Application for the second funding period of research unit 986

STRUCTURAL CHANGE IN AGRICULTURE

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Signed: Berlin, 01.03.2010 .....

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Summary of requested funds

Total costs (4)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A *)					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

*) Central #####

Sum per categories	2010	2011	2012	2013	Sum
Staff costs (4.1)					
Scientific instrumentation (4.2)					
Consumables (4.3)					
Travel (4.4)					
Publication expenses (4.5)					
Other cost (4.6)					

Staff costs (4.1)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

Scientific instrumentation (4.2)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

Consumables (4.3)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

Travel (4.4)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

Publication expenses (4.5)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

Other costs (4.6)	2010	2011	2012	2013	Sum
SP1					
SP2					
SP2-A					
SP3					
SP4					
SP5					
SP6					
SP7					
SP8					
SP9					
SP10					
SP11					
Sum					

Part I: Description of the general project

1 Background and problem description

1.1 Problem statement and state of knowledge

Structural change in agriculture is a fundamental phenomenon that accompanies the development of market based economies. Since the industrial revolution structural change is driven by shifts of supply and demand leading to a permanent shrinkage of the agricultural sector within growing economies. This process is characterized by high productivity gains and a relatively slow increase of demand for food resulting in price pressure in mature markets and migration of workforce from agricultural production. The scope of this change can be expressed by a few simple figures: While the share of agricultural labor in Germany amounted to 38 % in 1900 it fell to 2,1 % in 2008. In the same time period the contribution of the agricultural sector to the GDP declined from 30 % to 0,9 %. At the beginning of the previous century one farmer was able to feed four people, nowadays this ratio mounted to an impressive value of 1: 130 (cf. Statistisches Bundesamt 2009)

This stylized picture of structural change in agriculture is well know and widely documented. However, it can no longer capture the complexity of structural adjustment processes that take place in developed economies at the beginning of the new millennium. Today, structural change is characterized by a multiplicity of economic, political, and institutional changes which are interrelated in a complex manner. A few examples may illustrate the diversity and complexity of structural change and the related development processes:

- The agricultural sector is an integral part of a country's whole economy and thereby affected by a general tendency towards internationalization and globalization. More specifically, this includes the deregulation of agricultural markets in the EU as well as the lowering of import barriers and domestic price policies as part of the multilateral trade negotiations in the WTO as well as the conclusion of many bilateral and regional trade agreements. This does not only lead to a decline in the protection level, but also an increasing price volatility that can be observed on many formerly regulated agricultural commodity markets, e.g. milk and cereals. This increased price risk may affect the viability of farms and thus income stabilization is currently on the agenda of agricultural policy makers.
- Agriculture is – perhaps more than any other sector – affected by climate change. Increasing temperatures and changing rainfall patterns require affect the natural conditions of crop production. Though it is not yet clear what the impact on productivity and competitiveness will exactly look like, changed weather conditions call for adjustments of the production program as well as the production technology (#source#). Apart from slow shifts in temperature and precipitation climate change is suspected of increasing weather risk and the frequency of weather hazards. This, in turn, increases yield risks which may further destabilize farm incomes #source#.
- New production technologies, such as genetically modified organism (GMOs), precision farming, or energy conversion techniques are available which constitute an important driving force for structural change (#source#). These technologies affect the productivity

as well as the quality of agricultural production. Moreover, they offer alternative income generation activities for farmers, particularly in the field or biomass production and renewable energies (OECD 2006).

- The societal demands on the agricultural sector changed and became more complex. Nowadays these demands go far beyond the provision of a sufficiently large food basis. Food quality aspects, the quality of the production process, as well was animal welfare became increasingly important during the last decades. All in all, much more attention is paid to the protection of natural resources and the sustainability of agricultural production. This broadening of targets is to some extend reflected by the discussion of a multifunctional agriculture.
- In line with these developments a paradigm shift took place in the common agricultural policy of the European Union, which has been described as a process of “greening the CAP”. Agricultural policy does no longer aim at protecting domestic farmers from global markets by protective measures. Instead policy instruments are more oriented towards environmental and quality goals and intended as a reward to farmers’ supply of public goods (e.g. Kirschke, Häger and Grams 2005).
- #Example for institutional change#

In view of these developments a new approach seems necessary for capturing and understanding the complex adjustment processes that characterize structural change in agriculture. This approach should embrace different perspectives, but eventually these different aspects have to be brought together in order to allow an integrative view of structural change. Developing such an integrative view is a challenging scientific task despite numerous partial explanation concepts that are available in the literature. Boehlje (1992), Harrington and Reinsel (1995), de Haen (1985) and Tangermann (1975) summarize traditional explanation concepts and driving forces of structural change in agriculture. Within claiming completeness the following hypotheses should be mentioned:

One of the earliest attempts for understanding structural change has been offered by Chocrane (1958) who formulated the “technological treadmill hypotheses”. This hypothesis focuses on the adoption and diffusion of new technologies. A technical innovation reduces the unit costs of output and thus producers with constant price expectations have an incentive to adopt the new technology. However, diffusion of the innovation increases sector supply and causes a decrease of product prices that erode cost savings. That means collective adoption decisions make no better of as before. The implication for structural change results from the fact that many new technologies are embodied in capital goods that require a minimum production size. Thus lager farms are in a better position to adopt new technologies.

Johnson (1947) casts doubt on the assumption of perfect capital mobility and emphasizes the role of asset fixity. Farms invest when expected marginal returns exceed the acquisition cost of capital. Disinvestments in these assets, however, are triggered not before expected marginal returns fall below their salvage values. Asset specificity drives a wedge between acquisition and salvage values, meaning that in a certain range of investment returns

neither investment nor disinvestment occurs. As a result a wide distribution of farm sizes and technologies can be observed, at least in a short-term equilibrium. This simple explanation concept has been refined and extended in the last decades. Dixit and Pindyck (1994) put this model in a dynamic and stochastic context when developing the real options approach of investment. Actually, real options models can potentially explain economic inertia and hysteresis in general. Applications to structural change in agriculture have been carried out by Chavas (1994), Odening and Balmann (2003) and Odening, Mußhoff and Balmann (2004).

Closely related to economic hysteresis is the concept of path dependence. Path dependence describes lock-in-situations from which it is difficult to escape for agents or a whole industry. The existence of this phenomenon can be attributed to sunk costs, network externalites or increasing returns (cf. Brandes # and Theuvsen # for an overview). Balmann (1995) invokes this concept in multi-agent-setting and demonstrates that dual structures in agriculture may persist over a long time horizon.

