeast England and Saxony. There is also a big variation in the prices per piglet. In the NMS, the lowest price is around 27 Euro per piglet, whereas the prices in the EU-15 are around 50 Euro per piglet. The lower number of piglets and the almost 50 % lower price per piglet lead to extremely low revenues (around 400 Euro) per breeding sow in comparison with the EU-15 countries (around 1,000 Euro). But in the NMS, costs are 50 % lower, which compensates partially the large difference in the revenues of 600 and more Euro. Additionally it should be considered that in the NMS labour costs are lower than in the EU-15 and hence the difference gets smaller. Another important issue is that all prices are from before accession and that they get adjusted between Old and NMS since the accession.

Table 48: Breeding sows

	Piglets per Year	Price per piglet	Revenue	Variable cost	Gross margin
		Euro	Euro/year	Euro/year	Euro/year
Southeast	21.0	41	915	544	371
Hohenlohe	17.4	61	1,151	683	468
Saxony	21.6	49	1,098	754	344
Brittany	19.5	52	1,087	657	430
Vysočina	15.3	26	402	238	164
Šiauliai		29	290	103	187
Nitra	15.7	29	455	276	179

Note: no value, means we didn't receive data from our partners

The total labour costs are also influenced by the labour input and the labour input differs for each production activity from one country to another. These differences are shown in Table 49, by considering the same operation size for each country. In some regions we model not all production activities and hence we have not about all production activities the figures about labour input. For example in Sweden and Italy no sows and pigs are modelled. In the Italian region Marche there are also no dairy cows modelled. The same holds for suckler cows in Nitra. But for Italy and Hohenlohe there are no suckler cow and beef cattle stables with more than 40 places. Hence it is not possible to compare these two regions with the others. For crops it is assumed that the labour input decreases corresponding to the increase of the farm size, because farmers can use bigger and more efficient machinery. In Table 49 the labour input is compared for wheat or barley on a 100 ha farm.

When comparing labour input of the different production activities, the difference between the EU-15 and the NMS is obvious too, at least for Lithuania (Šiauliai) and Slovak Republic (Nitra). In Czech Republic the differences to the EU-15 are quite small. But there are also differences within the EU-15 countries. In Sweden for example, crop production is very extensive and labour input is low. The huge difference to the other regions is also caused by a high input of agri-services in Sweden. Plant protection and fertilisation is done by contractors. In Italy, labour input is extremely high, compared to the other regions.

Table 49: Labour input per place or ha in the different regions for the same operation size

	Beef Cattle	Suckler cows	Dairy	Sows	Pigs	Crops
Operation size	100	100	120	ca. 120	600	100 ha
Sweden	6.0	9.7	35.0	-	-	2.5
Southeast	7.9	6.5	30.0	16.5	1.8	8.0
Calabria	-	-	50.0	-	-	22.0
Marche	-	-	-	-	-	22.0
Hohenlohe	12.0	-	51.0	20.0	2.0	8.8
Saxony	14.5	20.0	37.0	16.0	1.3	8.5
Brittany	11.5	20.0	37.0	15.0	1.3	8.5
Vysočina	15.0	9.7	33.0	17.0	1.6	8.5
Šiauliai	21.3	22.0	37.5	19.0	2.3	10.0
Nitra	23.1	-	69.0	29.2	3.7	11.0

Note: “-“, means there exists no stable with this operation size

In Sweden and Southeast England beef cattle and suckler cow production seems to be very extensive, because the labour input is much lower than in the other regions. This corresponds to the high grassland share in these two regions, of which a lot is used as pasture. In dairy production, the most labour intensive regions are Calabria, Marche, Hohenlohe and Nitra, where 50 or more hours are needed to keep a cow, whereas in the other regions the labour demand is between 30 and 40 hours.

6.2 Investment options

Typical farms in AgriPoliS can re-invest and they can also expand their production during the simulation by new investments. Hence data about several typical investment options are collected for each region. In AgriPoliS we assume also economies of scale for larger investment objects. Table 50 shows the different stable and machinery sizes in the region Nitra (Slovak Republic) and the assumed useful life for these investment options. In AgriPoliS all selected farms are initialised with investment objects corresponding to the number of livestock identified for the selected farm. The same holds for machinery. As data on asset vintage is not available we assign a random age such that the residual value and the depreciation of the stables can be further calculated in AgriPoliS in each simulation period.

Table 50: Investment options Nitra

Investment	Capacity (place, ha)	Useful life (years)
Sows	40, 60, 120, 250, 500, 800, 1,200	20
Pigs	100, 200, 320, 600, 1,000, 2,000, 5,000	20
Beef cattle	80, 100, 200, 300	25
Dairy	40, 60, 120, 200, 400	25
Machinery	15, 30, 50, 100, 200, 500, 1,000	12

For the investments economies of scale are considered by way of the labour demand which decreases with an increase of the stable or machinery size. The same relation is valid for the investment costs per place or hectare. Table 51 gives an overview about the variation of the investment costs identified for the different regions. In the two Swedish and Italian regions the same costs and sizes are assumed, hence the values for these regions are shown together under the name of their country. Where possible, investment costs for one stable respectively for one hectare machinery in the same size class are listed. For example in Italy there are no beef cattle or suckler cow stables with 100 places. The same holds for pigs and machinery in Italy. For machinery we assume that a farm has enough machinery to use all his land, that means a farm with 15 ha has a pool of machinery with which it can cultivate the 15 ha. The costs for these machinery pools are derived out of machinery assets in FADN-data, from farms in different size classes.

Table 51: Investment costs per place in the different regions

	Beef Cattle	Suckler cows	Dairy	Sows	Pigs	Machinery
Capacity	100	100	120	100	ca. 120	600 ha
Sweden	1,756	2,964	7,135	1,679	-	-
Southeast	935	905	2,156	905	1,658	271
Italy	-	-	4,500	973	-	-
Hohenlohe	2,400	-	4,160	1,235	2,300	360
Saxony	2,400	1,800	4,160	1,200	2,300	360
Brittany	2,100	2,057	4,000	1,200	2,100	390
Vysočina	1,541	525	2,914	420	1,212	359
Šiauliai	842	620	1,460	421	737	120
Nitra	1,472	-	1,788	900	842	237

Investment costs are the lowest in Lithuania. The highest investment costs can be found in Sweden, except for beef cattle stables, which are cheaper than in Germany or France. But the costs of a stable depend also on the equipment components of the investment, which are not known. It is obvious that in Southeast England the investment costs are similarly low like in the NMS, what could be explained by a lower level of equipment in the stables, than in the other OMS. Beside this the investment costs in Germany and France are very similar. Concerning the NMS the highest investment costs can be observed in the Czech region, Vysočina. But by comparing the investment costs it has to be considered, that it is not defined how one stable type is build in the different countries. All these data intend only to show the assumed typical investment characteristics identified for the purpose of AgriPoliS. They are by no means a suitable basis for comparison and profitability considerations, as already mentioned at the beginning of this section.

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Appendix

Table 52: Upscaling results Jönköping county, Sweden

General characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms	3,824	**2,216**	2,274	3%	59%
Utilized agricultural area (UAA; ha)	134,216	**125,204**	125,975	1%	94%
Number of beef cattle older than 1 year	45,339	45,339	41,738	-8%	92%
Number of dairy cows	33,158	33,158	32,793	-1%	99%
Number of suckler cows	12,173	12,173	11,586	-5%	95%
Number of eves and rams	8,548	8,548	8,514	0%	100%
Sows after the first mating	4,826				
Fattening pigs	14,325				
Structural characteristics					
Area (ha)					
Arable land	91,369	**82,357**	81,028	-2%	89%
Grassland	42,847	42,847	44,948	5%	105%
Total	134,216	125,204	125,975		
Number of farms specialized in[1)]					
Field crop farms (13, 14, 60)	1,166				
Grazing livestock (41, 42, 43, 44)	2,054				
Pig and poultry (50)	19				
Mixed farms (71, 72, 81, 82)	931				
Total	4,170				
Number of farms in different size classes					
2-10 ha	1,608				
10-20 ha	779	779	784	1%	101%
20-30 ha	438	438	444	1%	101%
30-50 ha	506	506	524	4%	104%
50-100 ha	400	400	428	7%	107%
Above 100 ha	93	93	94	1%	101%
Total (excluded farms with less than 10 ha)	2,216	2,216	2,274		
Number of dairy cows in different livestock units					
1-9	474	478	472	0%	100%
10-24	5,332	5,374	5,346	-1%	100%
25-49	14,717	14,832	14,591	-2%	99%
50-74	6,766	12,474	12,384	-1%	100%
Over 74	5,611				
Total	32,900	33,158	32,793		

Source: STATISTICS SWEDEN (2003); 1) REGIONAL DATA (2002).