Several alternative approaches to structural change exist that go beyond classical microeconomic theory. For example, the sociological model stresses that other than purely profit goals are pursued by decision makers in the context of family farming. Farmers additionally appreciate values as an independent lifestyle, family bonding and tradition. These non-financial motives make small and/or inefficient farmers willing to accept profits lower than opportunity costs or to subsidize their farm operation by other income sources, at least in the short term. In this context the so called life cycle hypothesis also plays a role. The life cycle hypothesis assumes that individual farm operations follow a certain pattern consisting of the phases “entry”, “growth”, “decline” and “transfer” or “exit”, respectively. This pattern is only marginally affected by economic conditions or economic shocks. Structural change is then mainly the result of the exit or transferal decisions of an age cohort at the end of this cycle (Kimhi #, Weiss #).

Finally, Boehlje (1999) points out that food production in many parts of the world is changing from an industry dominated by family-based, small scale, and relatively independent firms to one of larger farms showing tighter relationships. This development can only be understood if one looks at the whole food supply chain comprising input markets, agricultural production, food processing industries and retailing. According to Boehlje, a supply chain analysis is different from traditional economic analysis as it focuses on the function performed and not on the firm or economic agents that perform it. Aspects to be considered are product flows, financial and informational flows as well as governance and incentive systems that regulate the sharing of profits and risks. The relevance for structural change comes from the fact that the development of value chains may discriminate smaller farm sizes.

Though structural change is a major research area in agricultural economics and despite of the aforementioned explanation concepts we can agree with Schmitt (1992) who concludes that a comprehensive theory of structural change in agriculture is not available. In fact, many important research questions remain unsolved. The following incomplete list may exemplify these open research questions: Does the recent price boom on agricultural commodity markets mark the end of the “treadmill” or was is just a single event? How viable

are small dairy farms in the EU and what is their economic perspective? Will increasing price volatility speed up structural change? What is the impact of decoupled payments on the competitiveness of different farm types? To what extent can (and should) structural change in agriculture be controlled by agricultural policy measures? #extend#

1.2 Objectives of the research unit

The objectives of the second funding period are quite similar to those of the first one. For the purpose of convenience we restate these objectives in what follows. Afterwards we indicate where changes in the emphasis of objectives occur or new goals emerge. These changes are a response to insights and results from the first project phase or take into account current developments in agricultural economics.

This research unit will take a fresh look on structural change in agriculture in developed economies. The overall objective is the refinement, the extension and the integration of existing concepts, theories and instruments that facilitate the analysis of economic adjustment processes in the agricultural sector. With these tools at hand a broader and clearer view of structural change can be derived that yields an improved understanding of causal relationships between entrepreneurial decisions, political instruments, and exogenous factors. A deeper understanding of these causalities, however, is an indispensable requirement for assessing and predicting structural change as well as for governing structural change in terms of economic, environmental, and social objectives. It is convenient to distinguish theoretical and methodological objectives on the one hand and applied objectives on the other hand. From a theoretical viewpoint the research unit faces the following challenges:

Existing theoretical models and empirical methods will be developed further in order to make them more realistic and more appropriate for analyzing adjustment processes in the agricultural sector. This holds for farm level models as well as for sectoral models. Challenges to be mentioned for farm level modeling are the inclusion of dynamics and uncertainty as well as the consideration of strategic aspects of decision making. Moreover, the general premise of rational behavior that underlies most neoclassical models should be questioned and tested against the bounded-rationality-hypothesis. Research questions that shall be tackled with regard to sectoral models are the incorporation of stochasticity into market models, the handling of complex and interrelated multiple objectives in policy design models as well as an improved assessment of the impact of complex trade policies with partial and general equilibrium models.

The sole refinement of partial models, however, is not sufficient when striving for a comprehensive view of structural change in agriculture. Therefore another important objective of the research unit consists of a cross fertilization of different models. The informational exchange between the models, which is necessary for their simultaneous use, will vary from an informal transfer of single parameters up to a technical linkage of submodels. The awareness of the necessity to link different model types in the context of a policy impact analysis is not new and several composite models are available in agricultural economics (#Deppermann, Grethe and Offermann#, Brockmeier, Kleinhanss and Offermann 2008, Britz 2008, Banse and Grethe 2008) Nevertheless, the implementation of

these integrated models is frequently carried out on an ad hoc basis (cf. Offermann 2008). Thus the theoretical foundation for a coherent linkage of simulation models on different aggregation levels is still an unsolved problem that SiAg-members want to address.

In agricultural economics, the development of models and methods is rarely an end in itself. In the research unit proposed here, they are used to analyze matters of relevance to policy makers and society as a whole. For example, structural changes in the farm sector are analyzed which are due to reforms of the Common Agricultural Policy (CAP), such as the abolishment of the dairy quota system, and to international trade regulation, such as the potential conclusion of the current Doha Round in the WTO. Furthermore, the enormous changes in the structure of the CAP with an increasing part of the budget being allocated to rural development policies and decoupled direct payments, urges a more transparent and methodologically sound evaluation of these policies, which is undertaken within the research unit. New challenges arise for the agricultural sector from environmental as well as macroeconomic pressure. To an increasing extent, agriculture contributes to energy supplies world wide. The net effect, however, on greenhouse gas emissions is unclear, as increasing production of energy crops results in more intensive land use and an extension of agricultural area. As a basis for appropriate climate policies, the simultaneous analysis of agricultural production systems, markets and energy systems is essential.

Compared to the first funding period more emphasis is put on the following objectives:

- German dairy sector
  While the projects in the previous funding period did not focus on a particular farm type or product market it is now intended to pay special attention to the dairy sector. Five out of eleven subprojects will explicitly deal with dairy farms, the milk processing industry or milk markets. This narrowing of the research subject is due to the dramatic changes that took place in the recent past and that are expected to continue in the future as a result to the liberalization of the EU milk market (source: #, Hüttel and Jongeneel #). Milk prices of 20 cent per kg or even less jeopardize the existence of the majority of dairy farms in Germany and the EU, not only a minority of poorly performing farms. Accordingly, there is a massive call for market intervention and stabilizing measures by farmers' unions and due to the importance of this farm type agricultural politicians seem to be willing to provide supporting measures. However, neither a clear prediction of the dynamics of structural change in this area nor a profound and quantitative appraisal of alternative policy instruments are yet available. The research unit wants to contribute to this discussion by estimating the impact of milk quotas and direct payments on structural change in the dairy sector. Moreover, an evaluation of different exit strategies will be conducted.
- Climate change and bioenergy
  While the interactions between the agricultural sector and energy markets were dealt with in the first phase of the research unit, they were addressed with a General Equilibrium Model with a focus on agricultural markets and limited detail in the specification of bioenergy demand and policies (Banse and Sorda, 2009; Sorda et al., 2009). This analysis has clearly shown that interactions between these markets and a more detailed (with regard to the energy sector and its policies) and more comprehensive (including bioenergy other than liquid biofuels) analysis would be

interesting, especially as bioenergy may become an important part of the European energy mix, although not in the form of liquid biofuels (König, 2009). Therefore, these ideas are envisaged in a new subproject. Closely interrelated with bioenergy policies is the inclusion of agriculture in greenhouse gas mitigation policies. More than 30 % of greenhouse gas emissions world wide stem from agriculture and land use changes (Stern 2007) and the pressure and need to include this sector in mitigation policies is increasing (von Witzke and Noleppa 2007, Hirschfeld et al. 2008). To evaluate the potential of European agriculture to contribute to mitigation and to comparatively assess different policy options has become a new topic in the second phase of the research unit. In combination with the bioenergy project, this allows for the integrated analysis of, on the one hand, potential GHG mitigation due the production of bioenergy, but also potentially higher GHG emissions from agriculture due higher land use intensity and an increasing area being cultivated.

- Efficiency analyses
  More attention will also be paid to the analysis of economic efficiency as it is a major driver of structural change. In the literature it is widely acknowledged that structural change is closely related to the efficiency of the firms within a sector (e.g. Goddard et al. 1993). According to the Efficient-structure-hypothesis economic performance causes structure (e.g. Demetz 1973). Firms showing superior performance and higher efficiency increase their market share at the expense of less efficient firms, thereby increasing concentration. Anyhow, the existence and persistence of differences in efficiency among farms is a puzzling fact and solid empirical work is still necessary for explaining the observed heterogeneity in efficiency.

- Microeconometric analyses of structural change and policy impacts
  Besides ex-ante policy impact analyses empirical foundation of (micro)economic causal relations are essential for the understanding of adjustment processes in agriculture. Important aspects include, for example, investment behavior of farmers, entry and exit decisions, farm growth and specialization. Advances in econometric methods and the use of statistical data on a low aggregation level allow for disentangling the complex relations between variables indicating structural adjustments and the economic drivers behind these processes. Econometric methods have also been successfully used for improving the evaluation of agricultural policies of the second pillar (e.g. Henning and Michalek 2008, Pufahl and Weiss 2008, Petrick and Zier 2009). The challenge when evaluating the success or failure of policy programs is the consistent comparison of the economic performance of economic subjects with and without program participation which requires quantifying a counterfactual situation. Despite recent advances many theoretical problems are unsolved, for example relaxing restrictive assumptions on treatment effects in panel data models.

- Consideration of findings from behavioral economics #Mußhoff#

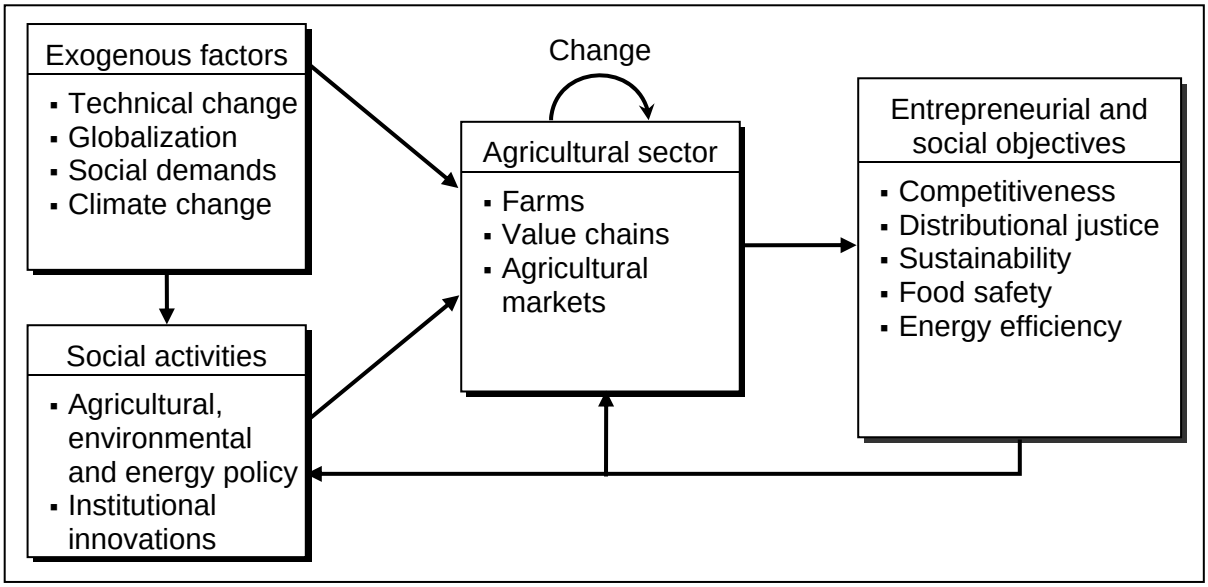
2 Concept of the research unit

2.1 Research subject

The center point of the research unit is the agricultural sector of developed economies and its elements. These elements and their dependencies are outlined in figure 1. A main

component of the agricultural system is, of course, single farms that operate in various types, sizes, and legal forms. In this context we will focus on managerial decisions that are particularly relevant from the perspective of structural change, namely growth and shrinkage, adoption of new technologies as well as entry and exit decisions w.r.t. farm branches or the whole farm. Thus the understanding of investment and disinvestment processes has a pivotal role in this research unit. The analysis of such decisions is challenging since they are subject to interdependencies, dynamics, and uncertainties. On the other hand, it is widely acknowledged that the behavior of individual decision makers is characterized by bounded rationality (e.g. Camerer 1995). Therefore we have also to raise the general question if the development of sophisticated microeconomic models is really helpful for understanding real world decisions.

Figure 1: The research subject and its components



In either case it is not sufficient analyzing farms in isolation when targeting at a comprehensive understanding of important changes within the agricultural sector. Rather, the various relations between farms as well as their interplay with enterprises in the entire agribusiness have to be investigated. Actually, the organization of food production within value chains became more and more important during the last decades. This development led some researchers to the question whether the traditional farm is still a viable paradigm in agriculture (Berg 1999).

From an aggregated perspective we will look at agricultural and food markets. But these markets are interrelated to an increasing extent with energy markets due to high price levels for energy, technological progress in the substitution of bioenergy for fossil energy and a high degree of government intervention. Apart from developments on product markets, structural change is also affected by factor markets. This is particularly true for land markets. Agricultural production heavily depends on this production factor, which frequently constitutes a bottleneck for farm growth strategies due to its immobility and non-increasibility. Thus land markets are characterized by pronounced competition, strategic behavior of market participants and regional differences. Acknowledging the importance of this factor two subprojects (SP 1, SP 5) are directly committed to land markets.

A notably strength of this research unit is its explicit investigation of the linkage between the farm level and the sectoral level. Both perspectives offer important and complementary insights into structural change, but it is not a trivial issue to bring them together in a consistent manner. Farm level models, on the one hand, face an aggregation problem and they are frequently silent about the representativeness of their results. Market models, on the other hand, ensure that equilibrium conditions are met, but they are usually based on simple assumptions concerning available technologies, objectives and decision making of market participants. Therefore three subprojects (SP 3, SP5 and SP6) will try to bridge these two perspectives by means of bottom-up-modeling approaches and model-linking, respectively.