Table 53: Upscaling results Västerbotten county, Sweden

General characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms	2,506	**1,500**	1,508	1%	60%
Utilized agricultural area (UAA; ha)	74,414	**68,032**	70,718	4%	95%
Number of beef cattle older than 1 year	15,336	15,336	14,208	-7%	93%
Number of dairy cows	15,526	15,526	15,359	-1%	99%
Number of suckler cows	1,130	1,130	1,140	1%	101%
Number of eves and rams	3,857				
Sows after the first mating	2,322				
Fattening pigs	15,039				
Structural characteristics					
Area (ha)					
Arable land	70,269	**64,423**	67,173	4%	96%
Grassland	4,145	3,609	3,545	-2%	86%
Total	74,414	68,032	70,718		
Number of farms specialized in[1)]					
Field crop farms (13, 14, 60)	1,807				
Grazing livestock (41, 42, 43, 44)	745				
Pig and poultry (50)	21				
Mixed farms (71, 72, 81, 82)	544				
Total	3,117				
Number of farms in different size classes					
2-10 ha	1,006				
10-20 ha	516	516	510	-1%	99%
20-30 ha	250	250	254	2%	102%
30-50 ha	283	283	291	3%	103%
50-100 ha	328	328	332	1%	101%
Above 100 ha	123	123	121	-2%	98%
Total (excluded farms with less than 10 ha)	1,500	1,500	1,508		
Number of dairy cows in different livestock units					
1-9	299	**332**	336	1%	112%
10-24	3,593	**3,992**	3,915	-2%	109%
25-49	6,926	**7,696**	7,598	-1%	110%
50-74	2,240	**2,489**	2,500	0%	112%
Over 74	915	**1,017**	1,010	-1%	110%
Total	13,973	15,526	15,359		

Source: STATISTICS SWEDEN 2003; 1) REGIONAL DATA (2002).

Table 54: Upscaling results Southeast England, UK

General characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms bigger than 8 ESU	11,214	**2,526**	2,813	11 %	79 %
Utilized agricultural area (UAA; ha)	530,696	445,973	460,043	3 %	103 %
Beef cows	34,467	34,467	31,371	-9 %	91 %
Beef fatteners	46,479	46,479	44,561	-4 %	96 %
Dairy cows	58,362	58,362	57,790	-1 %	99 %
Breeding sheep	430,528	430,528	397,155	-8 %	92 %
Fattening pigs	27,860				
Structural characteristics					
Area (ha)					
Arable land (Crops, fallow and temporary grassland)	259,485	259,485	296,748	14 %	114 %
Grassland (permanent and rough grazing)	186,488	186,488	163,295	-12 %	88 %
Total	445,973	445,973	460,043		
Number of farms bigger than 8 ESU specialized in					
Field crop farms (13)	1,111	1,111	1,069	-4 %	96 %
Specialist fruit (32)	294				
Specialist glass (20)	269				
Other horticulture (20)	195				
Specialist Hardy Nursery Stock (20)	119				
Pigs and poultry (50)	139				
Dairy (41)	276	276	298	8 %	108 %
Grazing livestock (42, 43, 44)	708	708	845	19 %	119 %
Mixed farms (71, 72, 81, 82)	431	431	601	39 %	139 %
Total	3,542	2,526	2,813		
Number of breeding sheep in different live-stock units					
Below 100	49,389	49,389	20,480	-59 %	41 %
100-200	49,124	49,124	38,073	-22 %	78 %
200-500	124,648	124,648	132,342	6 %	106 %
500-1000	119,747	**119,747**	**120,793**	1 %	101 %
Over 1000	87,620	87,620	85,467	-2 %	98 %
Total (excluded farms with less than 10 ha)	430,528	430,528	397,155		
Number of dairy cows in different livestock units					
Below 100	12,911	12,911	12,580	-3 %	97 %
100-200	26,010	26,010	25,740	-1 %	99 %
Over 200	19,441	19,441	19,470	0 %	100 %
Total	58,362	58,362	57,790		

Source: DEFRA (2002), data from 2001 and 2002.

Table 55: Upscaling results Saxony Wirtschaftsgebiet II, Germany – part 1

General characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms	2,858	1,852	1,835	-1 %	64 %
Utilized agricultural area (UAA; ha)	496,451	479,100	483,145	1 %	97 %
Number of beef cattle older than 1 year	8,197	7,451	7,500	1 %	91 %
Number of dairy cows	96,705	96,272	96,119	0 %	99 %
Number of breeding sows	**27,479**	26,574	26,546	0 %	97 %
Number of fattened pigs	**69,602**	67,944	68,045	0 %	98 %
Number of suckler cows	12,079	10,500	10,500	0 %	87 %
Structural characteristics					
Area (ha)					
Arable land	425,185	417,530	423,290	1 %	100 %
Grassland	64,418	61,570	59,855	-3 %	93 %
Total					
Number of farms in different organisational forms					
Juristische Personen	278	234	222	-5 %	80 %
Personengesellschaften	221	208	222	7 %	100 %
Full time farms	881	761	738	-3 %	84 %
Part time farms	1,478	649	653	1 %	44 %
Number of farms specialized in					
Field crop (13, 14, 60)	1,625	1,288	1,298	1 %	80 %
Dairy (41) and grazing livestock (42, 43, 44)	921	526	498	-5 %	54 %
Pig and poultry (50)	33	21	21	0 %	64 %
Mixed (71, 72, 81, 82)	67	17	18	6 %	27 %
Others (20, 31 - 34)	209				
Total	2,855				
UAA of granivore farms	2,223	2,155	2,205	2 %	99 %
UAA of Juristische Personen specialized in					
Field crop	170,733	170,665	166,195	-3 %	97 %
Dairy and grazing livestock	80,273	80,145	90,765	13 %	113 %
Mixed	23,422	23,295	20,160	-13 %	86 %
Others 1)	4,601				
UAA of Personengesellschaften specialized in					
Field crop	57,567	57,580	57,320	0 %	100 %
Dairy and grazing livestock	17,434	17,390	17,760	2 %	102 %
Others 1)	2,048				
UAA of full time farms specialized in					
Field crop	88,850	88,785	90,265	2 %	102 %
Dairy and grazing livestock	21,020	20,915	19,360	-7 %	92 %
Mixed	896				
Others 1)	2,140				
UAA of part time farms specialized in					
Field crop	16,953	15,495	16,310	5 %	96 %
Dairy and grazing livestock	4,203	2,675	2,805	5 %	67 %
Mixed	417				
Others 1)	3,669				

Table 55: Upscaling results Saxony Wirtschaftsgebiet II, Germany – part 2

Structural characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms in different size classes					
Less than 10 ha	888				
10 - 50 ha	904	797	775	-3 %	86 %
50 - 100 ha	292	293	298	2 %	102 %
100 - 200 ha	274	273	269	-1 %	98 %
200 - 500 ha	260	249	253	2 %	97 %
500 - 1000 ha	111	111	113	2 %	102 %
1000 - 2500 ha	105	104	104	0 %	99 %
2500 ha und mehr	24	24	23	-4 %	96 %
Total	2,858	1,851	1,835		
Number of dairy cows in different livestock units					
Less than 50	4,460	4,187	4,224	1 %	95 %
50-150	11,840	11,680	11,600	-1 %	98 %
150-250	6,979	6,979	7,000	0 %	100 %
250-500	24,010	24,010	23,095	-4 %	96 %
500-1000	21,227	21,227	21,000	-1 %	99 %
More than 1000	28,189	28,189	29,200	4 %	104 %
Total	96,705	96,272	96,119		
Number of breeding sows with more than 50 kg					
Less than 100	1,271	1,021	1,026	0 %	81 %
100-200	1,474	1,474	1,480	0 %	100 %
200-500	5,478	5,478	5,480	0 %	100 %
500-1000	8,025	7,370	7,360	0 %	92 %
More than 1000	11,231	11,231	11,200	0 %	100 %
Total	27,479	**26,574**	26,546		
Number of fattened pigs with more than 20 kg					
Less than 50	2)	1,619	1,660	3 %	
50-199		3,250	3,255	0 %	
200-499		4,753	4,750	0 %	
500-1000		10,250	10,280	0 %	
1000-2500		22,620	22,600	0 %	
More than 2500		25452	25,500	0 %	
Total	69,602	**67,944**	68,045		98 %

Comments: 1) wine, other permanent crop, horticulture and other farms, 2) These data were not required in the first query

Source: Based on data from (LfL Sachsen 2002) out of applications for agricultural subsidies 2002 and own calculations

Table 56: Upscaling results Hohenlohe, Germany – part 1

General characteristics	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Representation of the characteristics
Number of farms	2,869	2,869	2,857	0 %	100 %
Utilized agricultural area (UAA; ha)	73,439	73,439	73,587	0 %	100 %
Number of beef cattle older than 1 year	50,902	50,902	48,006	-6 %	94 %
Number of dairy cows	17,667	17,667	17,562	-1 %	99 %
Number of breeding sows	101,122	101,122	99,785	-1 %	99 %
Number of fattened pigs	106,008	106,008	106,074	0 %	100 %
Number of turkeys	450,000	450,000	457,664		
Structural characteristics					
Area (ha) [2]					
Arable land	59,974	**57,468**	59,034	3 %	98 %
Grassland	16,667	**15,971**	14,553	-9 %	87 %
Total	76,641				
Number of farms in different organisational forms[1]					
Full time farms	1,553	1,553	1,607	4 %	103 %
Part time farms	1,316	1,316	1,250	-5 %	95 %
UAA of farms in different organisational forms[1]					
Full time farms	57,321	57,321	57,350	0 %	100 %
Part time farms	16,117	16,117	16,237	1 %	101 %
Number of farms specialized in[1]					
Field crop (13, 14, 60)	459	459	521	14 %	114 %
Dairy (41) and grazing livestock (42, 43 44)	906	906	873	-4 %	96 %
Pig and poultry (50)	988	988	951	-4 %	96 %
Mixed (71, 72, 81, 82)	516	516	512	-1 %	99 %
UAA of farms specialized in[1]					
Field crop	9,569	9,569	9,143	-4 %	96 %
Dairy and grazing livestock	21,683	21,683	23,408	8 %	108 %
Pig and poultry	27,766	27,766	26,774	-4 %	96 %
Mixed	14,421	14,421	14,261	-1 %	99 %
Total	73,439	73,439	73,856		
Number of farms in different size classes[2]					
Less than 10 ha	817	828	712	-14 %	87 %
10 -30 ha	968	981	1,042	6 %	108 %
30 - 50 ha	622	630	666	6 %	107 %
Above 50 ha	424	430	437	2 %	103 %
Total (excluded farms < 1 ha and > 100 ha)	2,831	2,869	2,857		
Number of dairy cows in different livestock units[3]					
Less than 20	23 %	4,063	3,942	-3 %	97 %
20-29	20 %	3,533	3,502	-1 %	100 %
30-39	17 %	3,003	3,032	1 %	99 %
40-59	25 %	4,417	4,445	1 %	99 %
Above 60	15 %	2,650	2,641	0 %	100 %
Total	17,667	17,666	17,562		