The outcome of activities of individual farms, value chains and markets affect several objectives which are important from an entrepreneurial or a societal viewpoint such as competitiveness, distributional justice, sustainability, food safety and security, energy efficiency or economic efficiency in general. It is impossible to address all these objectives in each subproject, but each subproject considers at least one of them. Integrating the different views contributes to a “big picture” of structural change in agriculture.

The dynamics of structural change is driven by internal forces, e.g. innovative behavior of farmers or competition on markets, by external factors like technical progress and finally by changes in the political and institutional environment. Agricultural policy aims at influencing the outcome of structural change in accordance with the aforementioned societal objectives. This is per se difficult, because it constitutes a two-level-problem where goals can only be indirectly controlled by setting incentives to economic agents. In addition to the more traditional exogenous drivers of agricultural policy reforms such as multilateral and regional negotiations on agricultural and food trade liberalization (SP 6), other drivers such as the security of energy supplies (SP 8) and the direct effects of climate change, as well as those caused by GHG mitigation policies (SP 7) may play an increasing role in the future. In accordance with the increasing importance of the second pillar three subprojects will focus on environmental and rural policies and related governance issues (SP 9, SP 10 and SP 11).

Finally, we emphasize that it is impossible to investigate all relevant aspects and drivers of structural change in agriculture within the framework of this research unit. Obvious examples are the demand side of food markets or the spatial dimension of structural change. Moreover, neither sociological nor ecological aspects will be analyzed in depth.

2.2 Methods and procedures

The sophisticated view on structural change in the agricultural sector, which is the primary target of the research unit, requires a differentiated set of methods and analytical instruments. Figure 2 summarizes and classifies the most important methods that will be applied by the proposed subprojects in the second funding period.

Figure 2: Overview about utilized methods

<table>
<tr><td></td><td></td><td>Firm oriented</td><td>Policy / sector oriented</td></tr>
<tr><td rowspan="6">Methodological approach</td><td rowspan="2">qualitative</td><td>• #Network analysis#</td><td>• Analytic narratives
• Mental models</td></tr>
<tr><td colspan="2">• Expert interviews</td></tr>
<tr><td rowspan="4">quantitative</td><td>• Dynamic programming
• Efficiency analysis
• Game theory
• Economic experiments</td><td>• Interactive programming models
• Partial equilibrium models
• General equilibrium models</td></tr>
<tr><td colspan="2">• Econometric models</td></tr>
<tr><td colspan="2">• Linear and non-linear programming</td></tr>
<tr><td colspan="2">• Farm sample models</td></tr>
<tr><td colspan="2">• Multi-agent-models</td></tr>
</table>

The majority of the utilized methods can be characterized as quantitative methods. Nevertheless, qualitative methods such as #network analysis#, expert interviews or analytic narratives are needed for describing complex development processes for which no straightforward model or theory is available yet. This is the case, for example ###

The methods depicted in table 2 support both, empirical and normative analysis related to structural change. Econometric models or efficiency analyses are primarily designed for analytical purposes and look at structural change from an ex-post perspective. In contrast, mathematical programming techniques or simulation models can be used for ex-ante analysis in a positive sense, as well as in a normative way, for example to derive optimal farm strategies or the design of optimal policies given a set of policy objectives, which is also a primary objective of SIAG.

In accordance with the multi-level approach of this research unit, some methods are firm oriented, while others are sector or policy oriented. Dynamic programming or economic experiments belong to the former class, whereas partial and general equilibrium models belong to the latter. Apparently, some tools will be used on either aggregation level, for example econometric methods. Moreover, some models are predestinated for bridging the farm and the sector level, namely multi-agent-models and farm sample models.

The data sources that shall be used are as diverse as the underlying methods. Some subprojects will directly acquire the needed data, e.g. through expert interviews or by conducting economic experiments. Fortunately, many subprojects may utilize data from existing statistics such as the FADN, FAOSTAT or EUROSTAT. Thus the effort and the expenses for data acquisition are rather low compared with other coordinated research projects.

Having the complexity of objectives and the diversity of methods in mind it is not surprising that a definite regional focus, which is binding for all subprojects, cannot be determined.

Almost all subprojects refer to the German agricultural sector, since Germany is one of the main producers in the EU that can be considered as a representative example for other EU countries. Furthermore, domestic data are easily accessible. Nevertheless, the spatial level of the subprojects differs. For example, rural policies are implemented at a state level and hence focusing on a particular state or region within Germany is adequate. Some subprojects adopt a comparative view that takes into account differences in economic variables occurring on a county level. Moreover, subprojects applying market models or CGE models cannot confine their analysis to Germany, as German agricultural markets are deeply integrated with EU as well as world agricultural markets. Finally, there are subprojects, which may ignore the spatial dimension without a loss of information. Bringing the results from these different approaches into line is definitely one of the main challenges of the SIAG research unit.

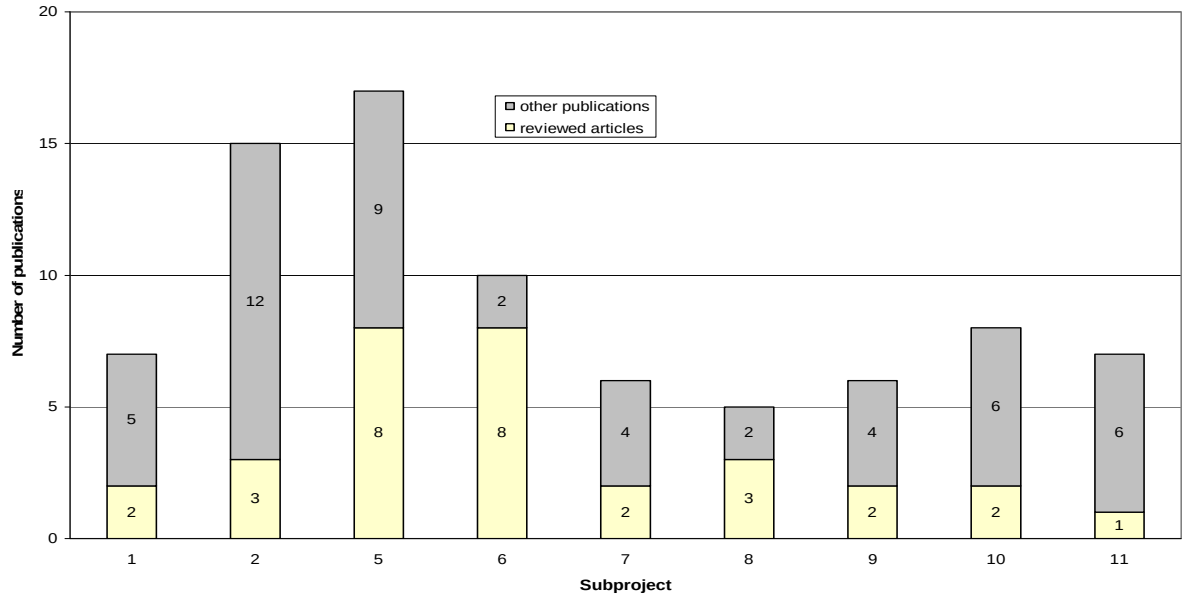
3 Achievements during the first funding period

3.1 Scientific output

Since its establishment in August 2007 the SIAG research unit has successfully discharged the research questions of the first project phase. For details of the project development and the scientific output we refer to sections 2.2 of the subproject descriptions in part II of this proposal. At this point we present some overall indicators of the productivity of the research unit and highlight selected research outcomes of SIAG.

Figure 3 depicts the number of publications related to SIAG which is perhaps the most important indicator of scientific output. The total number of publications amounts to # articles. # articles appeared in reviewed journals, among them the European Review of Agricultural Economics, Agricultural Economics, Food Policy, Canadian Journal of Agricultural Economics, Applied Economics, and the Journal of Economic Behavior and Organization. Further # articles are currently under peer review in these or comparable journals. Figure 3 also shows that all subprojects equally contribute to this publication output.

Figure 3: Publications related to the subprojects of SiAg



In addition to these publications the members of SIAG have disseminated their research results on major conferences and seminars. In total # oral and poster presentations have been given on occasions as the 2007 AAEA annual meeting, the 2007 EAAE conference, the 2009 IAAE conference, the 2009 GTAP conference, and the 2008 IATRC Winter Meeting. The visibility of SIAG will be further enhanced by the organization of the 114th EAAE-Seminar entitled “Structural Change in Agriculture: Modeling Policy Impacts and Farm Strategies”. The seminar, which is hosted by Humboldt-Universität zu Berlin, will take place on April 15-16, 2010. Following the idea of SIAG, the seminar takes a fresh look at structural changes of agricultural sectors in developed economies. The objective of this seminar is to gain a deeper understanding of the adjustment processes that take place in agriculture. The focus of the seminar is on theoretical models and quantitative methods supporting the analysis of structural change. The seminar brings agricultural economists from European countries into an intense dialogue with colleagues from all over the world and to exchange theoretical and practical experiences on modeling structural change in agriculture across different disciplines.

The outstanding quality of this seminar is documented by the fact that a special issue of the European Review of Agricultural Economics will be shaped from the best contributed papers. The coordinators of SIAG, Odening and Grethe, will serve as guest editors for this special issue.

It should also be noted that during the first funding period four members of the SIAG research unit received offers for professorships, namely Mußhoff (University Göttingen, accepted), Grethe (University Hohenheim, accepted), Brockmeier (University Hohenheim, accepted) and Schade (University Hamburg, declined). On the one hand these appointments document the quality of the SIAG research team. On the other hand they call for some organizational changes (see section 4).

3.2 Cooperation

The primary motivation for establishing a coordinated research program like SIAG is the expected realization of synergy effects and gains through scientific cooperation of individual researches. In order to prove how seriously the members of the research unit considered this claim we briefly describe a few examples of successful cooperation between subprojects.

- Subprojects 1, 2, and 5 jointly investigate disinvestment problems (cf. Sandri et al 2009). Disinvestment, in the sense of project termination and liquidation of assets, is an important realm of entrepreneurial decision-making and structural change which has still not been entirely investigated. In their study the authors design economic experiments that model the choice to disinvest as a dynamic problem of optimal stopping in which the value of flexibility is manipulated and the patterns of decisions of entrepreneurs and non-entrepreneurs are compared. The experimental evidence is then confronted with the benchmark predictions of traditional and new investment theory (Real Options Approach). The experimental results reject the Net Present Value approach and reveal a significant correlation between the behavior observed experimentally and the theoretical predictions of the Real Options Approach, but also provide evidence for psychological inertia, which can be related to status-quo phenomena.

- Subproject 1 and 5 jointly investigate numerically and experimentally solutions for a coordination game with heterogeneous agents which is relevant for land allocation and horizontal cooperations of farmers in order to benefit from economies of size. The study considers an entrepreneur who wants to establish a large farm by buying or renting homogeneous land from a limited number of existing farms with heterogeneous opportunity costs. For this setting a Pareto-optimal solution is only feasible if the existing farmers accept heterogeneous prices and reveal their true individual opportunity costs. Several earlier studies claim that such a situation may lead to a market failure (Balmann 1995, Aurbacher et al. 2007). However, Balmann, Kellermann, Larsen, Sandri and Schade (2009) found that an agent-based auction model in which the agents optimize their bidding by using a genetic algorithm leads to an equilibrium where the potential additional rent is equally shared among the existing farms with the exception that the potential price is capped towards the average and marginal rent of the entrepreneur for high opportunity cost bidders. Actually, this scenario is repeated by laboratory experiments in order to analyze whether and how real persons are able to coordinate themselves in a similar way.
- The results of the collaboration between subprojects 2 and subproject 6 provide the basis to account for structural change the farm group model FARMIS. Based on a theoretical framework dealing with strategic interaction of farms on the land market regionally differentiated patterns of structural change are explored (cf. Hüttel and Margarian 2009). The main research question focuses on the causes of regionally persistent structures. The findings from TP2 that sunk costs and imperfect capital markets are major determinants of farms being reluctant to (dis)invest are used to explain why regional differences in the farm size structure remain. The initial (historic) conditions in combination with farms' reluctance can be shown to explain persistent differences in regions characterized by different historic conditions such as the number of farms and differing capital intensities. The analysis is carried out for the West German agricultural sector. By means of the empirical Markov chain model it is possible to explain the probabilities of farm growth, decline or exit in terms of the current and former regional farm size structure. Further, the impact of variables describing the regional farm structure, thereby indicating market power of the large, the potential of high competition for land within a region and possibly high rents of the status quo in combination with sunk costs, is quantified.
- Subprojects 2, 7, and 10 analyze yield and price volatility of selected agricultural products in Germany and the EU and derive implications from a managerial and a policy perspective (cf. Grethe et al. 2010). A stochastic version of the ESIM model is used to assess the price effects of yield shocks in a partial equilibrium framework. The model outcome is calibrated on empirically observed price volatility estimates which are based on time series analyses. The impact on farm incomes is then calculated by means of scenario analyses for several farm types. Against this background the necessity of political intervention and the efficiency of several stabilization measures are discussed.
- Subprojects 6 and 7 established an interface between ESIM and FARMIS to run the models in a consistent way for a baseline as well as policy scenarios (#Deppermann, Grethe and Offermann#). This has opened opportunities for example for the joint

analysis of bioenergy and climate policy scenarios in the second phase of the research unit, while taking into account effects on farm groups and farm structure.