Table 56: Upscaling results Hohenlohe, Germany – part 2

Structural characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Representa-tion of the characteris-tics
Number of breeding sows with more than 50 kg[3)]					
Less than 30	6 %	6,067	5,976	-2 %	
30-49	8 %	8,090	8,022	-1 %	
50-99	25 %	25,281	24,740	-2 %	
Above 100	61 %	61,684	61,047	-1 %	
Total	101,022	101,022	99,785		
Number of fattened pigs with more than 20 kg[3)]					
Less than 100	9 %	9,541	10,007	5 %	
100-199	9 %	9,541	9,519	0 %	
200-399	21 %	22,262	21,635	-3 %	
400-599	24 %	25,442	25,531	0 %	
Above 600	37 %	39,223	39,382	0 %	
Total	106,008	106,009	106,074		

Source: 1) STATISTISCHES LANDESAMT BADEN-WÜRTTEMBERG (1999); 2) STATISTISCHES LANDESAMT BADEN-WÜRTTEMBERG (2003); 3) calculated from statistical reports, average of county Hohenlohe and Schwäbisch-Hall, STATISTISCHES LANDESAMT BADEN-WÜRTTEMBERG (2001)

Table 57: Upscaling results Colli Esini (Marche), Italy

General characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms	5,785	**5,726**	5,510	-4 %	95 %
Utilized agricultural area (UAA; ha)	49,082	49,093	49,040	0 %	100 %
Irrigated UAA	2,012	2,012	2,009	0 %	
Number of beef cattle older than 1 year	3,059	3,059	3,082	1 %	
Number of pigs	16,910	16,910	16,863	0 %	
Structural characteristics					
Area (ha)					
Arable	42,718	**43,083**	43,008	0 %	101 %
Grassland	1,052	**1,061**	1,062	0 %	101 %
Table wine	830	**837**	841	0 %	101 %
Quality wine	2,985	**3,010**	3,026	0 %	101 %
Olive oil	1,092	**1,101**	1,105	0 %	101 %
Total	48,677	49,093	49,040		
Number of farms in different size classes					
Farms without UAA	59				
Less than 1 ha	1,054	1,054	1,084	3 %	103 %
1 -2 ha	943	943	576	-39 %	61 %
2-5 ha	1,680	1,680	1,762	5 %	105 %
5-10 ha	1,008	1,008	1,035	3 %	103 %
10-20 ha	555	555	563	1 %	101 %
20-50 ha	357	357	361	1 %	101 %
50-100 ha	77	77	77	0 %	100 %
Above 100 ha	52	52	52	0 %	100 %
Total	5,785	5,726	5,510		
Number of farms specialized in					
Field crop (13, 14)	3,820	**3,880**	3,581	-8 %	94 %
Wine (31)	509	**517**	642	24 %	126 %
Olive oil (33)	0				
Horticulture (20)	0				
Fruits (32)	146				
Milk (41)	0				
Grazing livestock (42, 43, 44)	0				
Pig and poultry (50)	0				
Mixed (60, 71, 72, 81, 82)	1,309	**1,329**	1,287	-3 %	98 %
Total	5,784	5,726	5,510		
UAA of farms specialized in					
Field crop farms	37,465	**38,062**	38,125	0 %	102 %
Wine	1,275	**1,296**	1,203	-7 %	94 %
Olive oil	0				
Horticulture	0				
Fruits	760				
Milk	0				
Grazing livestock	0				
Pig and poultry	0				
Mixed	9,582	**9,735**	9,712	0 %	101 %
Total	49,082	49,093	49,040		

Source: ISTAT (2002), except for "type of farms" where we upscaled FADN data, Info: lobianco@dea,unian,it

Table 58: Upscaling results Piana di Sibari (Calabria), Italy

General characteristics	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Representation of the characteristics
Number of farms	10,626	**4,655**	4,631	-1 %	44 %
Utilized agricultural area (UAA; ha)	29,176	**20,413**	19,027	-7 %	65 %
Irrigated UAA	9,729	**6,807**	7,248	6 %	74 %
Number of beef cattle older than 1 year	2,531	2,531	1,667	-34 %	66 %
Number of dairy cows	2,042	2,042	1,650	-19 %	81 %
Number of pigs	3,095	3,095	2,940	-5 %	95 %
Number of ovins	3,664	3,664	4,255	16 %	116 %
Number of goats	3,665	3,665	3,330	-9 %	91 %
Structural characteristics					
Area (ha)					
Arable land	8,614	**6,092**	6,646	9 %	77 %
Grassland	1,332	**942**	1,481	57 %	111 %
Table wine	282	**199**	218	9 %	77 %
Olive oil	9,815	**6,941**	5,662	-18 %	58 %
Fruits	8,820	**6,238**	5,021	-20 %	57 %
Total	28,863	**20,413**	19,027		
Number of farms in different size classes					
Farms without UAA	54				
Less than 1 ha	5,887				
1 -2 ha	2,137	2,137	2,196	3 %	103 %
2-5 ha	1,647	1,647	1,562	-5 %	95 %
5-10 ha	482	482	493	2 %	102 %
10-20 ha	210	210	211	0 %	100 %
20-50 ha	146	146	149	2 %	102 %
50-100 ha	33	33	20	-39 %	61 %
Above 100 ha	30				
Total (excluded farms < 1 ha and > 100 ha)	4,655	4,655	4,631		
Number of farms specialized in					
Field crop (13, 14)	1,665	**729**	778	7 %	47 %
Wine (31)	0				
Olive oil (33)	1,427	**625**	522	-16 %	37 %
Horticulture (20)	0				
Fruits (32)	4,679	**2,050**	2,003	-2 %	43 %
Milk (41)	317	**139**	141	2 %	44 %
Grazing livestock (42, 43, 44)	555	**243**	185	-24 %	33 %
Pig and poultry (50)	0				
Mixed (60, 71, 72, 81, 82)	1,983	**869**	1,002	15 %	51 %
Total	10,626	4,655	4,631		
UAA of farms specialized in					
Field crop farms	5,988	**4,189**	3,814	-9 %	64 %
Wine	0				
Olive oil	3,778	**2,643**	2,890	9 %	77 %
Horticulture	0				
Fruits	6,330	**4,429**	4,891	10 %	77 %
Milk	1,178	**824**	764	-7 %	65 %
Grazing livestock	812	**568**	555	-2 %	68 %
Pig and poultry	0				
Mixed	11,091	**7,760**	6,114	-21 %	55 %
Total	29,176	20,413	19,027		

Source: see Table 57

Table 59: Upscaling results Brittany, France – part 1

General characteristics[1)]	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Representation of the characteristics
Number of farms	51,219	**45,176**	43,967	-3 %	86 %
Utilized agricultural area (UAA; ha)	1,701,568	**1,669,031**	1,693,698	1 %	100 %
Number of beef cattle older than 1 year	695,300	634,500	513,179	-19 %	74 %
Number of dairy cows	779,400	771,936	840,748	9 %	108 %
Number of suckler cows	142,200	142,200	150,124	6 %	106 %
Sows after the first mating	550,000	551,100	563,635	2 %	102 %
Fattened pigs with more than 50 kg	3,171,500	3,171,500	3,359,765	6 %	106 %
Table type chicken [1000]	39,540	39,540	39,900	1 %	101 %
Hens [1000]	23,340	23,340	22,443	-4 %	96 %
Structural characteristics					
Number of farms in different organisational forms[1)]					
Private farms (family farms, only one owner)	37,906	**33,434**	32,676	-2 %	86 %
Agricultural Organization of farms (**G**roupement **A**gricole d'**E**xploitation en **C**ommun, GEAC)	4,525	**3,991**	3,797	-5 %	84 %
Farms with limited responsabilities (**E**xploitation **A**gricole à **R**esponsabilité **L**imitée, EARL)	6,927	**6,110**	6,199	1 %	89 %
Other types of cooperation's	1,861	**1,641**	1,295	-21 %	70 %
Total	51,252	45,176	43,967		
UAA of farms (ha)[1)]					
Private farms (family farms, only one owner)	928,437	**910,685**	929,605	2 %	100 %
Agricultural Organization of farms (Groupement Agricole d'Exploitation en Commun)	359,097	**352,231**	351,523	0 %	98 %
Farms with limited responsabilities (Exploitation Agricole à Responsabilité Limitée)	345,060	**338,462**	338,305	0 %	98 %
Other types of cooperation's	68,972	**67,653**	74,265	10 %	108 %
Total	1,701,566	1,669,031	1,693,698		
Area (ha)[1)]					
Arable land	1,559,879	**1,444,072**	1,495,298	4 %	96 %
Grassland	243,000	**224,959**	198,400	-12 %	82 %
Total	1,802,879	1,669,031	1,693,698		
Number of farms specialized in[2)]					
Field crops (13, 14)	7,240	7,240	7,551	4 %	104 %
Horticulture (20)	955				
Permanent crops (32, 33, 34)	522				
Milk (41)	16,201	16,201	16,208	0 %	100 %
Grazing livestock (42, 43)	5,098	5,098	4,974	-2 %	98 %
Sheep farms (44)	4,355				
Pig and poultry (50)	4,853	4,853	5,146	6 %	106 %
Mixed (60, 71, 72, 81, 82)	11,784	11,784	10,088	-14 %	86 %
Others (non classified)	211				
Total	51,219	45,176	43,967		