- Subprojects 9 and 11 cooperate with regard to the quantitative analysis of Bt maize adoption in German regions (cf. Consmüller, Beckmann, and Petrick 2009). Specifically, it is examined how the regulatory framework, farm structures as well as the socio-political environment of GM crop expansion in Germany have influenced regional adoption rates. Taking these factors into account, hypotheses concerning regional variation in Bt-maize adoption were developed and tested econometrically with unique data at the federal states (Länder) and county (Landkreis) level. The study provides evidence that the adoption of Bt maize in different regions is positively affected by the amount of maize grown per farm and by the European Corn Borer infestation rates. Furthermore, the data also supports the hypothesis that Bt-maize adoption is negatively affected by the activities of the anti-GM movement and the establishment of GM-free regions. Results were presented as contributed papers at the 2009 DPG/BCPC conference on Plant Protection and Plant Health in Europe, the Triennial Conference of the International Association of Agricultural Economists (IAAE), and the 2009 annual meeting of the Gewisola.

3.3 Individual Subprojects

From the viewpoint of the individual subprojects the following findings should be highlighted:

- #Subproject 1 #
- Subproject 2 in collaboration with subproject 5 was successful in bridging to strands of literature which aim at explaining investment reluctance, namely the literature on capital market frictions on the one hand and the real options theory on the other hand. In reality, both explanation concepts may coexist. A unifying theoretical model and an econometric model have been developed that allow for disentangling the impact of imperfect capital markets on investment behavior from investment reluctance due to irreversibility and uncertainty (cf. Hüttel, Mußhoff, and Odening 200#). From a theoretical viewpoint, disregarding either capital market imperfections or irreversibility and uncertainty may result in a misspecification of empirical investment models and hence in biased estimates for the included explanatory variables. Separating the two effects is not only an academic exercise, but it is also important from a policy perspective. Capital market imperfections lead to an inefficient factor allocation (e.g. underinvestment) and should be addressed by appropriate measures. By contrast, option related investment reluctance does not call for policy intervention at all as it is the outcome of optimal dynamic decision making under uncertainty.
- A research focus of subproject 5 is the development and use of computational intelligence approaches for modeling complex strategic decisions of farmers in competitive environments regarding investments under uncertainty and land markets. Balmann, Musshoff and Larsen (2009) analyze whether stronger vertical integration in the pork chain reduces investment reluctance. A real options approach is applied to a competitive market situation studied by stochastic simulations in combination with genetic algorithms. A comparison of extreme scenarios of on the one hand a closed

system for farrowing and hog feeding and on the other hand a spot market solution for the trade of piglets between farrowers and hog feeders led to identical investment and production dynamics. The results suggest that the real options approach does not deliver arguments for vertical integration as previously claimed by Pietola and Wang (2000). Kellermann and Balmann (2009) compare different behavioral approaches for modeling the bidding behavior of farmers regarding the land allocation in the agent-based model AgriPoliS. The authors find that farm behavior derived from genetic algorithms is superior to shadow price related routines. However, if the latter approach is extended by smart rules of thumb the disadvantage disappears,

- Subproject 6 in collaboration with Hans G. Jensen from the Institute of Resource and Food Economics, University of Copenhagen, Denmark, extended the GTAP model and database. The GTAP database version 7 has been updated using the OECD's dataset of PSE tables for the EU 25. This approach innovatively enables to separate different types of support given to primary agricultural production. The GTAP model has also been extended to better capture domestic support issues, especially the WTO classification of domestic support. For this purpose the agricultural policy instruments of the EU are directly implemented into the model by adding three new policy instruments. These variables represent the amber, blue and green box payments in each of the price wedges reflecting different kinds of support. #reference to publication necessary#
- The research unit involved in subproject 7 has gained experience in the combined use of general and partial equilibrium models (Banse and Grethe, 2008), contributed to a thorough review of the depiction of land markets and direct payments in equilibrium models, and has implemented fundamental changes in ESIM which have allowed for the linkage with FARMIS (Grethe et al., 2008), the envisaged linkage with an energy system model (Banse et al., 2008), and a systematic sensitivity analysis (Artavia et al., 2009). In cooperation with SP 6, an interface between ESIM and FARMIS to run the models in a consistent way for a baseline as well as policy scenarios was developed (#Deppermann, Grethe and Offermann#).
- Subproject 8 has assessed the impact of German and EU biofuel policies as well as third countries' biofuels policies on German agricultural markets (Sorda et al., 2009, Banse and Sorda, 2009) based on a Computable General Equilibrium model and has clearly shown that results are considerable in size.
- In the first funding period subproject 9 has focused on the estimation of static treatment effects of the entire portfolio of CAP measures in East German agriculture. In particular, effects of direct payments, investment support, village renewal, less favored area payments, agri-environmental measures as well as support to processing and marketing on labor use and value added in agriculture were analyzed. The principal technique was a fixed-effects linear panel data model based on regional data at the Landkreis level of the East German States of Brandenburg, Saxony-Anhalt and Saxony which, given the inherent assumptions of such a model, delivered satisfactory results. These were presented as contributed papers at two international conferences, the IAMO Forum 2009 in Halle, Germany (Petrick and Zier 2009a), and the Triennial Conference of the International Association of Agricultural Economists (IAAE) in Beijing, China (Petrick and Zier 2009b) and will now be submitted to academic journals.

- The overall objective of subproject 10 in the current first phase of the SiAg research unit was the development of an interactive programming approach suitable to guide objective-oriented rural development (RD) policy and structural change. So far, the research team was able to formulate the basic programming tool and to incorporate the most important parameters and elements into the model. The model involves more than 40 different policy measures and considers four relevant regional objectives and all important financial restrictions resulting from the specific regulatory framework of RD policy. Regarding the performance evaluation, a two-step Delphi approach was executed in which ministry representatives assessed impact coefficients via emailed scorecards and subsequently agreed upon them in a collective workshop. The interactive modeling exercise which is to be executed in November and December 2009 strategically analyses the entire RD program of Saxony-Anhalt and provides policy options. Particular emphasis is put on an improved user interface and on the development of appropriate approaches to display results of larger sensitivity and scenario analysis. Preliminary empirical results are to be expected in January 2010 when the decision support process with the ministry will be terminated.
- #Subproject 11#

4 Overview about the subprojects and expected results

In the second funding period the proposed research unit comprises eleven subprojects in total. Figure 4 provides an overview about the subprojects. Four subprojects are assigned to the firm level (SP 1, 2, 3 and 4) and five subprojects belong to the policy and sector level (SP 7, 8, 9, 10 and 11). Further two subprojects (SP 5 (Balmann) and SP 6 (Brockmeier / Offermann)) can neither be attached to the firm level not to the sector level. They rather constitute an interim layer that we call “meso level”. Subprojects 5 and 6 contribute to the important task of linking the two traditional levels of analysis by aggregating or disaggregating results from one or the other level. It should be noted, however, that the exchange of results between the subprojects on both levels is not an exclusive task of these two subprojects.

The selection of the subprojects on the firm level is guided by the idea of combining and integrating the view on complementary aspects of structural change. Subproject 1 (Schade) considers the decision making process of individual entrepreneurs. Subproject 2 (Odening / Hüttel) puts the decisions into the context of a single farm, whereas subproject 3 (Mußhoff) analysis the interaction between farms. Finally, subproject 4 (Hockmann / von Schlippenbach) focus on different firms along a value chain.

The choice of the subprojects on the sector level is motivated by the intention to further develop theories and methods used in the analysis of current and relevant policy issues. Traditional trade policy instruments and their impacts are investigated by subprojects 6 (Brockmeier / Offermann and, although to a lesser extent, 8 (Blesl / Grethe). Subprojects 7 (Lotze-Campen / von Witzke) and 8 focus on energy and climate policies, which are of growing importance for the agricultural sector. Instruments of the second pillar of the CAP are subject of subprojects 9 (Petrick) and 10 (Kirschke / Weingarten). Finally, subproject 11

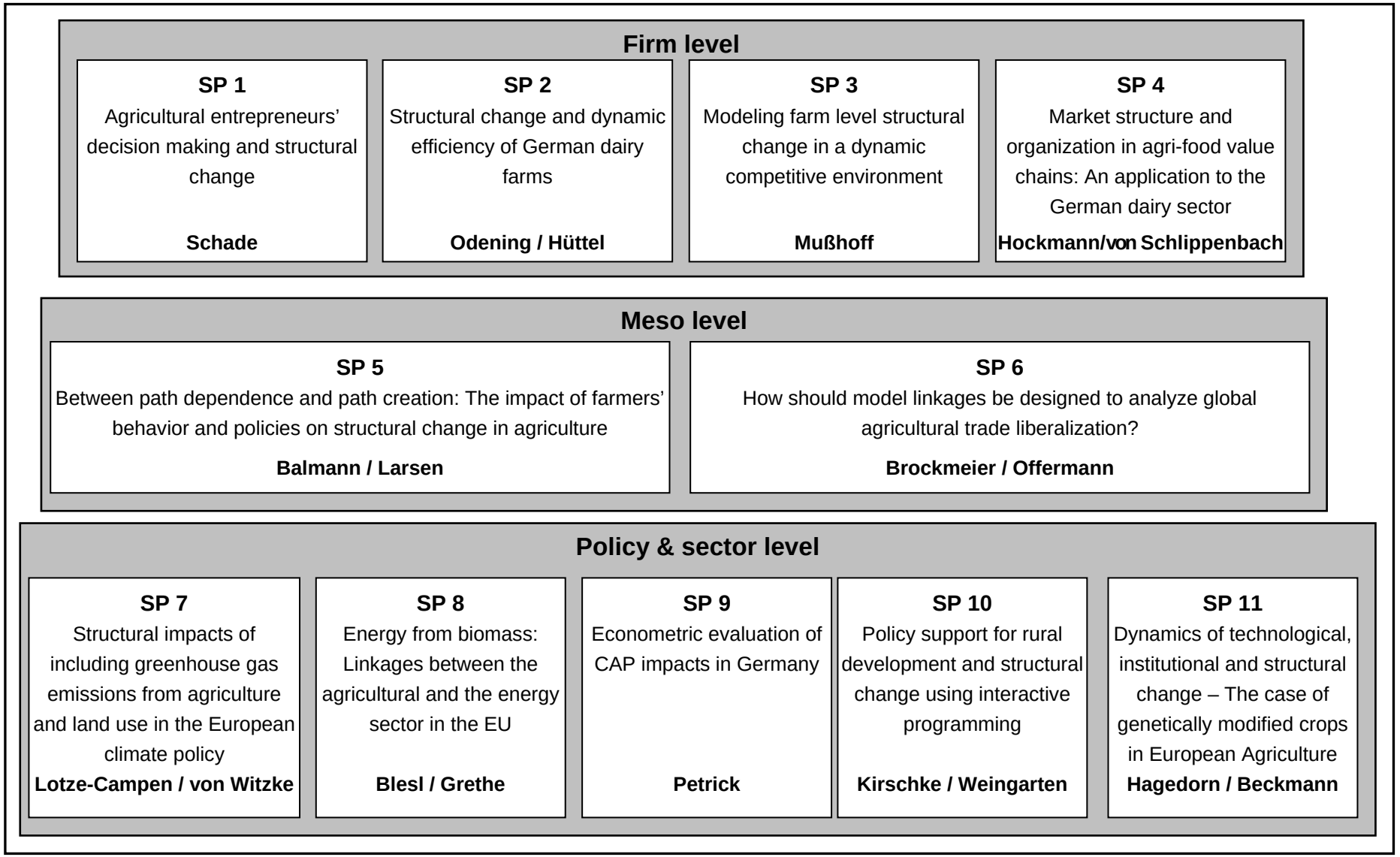
(Hagedorn / Beckmann) analyzes the process of institution building for the case of genetically modified crops.

Compared with the proposal in the first funding period some changes occurred:

- The former subproject 5 (Balmann /Mußhoff) has been split up into the new subproject 5 (Balmann) and subproject 3 (Mußhoff), mainly for organizational reasons. (As mentioned above, Mußhoff joined the University of Göttingen.)
- The former subprojects 3 and 4, which have not been funded during the first period, have been replaced by a new subproject 4 (Hockmann / von Schlippenbach). As before, the contribution of this subproject is the analysis of value chains. However, the cooperation and the exchange with other subprojects will benefit from the fact that now an industrial organization approach is suggested, which is closer to the microeconomic perspective adopted by many other subprojects.
- For organizational reasons (Grethe joined the University of Hohenheim), former subproject 7 (Grethe / von Witzke) has changed with regard to applicants (Lotze-Campen / von Witzke) and project focus (climate effects of agriculture).
- The interactions between the energy and the agricultural sector were already in the focus of former subproject 8 (Kemfert). In order to address these interactions even more intensively, the new subproject 8 (Blesl / Grethe) aims at combining established agricultural sector and energy system models.

Next, we briefly describe the main objectives of the individual subprojects and their contribution to the entire research unit.

Figure 4: Structure of the research unit and overview about subprojects



Subproject 1: Agricultural entrepreneurs' decision making and structural change
Short title: Entrepreneurial decision making
Principal investigator: Schade

The rational calculus assumed in most economic models is quite unrealistic and not predictive of economic agents' decision making. This statement holds for the existing literature on structural change in agriculture: based on a quite abstract characterization of agricultural entrepreneurs and not fully reflective of their actual decision making. Hence, the understanding of structural change in agriculture can be improved via a realistic modeling of the decision making of agricultural entrepreneurs. Applying and extending psychological and decision-oriented approaches from entrepreneurship research will help better predicting farmers' behavior and choices. Economic experiments are important to evaluate the predictive power of such approaches and to test them against economic benchmark models.