Table 59: Upscaling results Brittany, France – part 2

Structural characteristics	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Representation of the characteristics
UAA of farms specialized in (ha)2)					
Field crops	172,587	172,587	167,593	-3 %	97 %
Horticulture	5,383				
Permanent crops	3,693				
Milk	766,096	766,096	781,113	2 %	102 %
Grazing livestock	135,134	135,134	133,328	-1 %	99 %
Sheep farms	23,411				
Pig and poultry	104,708	104,708	95,318	-9 %	91 %
Mixed (crops and livestock)	490,506	490,506	516,348	5 %	105 %
Others	46				
Total	1,701,564	1,669,031	1,693,698		
Number of farms in different size classes3)					
< 5 ha	12,719	**6,676**	6,499	-3 %	51 %
5 - 20 ha	8,842	8,842	8,374	-5 %	95 %
20 - 35 ha	8,140	8,140	8,023	-1 %	99 %
35 - 50 ha	8,298	8,298	7,888	-5 %	95 %
50 - 75 ha	8,140	8,140	8,186	1 %	101 %
75 - 100 ha	3,138	3,138	3,055	-3 %	97 %
100 - 125 ha	1,205	1,205	1,204	0 %	100 %
125 - 150 ha	417	417	416	0%	100 %
Above 150 ha	320	320	322	1 %	101 %
Total	51,219	45,176	43,967		
Number of fattened pigs in different livestock units4)					
Below 100	94,959	**53,915**	54,650	1 %	58 %
100-499	731,743	**415,466**	453,852	8 %	62 %
500-999	1,100,408	**624,785**	640,668	3 %	58 %
1000-1999	1,798,637	**1,021,223**	1,101,123	8 %	61 %
Above 2000	1,860,081	**1,056,110**	1,109,472	5 %	60 %
Total	5,585,828	3,171,500	3,359,765		
Number of sows in different livestock units4)					
Below 20	157,231	**10,450**	10,131	-3 %	6 %
20-99	2,135,027	**141,900**	145,190	2 %	7 %
100-199	2,962,557	**196,900**	206,690	5 %	7 %
Above 200	3,020,485	**200,750**	201,624	0 %	7 %
Total	8,275,300	550,000	563,635		
Number of dairy cows in different livestock units5)					
Below 20	46,563	46,563	49,620	7 %	107 %
20-29	106,403	106,403	111,737	5 %	105 %
30-39	175,406	175,406	191,954	9 %	109 %
40-49	142,307	142,307	158,039	11 %	111 %
50 and above	301,257	301,257	329,398	9 %	109 %
Total	771,936	771,936	840,748		

Source: 1) AGRESTE BRETAGNE 2003 ; 2) AGRESTE 2000; 3) AGRESTE BRETAGNE; 4) INSTITUT TECHNIQUE DU PORC (ITP) (2003), these are national data, respective to the shares in each size class the regional values in the columng adjusted data are calcualted; 5) INSTITUT DE L`ELEVAGE (2003)

Table 60: Upscaling results Vysočina, Czech Republic – part 1

General characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of farms	3,443	**3,398**	3,443	0 %	100 %
Utilized agricultural area (UAA; ha)	393,726	393,726	468,470	19 %	119 %
Number of beef cattle older than 1 year	60,560	60,560	41,972	-31 %	69 %
Number of dairy cows	82,466	82,466	80,676	-2 %	98 %
Number of suckler cows	73,430	73,430	34,961	-52 %	48 %
Breeding sows of 50 kg or more	47,703	47,703	47,493	0 %	100 %
Fattened pigs with more than 20 kg	412,672	412,672	321,952	-22 %	78 %
Structural characteristics					
Cooperation's (more than one owner)	274	**273**	299	9 %	109 %
Private farms (family farms, only one owner)	3,159	**3,125**	3,144	0 %	100 %
Total	3,433	**3398**			
Area (ha)					
Arable land	309,913	309,913	373,054	20 %	120 %
Grassland	82,800	82,800	95,415	15 %	115 %
Orchards and berry plantations	4,265				
Total	426,504	376,504	485,733		
Number of farms specialized in					
Field crops (13, 14, 60)	1,733	1,733			
Horticulture (20)	23				
Permanent crops (32, 33, 34)	12				
Milk (41)	163	163			
Grazing livestock (42, 43, 44)	162	162			
Pig and poultry (50)	132	132			
Mixed (71, 72, 81, 82)	1,208	1,208			
Total	3,433	**3,398**			
Number of farms in different size classes					
Below 10	4,421	**1,526**	1,542	-1 %	35 %
10 - 50 ha	1,257	1,257	1,258	0 %	100 %
50 - 100 ha	238	238	249	4 %	104 %
100 - 200 ha	95	95	95	0 %	100 %
200 - 500 ha	80	80	80	0 %	100 %
500 - 1000 ha	78	78	81	4 %	104 %
1000 - 2500 ha	100	100	111	11 %	111 %
Above 2500 ha	24	24	27	14 %	114 %
Total	6,293	3,398	3,443		
Number of fattened pigs in different livestock units					
Below 50	18,942	18,942	18,920	0 %	100 %
50-200	12,883	12,883	13,257	3 %	103 %
200-500	22,425	22,425	22,327	0 %	100 %
500-1000	45,082	45,082	39,141	-13 %	87 %
1000-2500	100,615	100,615	76,769	-24 %	76 %
Above 2500	212,725	212,725	151,539	-29 %	71 %
Total	412,672	412,672	321,952		

Table 60: Upscaling results Vysočina, Czech Republic – part 2

Structural characteristics	Regional Data	Considered and ad-justed data	Upscaling results	Deviation	Represen-tation of the character-istics
Number of sows in different livestock units					
Below 100	8,431	8,431	8,819	5 %	105 %
100-200	6,964	6,964	7,527	8 %	108 %
200-500	9,615	9,615	10,525	9 %	109 %
500-1000	4,859	22,693	20,622	-9 %	424 %
Above 1000	17,834				
Total	47,703	47,703	47,493		
Number of dairy cows in different livestock units					
Below 50	7,877	7,877	7,805	-1 %	99 %
50-150	8,037	8,037	7,482	-7 %	93 %
150-250	10,376	10,376	10,252	-1 %	99 %
250-500	25,459	25,459	25,354	0 %	100 %
500-1000	25,836	30,717	29,783	-3 %	115 %
1000-2000	4,881				
Total	82,466	82,466	80,676		

Source: CZECH STATISTICAL OFFICE (2004)

Table 61: Upscaling results Šiauliai, Lithuania

General characteristics	Regional Data	Considered and adjusted data	Upscaling results	Deviation	Representation of the characteristics
Number of farms	35,575	15,574	14,833	-5 %	42 %
Utilized agricultural area (UAA; ha)	426,504	376,504	485,733	29 %	114 %
Number of beef cattle older than 1 year	7,888	7,888	7,950	1 %	101 %
Number of dairy cows	65,365	65,365	29,340	-55 %	45 %
Number of suckler cows	942				
Sows after the first mating	21,878	21,878	16,612	-24 %	76 %
Fattened pigs with more than 50 kg	77,874	77,874	63,687	-18 %	82 %
Structural characteristics					
Number of					
Cooperation's (more than one owner) - agricultural companies and enterprises	123				
Private farms (family farms, only one owner) - Farmers and family farms (private farms)	35,452				
UAA of farms (ha)					
Cooperation's (more than one owner) - agricultural companies and enterprises	92,991				
Private farms (family farms, only one owner) - Farmers and family farms (private farms)	333,513				
Area (ha)					
Arable land	372,338	332,008	427,105	29 %	115 %
Grassland	49,901	44,496	58,628	32 %	117 %
Orchards and berry plantations	4,265				
Number of farms in different size classes					
Less 2 ha	4,256				
2 - 3 ha	7,487				
3 - 5 ha	8,258				
5 - 10 ha	8,211	8,211	7,988	-3 %	97 %
10 - 20 ha	4,104	4,104	3,817	-7 %	93 %
20 - 30 ha	1,006	1,006	1,007	0 %	100 %
30 - 50 ha	655	655	641	-2 %	98 %
50 - 100 ha	391	391	392	0 %	100 %
100 - 200 ha	142	142	145	2 %	102 %
200 - 300 ha	355	355	319	-10 %	90 %
300 - 500 ha	355	355	292	-18 %	82 %
Above 500 ha	355	355	232	-35 %	65 %
Total (excluded farms < 5 ha)	15,574	15,574	14,833		

Source: STATISTIKOS CENTRAS (2003a); STATISTIKOS CENTRAS (2003b); LAEI (2004a).

Table 62: Selected 'Typical farms' in Jönköping, Sweden

Organi-sational form	Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grass-land	Beef cat-tle	Dairy cows	Suckler cows	Sheep
Individual farms	**1**	D	297	28	18	10	-	10 - 24	-	-
	2	D	209	35	25	10	-	25 - 49	-	-
	3	D	267	63	48	15	10 - 24	25 - 49	-	-
	4	D	72	248	178	70	-	75 - 200	-	-
	5	GL	155	40	15	25	10 - 24	-	-	-
	6	GL	129	40	25	15	-	-	-	50 - 75
	7	GL	47	45	28	18	-	-	10 - 24	-
	8	GL	163	58	30	28	< 10	-	25 - 49	-
	9	GL	94	73	30	43	-	-	25 - 49	-
	10	GL	428	88	55	33	50 - 74	-	-	-
	11	M	332	13	10	3	< 10	-	-	-
Partnerships	**12**	D	59	33	25	8	-	< 10	-	-
	13	D	22	128	103	25	25 - 49	25 - 49	-	-

[a]) D: Dairy farms; GL: Grazing livestock farms; M: Mixed farms
Source: derived of FADN-data by regional partners

Table 63: Selected ‘Typical farms’ in Västerbotten, Sweden

Organi-sational form	Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grassland	Beef cattle	Dairy cows	Suckler cows
Individual farms	**1**	FC	468	18	18	-	-	-	-
	2	FC	41	125	125	-	-	-	-
	3	D	42	18	18	-	< 10	< 10	-
	4	D	254	30	25	5	< 10	< 10	-
	5	D	33	55	50	5	-	10 - 24	-
	6	D	37	53	53	-	-	10 - 24	-
	7	D	262	78	75	3	10 - 24	25 - 49	-
	8	D	10	183	183	-	< 10	> 74	-
	9	D	50	208	208	-	25 - 49	50 - 74	50 - 74
	10	GL	20	130	130	-	25 - 49	-	-
	11	M	291	35	30	5	10 - 24	-	-

[a]) FC: Field crop farms; D: Dairy farms; GL: Grazing livestock farms; M: Mixed farms
Source: derived of FADN-data by regional partners

Table 64: Selected 'Typical farms' in Southeast England, UK

Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grassland	Suckler cows	Beef cattle	Dairy cows	Sheep
1	FC	460	28	20	8	-	-	-	-
2	FC	609	348	338	10	-	-	-	< 50-
3	D	148	60	10	50	-	-	< 100	-
4	D	59	230	113	117	-	-	> 200	-
5	D	91	275	230	45	-	-	100 - 200	< 50
8	GL	353	18	10	8	-	-	-	< 50
6	GL	322	103	-	103	< 25	25 - 50	-	200 - 500
7	GL	170	110	50	60	-	100 - 150	-	-
9	M	343	110	15	95	25 - 50	< 25	-	100 - 200
10	M	7	158	43	115	25- 50	< 25	-	> 1,000
11	M	199	225	-	225	> 50	< 25	-	500 – 1,000
12	M	52	900	683	217	-	-	100 - 200	> 1,000

[a]) FC: Field crop farms; D: Dairy farms; GL: Grazing livestock farms; M: Mixed farms
Source: derived of FADN-data by regional partners

Table 65: Selected 'Typical farms' in Saxony (Wirtschaftsgebiet II), Germany – part 1

Organi-sational form	Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grass-land	Beef cat-tle[1)]	Dairy cows	Suckler cows	Sows[2)]	Fattened pigs[3)]
Individual farms	**1**	FC	14	80	60	20	-	-	< 25	< 100	-
	2	FC	264	90	90	-	-	-	-	-	-
	3	FC	46	110	110	-	-	-	-	< 100	< 50
	4	FC	77	185	180	5	< 25	-	-	-	-
	5	FC	164	270	270	-	-	-	-	-	-
Corpora-tions (Ju-ristische Personen)	**6**	FC	20	90	70	20	-	-	-	-	-
	7	FC	72	560	560	-	-	-	-	-	-
	8	FC	8	885	805	80	25 - 50	-	100 - 200	200 - 500	500 – 1,0
	9	FC	47	1,195	1,195	-	-	-	-	-	-
	10	D	88	145	110	35	-	< 50	-	-	-
	11	D	10	1,460	1,060	400	-	500 - 1,000	-	-	1,000 - 2,500
	12	G	7	45	45	-	-	-	-	-	-
	13	G	14	135	135	-	-	-	-	210 - 220	< 50
	14	GL	44	150	90	60	25 - 50	50 - 150	-	-	-
	15	GL	21	925	780	145	-	-	-	-	50 - 200

[a]) FC: Field crop farms; D: Dairy farms; G: Granivore farms; GL: Grazing livestock farms

[1]) Beef cattle older than one year.

[2]) Sows after the first mating.

[3]) Fattened pigs with more than 50 kg.

Source: derived of FADN-data by regional partners

Table 65: Selected 'Typical farms' in Saxony (Wirtschaftsgebiet II), Germany – part 2

Organisational form	Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grassland	Beef cattle[1)]	Dairy cows	Suckler cows	Sows[2)]	Fattened pigs[3)]
Corporations (Juristische Personen)	**16**	FC	11	465	395	70	-	-	-	-	-
	17	FC	8	4,690	3,790	900	250 - 500	1,000 - 2,000	-	100 - 200	500 – 1,000
	18	D	10	2,415	1,965	450	-	1,000 - 2,000	< 25	-	-
	19	D	5	3,260	2,725	535	-	1,000 - 2,000	-	-	200 - 500
	20	D	8	3,400	2,700	700	-	1,000 - 2,000	-	-	< 2,500
	21	M	4	820	725	95	-	150 - 250	-	500 - 1,000	-
	22	M	6	1,840	1,620	220	-	250 - 500	-	1,000 - 3,000	-
	23	M	12	1,040	820	220	-	250 - 500	-	-	-
Part time farms	**24**	FC	466	35	25	10	< 25	-	< 25	-	-
	25	GL	187	15	5	10	-	-	< 25	-	-
Partnerships (Personengesellschaften)	**26**	FC	53	380	315	65	-	50 - 150	-	-	-
	27	FC	26	1,430	1,220	210	-	250 - 500	-	-	-
	28	D	24	495	370	125	-	150 - 250	-	-	-
	29	D	4	895	645	250	-	250 - 500	-	-	-
	30	GL	115	20	10	10	-	-	< 25	-	-

[a]) FC: Field crop farms; D: Dairy farms; GL: Grazing livestock farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Sows after the first mating.

[3]) Fattened pigs with more than 50 kg.

Source: derived of FADN-data by regional partners

Table 66: Selected 'Typical farms' in Hohenlohe, Germany

Organi-sational form	Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grass-land	Dairy cows	Sows	Fattened pigs	Turkeys
Individual farms	**1**	D	140	30	13	17	20 - 29	-	-	-
	2	D	111	33	10	23	40 - 59	-	-	-
	3	D	101	38	10	28	30 - 39	-	-	-
	4	D	41	90	57	33	> 60	-	-	-
	5	G	94	15	15	-	-	50 - 99	-	-
	6	G	178	20	20	-	-	30 - 49	-	-
	7	G	67	33	33	-	-	100 - 200	-	-
	8	G	13	35	35	-	-	50 - 99	-	-
	9	G	42	35	35	-	-	100 - 200	100 - 199	-
	10	G	83	50	50	-	-	100 - 200	200 - 399	~ 5,500
	11	G	49	55	55	-	-	100 - 200	> 600	-
	12	G	72	55	55	-	-	100 - 200	< 100	-
	13	GL	122	15	10	5	< 20	-	-	-
	14	FC	20	30	30	-	-	-	100 - 199	-
	15	FC	52	78	78	-	-	50 - 99	-	-
	16	G	110	20	20	-	-	100 - 200	-	-
	17	GL	63	30	22	8	< 20	< 30	-	-
	18	M	109	43	28	15	-	50 - 99	< 100	-
	19	M	140	50	50	-	-	70 - 75	-	-
Part time farms	**20**	FC	449	10	10	-	-	-	-	-
	21	FC	52	78	78	-	-	50 - 99	-	-
	22	G	183	18	18	-	-	< 30	< 100	-
	23	G	59	25	25	-	-	-	400 - 599	-
	24	GL	295	15	10	5	-	-	-	-

[a)] FC: Field crop farms; G: Granivore farms; GL: Grazing livestock farms; M: Mixed farms
Source: derived of FADN-data by regional partners

Table 67: Selected 'Typical farms' in Colli Esini (Marche), Italy

Farm No.	Farm type[a)]	Weight	Total UAA	Irrigable land	Arable land	Grass-land	Table wine	Quality wine	Olive oil	Beef cat-tle	Pigs
1	FC	1,084	0.5	0.5	0.5	-	-	-	-	-	-
2	FC	264	3.5	3.5	3.5	-	-	-	-	-	< 20
3	FC	795	4	-	3.5	0.5	-	-	-	-	< 20
4	FC	462	9	-	9	-	-	-	-	-	< 20
5	FC	313	11	-	9.5	1	0.5	-	-	< 25	< 20
6	FC	250	18	0.5	16	-	0.5	-	0.5	-	< 20
7	FC	168	35	-	34	-	-	-	1	-	-
8	FC	156	41	-	40	-	-	1	-	-	-
9	FC	37	82	-	76	-	-	5	1	-	-
10	FC	52	120	-	120	-	-	-	-	-	-
11	M	353	2.5	-	1.5	-	-	0.5	0.5	-	-
12	M	350	5	-	4	-	1	-	-	-	-
13	M	209	5.5	2	3.5	-	1	-	1	-	-
14	M	298	9.5	-	5.5	-	-	3.5	0.5	-	-
15	M	37	27	-	15.0	10	-	2	-	25 - 50	-
16	M	40	53	-	39	-	-	8	6	-	-
17	W	576	1	-	-	-	-	1	-	-	-
18	W	66	9.5	-	2	-	-	7.5	-	-	-

[a]) FC: Field crop farms; M: Mixed farms; W: Wine producing farms
Source: derived of FADN-data by regional partners

Table 68: Selected 'Typical farms' in Piana di Sibari (Calabria), Italy

Farm No.	Farm type[a)]	Weight	Total UAA	Irri-gable land	Arable land	Grass-land	Table wine	Olive oil	Fruits	Beef cattle	Dairy cows	Pigs	Ovins	Goats
1	FC	642	2.5	1	1.5	-	-	1	-	-	-	-	-	-
2	FC	73	13	1	8	5	-	-	-	< 25	-	-	-	-
3	FC	63	20	-	20	-	-	-	-	-	-	-	-	-
4	D	121	4	1	1	2	-	1	-	-	< 25	-	-	-
5	D	20	14	3	9	5	-	-	-	-	< 25	-	-	-
6	GL	185	3	1	2	1	-	-	-	-	-	-	25 - 50	< 25
7	M	614	4	2	1	-	-	3	-	-	-	-	-	-
8	M	104	6	1	1	1	-	4	-	-	-	25 - 50	-	-
9	M	263	9	-	8	-	-	2	-	-	-	-	-	-
10	M	20	51	3	22	26	-	-	3	< 25	-	-	-	-
11	PC	733	1	1	-	-	-	-	1	-	-	-	-	-
12	PC	436	2	-	-	-	1	1	-	-	-	-	-	-
13	PC	1,027	2	2	-	-	-	-	2	-	-	-	-	-
14	PC	125	6	4	-	-	-	2	4	-	-	-	-	-
15	PC	118	12	12	-	-	-	-	12	-	-	-	-	-
16	PC	86	26	3	-	-	-	23	3	-	-	-	-	-

[a]) FC: Field crop farms; D: Dairy farms; GL: Grazing livestock farms; M: Mixed farms; PC: Permanent crop farms
Source: derived of FADN-data by regional partners

Table 69: Selected 'Typical farms' in Brittany, France – part 1

Organi-sational form	Farm No.	Farm type[a)]	Weight	Total UAA	Arable land	Grass-land	Beef cat-tle[1)]	Dairy cows	Suckler cows	Sows[2)]	Fattened pigs[3)]	Hens	Chicken male
Individual farms	**1**	FC	5,115	2.5	2.5	-	-	-	-	-	-	-	-
	2	D	4,135	13	8	5	-	< 20	-	-	-	-	-
	3	D	2,461	33	33	-	< 25	20 - 29	-	-	-	-	-
	4	D	2,977	40	25	14	-	20 - 29	< 25	-	-	-	-
	5	D	2,020	70	52	18	< 25	20 - 29	-	-	-	-	-
	6	G	2,360	5	5	-	25 - 49	40 - 49	-	-	-	5,000 - 10,000	-
	7	G	57	40	40	-	-	-	-	-	-	-	~ 700,000
	8	G	363	93	90	3	25 - 49	-	-	-	1,000 - 2,000	-	-
	9	GL	4,785	25	25	-	< 25	> 50	-	-	-	-	-
	10	GL	189	73	33	40	< 25	> 50	-	-	-	-	-
	11	M	1,879	13	13	-	-	-	-	100 - 199	-	-	-
	12	M	744	40	40	-	-	-	-	> 200	-	-	-
	13	M	3,602	48	45	3	-	-	-	-	100 - 499	-	-
	14	M	1,989	60	40	20	< 25	-	25 - 49	20 - 99	-	-	-

[a]) FC: Field crop farms; D: Dairy farms; G: Granivore farms; GL: Grazing livestock farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Sows after the first mating.

[3]) Fattened pigs with more than 50 kg.

Source: derived of FADN-data by regional partners

Table 69: Selected 'Typical farms' in Brittany, France – part 2

Organi-sational Form	Farm No.	Farm type [a]	Weight	Total UAA	Arable land	Grass-land	Beef cattle [1]	Dairy cows	Suckler cows	Sows [2]	Fattened pigs [3]	Hens	Chicken male
Corpora-tions (EARL)	**15**	FC	777	30	25	5	-	-	< 25	-	-	-	-
	16	FC	1,337	55	55	-	-	-	-	-	-	-	-
	17	FC	322	180	180	-	-	-	-	-	-	-	-
	18	D	921	75	70	5	< 25	40 - 49	-	< 20	-	-	-
	19	G	1,384	-	-	-	25 - 49	30 - 39	-	-	-	5,000 - 10,000	-
	20	M	1,052	75	75	-	50 - 99	-	-	-	500 - 999	-	-
	21	M	406	88	88	-	-	-	-	20 - 99	-	-	-
Partner-ships (GEAC)	**22**	D	1,093	73	65	8	25 - 49	30 - 39	-	-	< 100	-	-
	23	D	1,084	73	70	3	25 - 49	> 50	-	-	-	-	-
	24	D	1,204	113	95	18	< 25	30 - 39	< 25	-	-	-	-
	25	M	416	140	140	-	-	30 - 39	-	-	-	-	-
Other kinds of Corpora-tions	**26**	D	313	85	85	-	25 - 49	40 - 49	-	-	-	-	-
	27	G	508	43	43	-	-	-	-	-	> 2,000	-	-
	28	G	474	55	55	-	-	-	-	20 - 99	1,000 - 2,000	-	-

[a]) FC: Field crop farms; D: Dairy farms; G: Granivore farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Sows after the first mating.

[3]) Fattened pigs with more than 50 kg.

Source: derived of FADN-data by regional partners

Table 70: Selected 'Typical farms' in Vysočina, Czech Republic – part 1

Organisa-tional Form	Farm No.	Farm type [a]	Weight	Total UAA	Arable land	Grass-land	Beef cattle[1]	Dairy cows	Sows[2]	Fattened pigs[3]	Suckler cows
Individual farms	**1**	FC	908	5	5	-	-	-	-	-	-
	2	FC	538	10	10	-	-	-	-	-	-
	3	FC	278	38	23	15	< 25	-	-	-	-
	4	FC	249	85	60	25	< 25	-	-	-	25 - 50
	5	D	218	25	20	5	-	< 50	-	-	-
	6	G	97	5	5	-	-	-	< 100	20 - 500	-
	7	GL	351	43	-	43	< 25	-	-	-	< 25
	8	M	95	125	120	5	< 25	< 50	-	-	-
	9	M	411	40	33	8	-	-	< 100	< 50	< 25
Partnerships	**10**	M	6	1,200	920	280	-	250 - 500	500 - 1,000	-	50 - 100

[a]) FC: Field crop farms; D: Dairy farms; G: Granivore farms; GL: Grazing livestock farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Breeding sows of 50 kg or more.

[3]) Fattened pigs of 20 kg or more.

Source: derived of FADN-data by regional partners

Table 70: Selected 'Typical farms' in Vysočina, Czech Republic – part 2

Organi-sational Form	Farm No.	Farm type [a)]	Weight	Total UAA	Arable land	Grass-land	Beef cat-tle[1)]	Dairy cows	Sows[2)]	Fattened pigs[3)]	Suckler cows
Partner-ships	**11**	FC	67	400	388	13	25 - 50	-	-	50 - 200	100 - 200
	12	FC	13	445	395	50	25 - 50	50 - 150	-	-	-
	13	FC	9	830	695	135	50 - 100	150 - 250	100 - 200	500 - 1,000	-
	14	FC	7	948	855	93	-	150 - 250	-	500 - 1,000	-
	15	FC	22	1,138	970	168	100 - 200	250 - 500	< 100	500 - 1,000	-
	16	FC	27	2,888	2,725	163	-	150 - 250	500 – 1,000	> 2,500	-
	17	M	8	690	690	-	-	150 - 250	100 - 200	1,000 - 2,500	-
	18	M	58	875	320	555	100 - 200	50 - 150	-	-	100 - 200
	19	M	17	1,800	1,500	300	-	500 - 1,000	200 - 500	~ 3,000	50 - 100
	20	M	17	1,823	1,765	58	100 - 200	250 - 500	200 - 500	1,000 - 2,500	-
	21	M	18	1,880	1,395	485	200 – 500	250 - 500	-	500 - 1,000	-
	22	M	30	2,270	2,100	170	200 - 500	500 - 1,000	100 - 200	1,000 - 2,500	-

[a]) FC: Field crop farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Sows after the first mating.

[3]) Fattened pigs with more than 50 kg.

Source: derived of FADN-data by regional partners

Table 71: Selected 'Typical farms' in Šiauliai, Lithuania

Organi-sational Form	Farm No.	Farm type [a]	Weight	Total UAA	Arable land	Grassland	Beef cattle [1]	Dairy cows	Suckler cows	Sows [2]	Fattened pigs [3]
Individual farms	**1**	FC	7,988	8	5	3	-	-	-	< 10	< 10
	2	FC	3,817	13	13	-	-	-	-	-	-
	3	FC	1,007	25	20	5	< 10	< 10	< 10	< 10	< 10
	4	FC	239	55	55	-	-	-	-	< 10	10 - 20
	5	FC	145	118	118	-	-	< 10	-	10 - 20	30 - 50
	6	FC	45	218	210	8	-	< 10	< 10	< 10	< 10
	7	FC	292	308	308	-	-	-	-	-	-
	8	FC	232	600	600	-	-	-	-	-	-
	9	M	641	30	20	10	< 10	< 10	< 10	< 10	< 10
	10	M	153	65	55	10	-	10 - 20	< 10	-	< 10
	11	M	274	200	108	92	10 - 25	50 - 75	20 - 30	< 10	< 10

[a]) FC: Field crop farms; M: Mixed farms

[1]) Beef cattle older than one year.

[2]) Sows after the first mating.

[3]) Fattened pigs with more than 50 kg.

Source: derived of FADN-data by regional partners

Table 72: Wheat

	Yield in	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Southeast	8.0	109	875	339	535	355
Calabria	4.3	155	1,280	234	1,046	271
Hohenlohe	6.5	134	870	510	360	324
Saxony	7.2	106	766	416	350	392
Brittany	7.3	110	803	352	451	355
Vysočina	5.8	100	616	311	305	0
Šiauliai	3.8	111	480	166	314	12[1)]/0[2)]
Nitra	4.2	104	426	286	140	

Note: no value means that no data was available
1) in 2002
2) in 2003

Sources: Sweden: AGRIWISE (2004). Prices are based on actual levels for 2003.
UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
Italy: derived from the FADN data set by Antonello Lobianco, Marche Polytechnic University of Ancona (UNIVPM), 2005.
Hohenlohe: SAHRBACHER (2002) based on REGIERUNGSBEZIRK MITTELFRANKEN (2000)
Saxony: LFL SACHSEN (2003)
Brittany: price for peas and yields of field crops except for rape seed are out TESSIER (2002); yield for rape seed and prices of field corps except for peas are out of AGRESTE BRETAGNE 2003.
Vysočina: yields and prices from KAVKA, M. et al. (2000); variable costs from JUŘICA, A. et. al (2004) and calculated by Zdeněk Louda, VÚZE in Prague, Department „Centre for Economic Modelling“ and Jana Poláčková, VÚZE in Prague, Division of Structural and Economic Development of Agriculture.
Šiauliai: STATISTIKOS CENTRAS (2003b)
Nitra: Commodity Reports 2003 - SR average data: SIROTSKÝ, ĽUBOMÍR; (2003); TIBENSKÁ, HELENA; (2003).
Yields of plant production are out of: special query for region Nitra in 2002 from central database of Ministry of Agriculture of the Slovak Republic and from database of own costs and economic results of agricultural enterprises in Slovak Republic

Table 73: Triticale

	Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Jönköping	4.0	99	395	293	102	186
Brittany	7.3	100	730	350	380	355

Source: See Table 72

Table 74: Oats

	Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Västerbotten	2.4	83	200	333	-133	273
Jönköping	3.3	83	275	268	7	186
Southeast	6.8	100	678	241	437	355
Calabria	3.2	165	1,139	201	937	321

Source: See Table 72

Table 75: Rape Seed

	Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Southeast	3.2	234	746	317	429	355
Hohenlohe	3.5	219	767	537	230	324
Saxony	3.0	225	675	403	272	392
Brittany	3.8	220	836	447	389	355
Vysočina	3.0	200	631	352	279	0
Šiauliai	1.8	216	403	140	263	23
Nitra	2.7	183	508	421	87	

Note: no value means that no data was available

Source: See Table 72

Table 76: Potatoes

	Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Southeast	33.1	113	3,742	1,447	2,295	0
Vysočina	19.0	118	2,360	1,386	974	0
Šiauliai			2,763	2,057	706	52[1)]

Note: no value means that no data was available

1) in 2003, if a farm has more than 5 ha potatoes

Source: See Table 72

Table 77: Sugar Beets

	Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
	t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Marche	34	52	1,709	475	1,233	11
Saxony	52	47	2,482	960	1,522	0
Hohenlohe	60	54	3,252	1,094	2,158	0
Šiauliai	36	44	1,605	828	777	0

Source: See Table 72

Table 78: Protein Plants

		Yield	Price	Revenue	Variable cost	Gross margin	Premium before 2004
		t/ha	Euro/t	Euro/ha	Euro/ha	Euro/ha	Euro/ha
Southeast	Winter Beans	3.8	132	498	181	317	407
Hohenlohe	Field bean	3.5	114	390	470	-80	384
Saxony	Peas	4.0	115	460	322	138	452
Brittany	Peas	5.5	130	715	410	305	409
Šiauliai	-	1.8	218	374	142	232	23

Source: See Table 72

Table 79: Breeding Sows

	Piglets per Year	Price per piglet	Revenue[55]	Variable cost	Gross margin
		Euro	Euro/year	Euro/year	Euro/year
Southeast	21.0	41	915	544	371
Hohenlohe	17.4	61	1,151	683	468
Saxony	21.6	49	1,098	754	344
Brittany	19.5	52	1,087	657	430
Vysočina	15.3	26	402	238	164
Šiauliai	21.0	29	290	103	187
Nitra	15.7	29	455	276	179

Sources: UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
Hohenlohe: SAHRBACHER (2002) based on REGIERUNGSBEZIRK MITTELFRANKEN (2000)
Saxony: LFL SACHSEN (2003)
Brittany: TESSIER (2002).
Vysočina: KAVKA, M. et al. (2000); variable costs same source as for plant production see Table 72
Nitra: Commodity Reports 2003 - SR average data: BORECKÁ, SVETLANA; (2003a)
Lithuania: LAEI (2004a,b).

Table 80: Sheep

	Lambs per ewe and year	Carcass weight	Price	Revenue	Variable costs	Gross margin	Premium before 2004
		Kg	Euro/kg	Euro/year	Euro/year	Euro/year	Euro/year
Västerbotten	1.70	18.5	3.4	95	57	38	51
Jönköping	1.70	18.5	3.4	95	31	64	51
Southeast	1.60		54.4	60	17	43	20
Calabria				264	38	226	19

Note: no value means that no data was available
Sources: Sweden: AGRIWISE (2004). Prices are based on actual levels for 2003.
UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
Italy: derived from the FADN data set by Antonello Lobianco, Marche Polytechnic University of Ancona (UNIVPM), 2005.

[55] Including yields for selling the old breeding sow

Table 81: Suckler Cows

	Revenue	Variable costs	Gross margin	Premium before 2004
	Euro/year	Euro/year	Euro/year	Euro/year
Västerbotten	489	141	348	300
Jönköping	489	135	354	300
Southeast	338	148	190	238
Marche	1,268	146	1,122	200
Calabria	2,050	341	1,709	200
Hohenlohe	635	265	370	358
Saxony	493	227	266	258
Brittany	661	200	461	388
Vysočina	500	237	263	-
Šiauliai	320	103	217	155

Sources:
Sweden: AGRIWISE (2004). Prices are based on actual levels for 2003.
UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
Italy: derived from the FADN data set by Antonello Lobianco, Marche Polytechnic University of Ancona (UNIVPM), 2005.
Hohenlohe: SAHRBACHER (2002) based on REGIERUNGSBEZIRK MITTELFRANKEN (2000)
Saxony: LFL SACHSEN (2003)
Brittany: TESSIER (2002).
Vysočina: JUŘICA, A. et. al (2004) and calculations by Zdeněk Louda, VÚZE in Prague, Department „Centre for Economic Modelling“ and Jana Poláčková, VÚZE in Prague, Division of Structural and Economic Development of Agriculture.
Lithuania: LAEI (2004a).

Table 82: Dairy Cows

	Milk yield	Milk price	Revenue	Variable costs	Gross margin	Premium before 2004
	Kg	Euro/kg	Euro/year	Euro/year	Euro/year	Euro/year
Västerbotten	9,000	0.32	2,914	1,018	1,896	1,025
Jönköping	9,000	0.31	2,816	939	1,877	324
Southeast	6,300	0.27	1,737	547	1,190	
Calabria	7,260		3,186	965	2,220	
Hohenlohe	5,700	0.33	2,300	920	1,380	53/80 1)
Saxony	7,260	0.30	2,383	1,123	1,260	53/80 1)
Brittany	6,323 4)	0.32 5)	2,355	929	1,426	
Vysočina	6,175 6)	0.25 6)	1,330	723	607	20/27 2)
Šiauliai	4,000	0.20	786	167	619	19/38 3)
Nitra	6,479	0.22	1.497	826	671	

Note: 1) slaughtering premium per head in 2001 and 2002

2) in 2002 0,00324 €/l and in 2003 0.0044 €/l

3) 19 € in 2002 (4.84 €/t milk), 38 € in 2003 (9.47 €/t milk) plus slaughtering premium per head see below Table 84: Beef cattle.

Sources:
Sweden: AGRIWISE (2004). Prices are based on actual levels for 2003.
UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
Italy: derived from the FADN data set by Antonello Lobianco, Marche Polytechnic University of Ancona (UNIVPM), 2005.
Hohenlohe: SAHRBACHER (2002) based on REGIERUNGSBEZIRK MITTELFRANKEN (2000)
Saxony: LFL SACHSEN (2003)
Brittany: 4) TESSIER (2002), 5) AGRESTE BRETAGNE 2003.
Vysočina: 6) JUŘICA, A. et. al (2004); variable costs same source as for plant production see Table 72
Lithuania: STATISTIKOS CENTRAS (2003b); LAEI (2004a,b).
Nitra: Commodity Reports 2003 - SR average data. BORECKÁ, SVETLANA; (2003b)

Table 83: Fattening Pigs

	Weight at the beginning	Weight at the end	Fattening period	Turn over	Daily weight gain	Carcass weight	Price per kg carcass weight	Revenue	Variable costs	Gross margin
	kg	kg	days	Pigs/year	kg/day	kg	Euro/kg	Euro/year	Euro/year	Euro/year
Southeast	30	95	100	3.7	0.70	71	1.36	333	305	28
Hohenlohe	28	117	127	2.9	0.70	94	1.46	370	314	56
Saxony	27	115	121	3.0	0.75	92	1.46	378	336	42
Brittany	27[1)]	110[1)]	120[1)]	3.0	0.75	88[1)]	1.40[2)]	332	260	72
Vysočina	15	110	158	2.3	0.60		1.18	281	162	119
Šiauliai	25[3)]	100[3)]	168[3)]	2.2	0.45	79[3)]	1.30[4)]	103	36[5)]	67
Nitra	18	109	166	2.2	0.55	91	1.10	218	133	85

Note: no value means that no data was available

Sources:
UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
Hohenlohe: Sahrbacher (2002) based on Regierungsbezirk Mittelfranken (2000)
Saxony: LfL Sachsen (2003)
Brittany: 1) Tessier (2002), 2) Agreste Bretagne 2003.
Vysočina: Kavka, M. et al. (2000); variable costs same source as for plant production see Table 72
Lithuania: 3) LAEI (2004b); 4) Rinka (2003); 5) LAEI (2004a,b).
Nitra: Commodity Reports 2003 - SR average data: Borecká, Svetlana; (2003a)

Table 84: Beef Cattle

	Weight at the beginning	Weight at the end	Fattening period	Daily weight gain	Carcass weight	Price	Revenue	Variable costs	Gross margin	Premium before 2004
	kg	kg	days	kg/day	Kg	Euro/kg	Euro/year	Euro/year	Euro/year	Euro/year
Västerbotten	75	570	488	1.01	300	2.37	356	289	67	200
Jönköping	75	570	488	1.01	300	2.37	356	244	112	200
Southeast	230	500	260	1.04		1.44	387	166	221	151
Marche							1,153	146	1,007	210
Calabria							2,158	341	1,817	210
Hohenlohe	90	660	500	1.14	376	3.16	868	600	268	212
Saxony	50	600	500	1.10	336	2.50	560	337	223	188
Brittany	275[2)]	710[2)]	365[2)]	1.19	426[2)]	2.60[3)]	1,108	920	188	290
Vysočina	35[4)]	590[4)]	635[4)]	0.87		1.13[5)]	564	250	314	0
Šiauliai	85[6)]	450[6)]	300[6)]	1.22	227[6)]	1.07[7)]	243	106[8)]	137	19)–38[1)]
Nitra	87	456	504	0.73	246	1.10	340	223	117	

Note: no value means that no data was available

1) slaughtering premium per head in 2002 20 – 64 €, average 23 €; in 2003 20 – 87 €, average 42 €

Sources:
- Sweden: AGRIWISE (2004). Prices are based on actual levels for 2003.
- UK: Nix JS (2003) and calculations by Paul Webster, Wye Campus, Imperial College London.
- Italy: derived from the FADN data set by Antonello Lobianco, Marche Polytechnic University of Ancona (UNIVPM), 2005.
- Hohenlohe: SAHRBACHER (2002) based on REGIERUNGSBEZIRK MITTELFRANKEN (2000)
- Saxony: LFL SACHSEN (2003)
- Brittany: 2) TESSIER (2002), 3) AGRESTE BRETAGNE 2003.
- Vysočina: 4) qualified estimation for livestock production for year 2004 by Mr. Kopecek VÚZE in Prague – Department „Centre for Economic Modelling"; 5) JUŘICA, A. et. al (2004); variable costs same source as for plant production see Table 72
- Lithuania: 6) LAEI (2004b); 7) RINKA (2003) 8) LAEI (2004a,b).
- Nitra: Commodity Reports 2003 - SR average data. BORECKÁ, SVETLANA; (2003b)

Table 85: Beef cattle activities in Sweden

	Weight at the beginning	Weight at the end	Fattening period	Bulls per Year	Daily weight gain	Carcass weight	Price	Revenue	Variable costs	Gross margin	Premium before 2004
	kg	kg	days		kg/day	kg	Euro/kg	Euro/year	Euro/year	Euro/year	Euro/year
Västerbotten											
Young bull	75	570	488	0.75	1.01	300	2.37	356	289	67	200
Bullock	75	560	702	0.52	0.69	280	2.33	326	180	146	295
Fatbull suckler	300	600	214	1.71	1.40	350	2.55	891	853	38	400
Fatbull dairy	75	235	122	2.99	1.31	117	2.59	909	973	-64	150
Jönköping											
Young bull	75	570	488	0.75	1.01	300	2.37	356	244	112	200
Bullock	75	560	702	0.52	0.69	280	2.33	326	170	156	295
Fatbull suckler	300	600	214	1.71	1.40	350	2.55	891	787	104	400
Fatbull dairy	75	235	122	2.99	1.31	117	2.59	909	850	59	150

Sources: Sweden: AGRIWISE (2004). Prices are based on actual levels for 2003.

Table 86: Investment options Västerbotten and Jönköping

Investment	Capacity (places, ha)	Useful life (years)
Fatbull dairy(vealer)	20, 50, 100, 200, 300	25
Bullock, bull, fatbull suckler	20, 50, 100, 200, 300	25
Suckler cows	20, 50, 100, 200, 300	25
Dairy	30, 60, 120, 200, 400	22
Sheep	50, 100, 200, 400	25
Machinery	20	18
	30, 50, 75	15
	100, 200, 300	12

Sources: own presentation

Table 87: Investment options UK

Investment	Capacity (places, ha)	Useful life (years)
Sows	100, 200, 300, 400, 500, 1,000, 1500	20
Pigs	500, 1,000, 2,000, 5,000, 10,000	20
Beef cattle	40, 100, 200, 500,	25
Suckler cows	10, 40, 100	25
Dairy	60, 120, 240, 480	25
Machinery	15, 30, 50, 100, 200, 500, 1,000	12

Sources: own presentation

Table 88: Investments options Calabria and Marche

Investment	Capacity (places, ha)	Useful life (years)
Beef cattle	2, 7, 16, 31, 44, 53	30
Suckler cows	1, 4, 9, 18, 26, 31	30
Dairy	16, 32, 50, 140, 164, 197	30
Ovins, goats	47, 171, 372, 606, 1068, 1282,	30
Machinery	8, 24, 50, 95, 156, 203	15

Sources: own presentation

Table 89: Investments options Hohenlohe

Investment	Capacity (places, ha)	Useful life (years)
Sows	40, 64, 128, 170, 252	20
Fattening pigs	100, 200, 400, 600, 1,000	20
Beef cattle	40, 100, 200	25
Suckler cow	10, 40	25
Turkey	5,000, 10,000, 15,000	20
Dairy	30, 60, 120, 240, 480	25
Machinery	15, 30, 55, 85, 150, 350	12

Sources: own presentation

Table 90: Investments options Saxony

Investment	Capacity (places ha)	Useful life (years)
Sows	64, 170, 252, 336, 672, 800, 1580	20
Pigs	100, 200, 400, 600, 1,000, 2,000, 5,400, 10,800	20
Beef cattle	40, 100, 200, 500	25
Suckler cow	10, 40, 100	25
Dairy	30, 60, 120, 240, 480	25
Machinery	15, 30, 50, 100, 200, 500, 1,000	12

Sources: own presentation

Table 91: Investments options Bretagne

Investment	Capacity (places, ha)	Useful life (years)
Hens	40,000, 55,000, 70,000,	20
Poultry chicken	400, 1,000	20
Pigs	100, 200, 400, 600, 1,000, 2,000, 5,400	20
Sows	30, 72, 144, 336, 672, 800, 1,580	20
Beef cattle	30, 60, 100, 200	25
Suckler cow	30, 60, 90	25
Dairy	30, 60, 90, 120, 240, 480	25
Machinery	15, 30, 50, 100, 200, 500, 1,000	12

Sources: own presentation

Table 92: Investments options Vysočina

Investment	Capacity (place, ha)	Useful life (years)
Sows	30, 50, 80, 120, 200, 300, 500, 1,000	20
Pigs	50, 80, 150, 300, 500, 700, 1,000, 1,500, 3,000	20
Beef cattle	80, 150, 300, 500	25
Suckler cow	60, 90, 150, 250	25
Dairy	50, 90, 150, 300, 600, 1,000	25
Machinery	15, 30, 50, 100, 200, 500, 1,000	12

Sources: own presentation

Table 93: Investments options Lithuania

Investment	Capacity (place, ha)	Useful life (years)
Sows	5, 25, 50, 70, 100, 200, 400, 600, 1,000	20
Pigs	2, 10, 50, 100, 200, 400, 2,000, 5,000	20
Beef cattle	10, 100, 200, 300	25
Suckler cow	5, 25, 50, 100	25
Dairy	2, 10, 20, 100, 200, 400	25
Machinery	15, 30, 50, 100, 200, 500, 1,000	12

Sources: own presentation