The underlying paradigm of our research is that of bounded rationality. With the overall aim of elaborating implications for regulatory agencies, this project seeks at modeling decision-making in scenarios relevant for farming. It thus aims at overcoming the quite abstract characterization of the agricultural entrepreneur in the agricultural economics literature, at applying entrepreneurship research to farming and farmers in general, as well as generating experimental evidence on farmers' decision-making, which is missing.

Building up on our experimental work on entrepreneurial behavior in general, on entrepreneurial disinvestment choices, and on coordination problems in the efficient allocation of land with economies of scale, in the prolongation period we plan to focus on three research domains: (1) understanding the economic and psychological drivers of farm exit, (2) deepening our understanding of evolving and persisting market structures as well as structural transition in agriculture, and, based on the first two, (3) better characterizing the agricultural entrepreneur.

The first research domain concerns itself with an issue crucial for understanding structural change in agriculture: inertia, i.e., "holding on for too long", in farm exit and disinvestment choices. There are rational (real options-based) and psychological explanations for such inertia. Laboratory experiments have been successfully developed and carried out in the current research period to disentangle these effects, but further research is necessary to more deeply understand the psychological drivers. Methodologically, economic experiments will be enriched via psychological questionnaires and framing manipulations.

Based on experimental evidence generated in the current research period, the second domain focuses on better understanding the barriers hampering the transition to efficient land units and on developing and testing new auction types for allocating land plots that take into account the bounded rationality of the interacting farmers. Recommendations for the regulation of land markets and for the consulting of farmers are expected.

The third research domain is partially based on the first two, but requires carrying out part of our experimental studies with different participants so to better characterize the profile of the agricultural entrepreneur via a comparison of farmers with non-farming entrepreneurs and non-entrepreneurs.

Subproject 2: Structural change and dynamic efficiency of German dairy farms

Short title: Structural change and dynamic efficiency

Principal investigators: Odening / Hüttel

The German dairy sector is the biggest in the European Union and reflects both, the complexity of agricultural production in highly regulated markets, as well as a complex system of livestock production. Since 1984 the EU dairy policy has been characterized by a milk quota system and its associated intervention prices. Under the milk quota, classical economic principles such as growth and scale do not necessarily hold. Within the 2003 CAP reform the decoupling of premia from any production level and a further reduction of the intervention prices induced sizeable adjustment processes at the farm level like growth or abandonment of milk production. The 2008 health check and falling prices induce further pressure on farms to adjust that may further alter the farm structure. It is widely acknowledged in the literature that structural change is closely related to the efficiency of the firms within a sector. Firms showing superior performance and higher efficiency increase their market share at the expense of less efficient firms, thereby increasing concentration.

The overall objective of this subproject is to improve the understanding of structural change in the German dairy sector. The relevance of this topic emanates from the dynamics, which has characterized dairy production in the past, in conjunction with the value that the dairy sector adds to farm income in Germany and the EU. We want to identify the main drivers of the adjustment process at the farm level. Thereby we aim to pave the way for predictions of developments in this sector, in particular after the milk quota period. The first specific aims focuses on the impact of the milk quota scheme on structural change; of particular interest are the determinants of abandoning milk production. The second specific objective of the research is to investigate the relation between efficiency and structural change in the German dairy sector. It will be interesting to investigate if high efficiency actually translates into higher profitability and competiveness or if the “poor but efficient” hypothesis holds, particularly for small dairy farms. Moreover, we want to understand why certain farms turn out to be efficient and competitive and if efficiency is a crucial determinant of farm closure.

The aforementioned objectives require sophisticated methods that are not fully available yet. An important contribution of this subproject is the refinement of existing models that allow for a quantitative analysis of adjustment processes in dairy farming. The first focus lies on econometric models that explain exit decisions in dairy production. Basically, this refers to a real disinvestment option with a decreasing value the closer the (uncertain) abolishment of the milk quota comes. Existing econometric models need to be broadened to account for uncertain future revenues, sunk costs and the role of the milk quota scheme. The second focus is on models for dynamic efficiency analyses. Based on a dual model of intertemporal decision making a shadow cost approach is used that allows for an econometric estimation of dynamic efficiency under uncertainty. Finally, it is aimed to test the impact of farm efficiency on exit decisions in the German dairy sector. Both approaches are based on German farm level panel data from the farm accountancy data network that requires the use of panel data methods.

Subproject 3: Modeling farm level structural change in a dynamic competitive environment

Short title: Real options

Principal investigator: Mußhoff

Agrarian structures are considered to be an important factor for the competitiveness of farming. Therefore, on the one hand, agricultural economists have been concerned for a long time with describing, analyzing and modeling structural change in agriculture. On the other hand, high political attention is devoted to the competitiveness of agricultural production and the income situation of farms. However, in order to adequately forecast the structural change in agricultural in general and to analyze the effects of different political schemes in particular, a profound understanding of farm level structural change, i.e., investment and disinvestment decisions of farmers, is necessary.

When attempting to model, explain and forecast structural change in agriculture in the past, only sub-aspects of the complexity of real decision making were considered. Presently, no model exists that accounts for uncertainty, dynamics and irreversibility though they coexist in many decision problems. Another important issue, which is frequently neglected in farm level models, is competition, i.e., interactions between different agents. The overall objective of subproject 3 is to develop a normative model, which enables realistic prognosis of farms' investment behavior and its implication for structural change in agriculture. The theoretical concept of the model is based on the real options approach. Real options theory allows quantifying the value of entrepreneurial flexibility under conditions of uncertainty and irreversibility, based on the well-founded results of financial option pricing theory. However, difficulties arise when analyzing (dis)investment decisions in a competitive environment, because real options in contrast to financial options are non-exclusive. Thus, a direct determination of equilibria in competitive markets is necessary, which is commonly assessed as not practicable. We will do this by using an agent-based real options market model. Furthermore, this model will incorporate bounded rationality of decision makers. For that purpose results from the first project phase can be utilized. With these extensions the real options model builds a starting point for an improved policy impact analysis.

The investment and disinvestment model will be applied to the dairy sector which shows a high (and further increasing) intensity of competition. Investments in the dairy sector are generally highly specific and thus cause sunk cost. Consequently, the resale values of buildings are low. At the same time, demand shocks, fluctuations of weather conditions, climate change and epidemics like BSE in combination with a temporal delay in adjusting production, lead to high price fluctuations and long-run uncertainty in the milk market. Moreover, investments in the dairy sector are not "now or never" decisions. Such decisions can instead be temporally postponed. For decisions to invest in the dairy sector, all three conditions of "uncertainty", "irreversibility" and "flexibility" of the real options approach are fulfilled. With respect to the dairy sector, the consequences of different policy schemes such as a rapid abolishment of the quota system, soft landing and/or the introduction of a minimum price for milk will be analyzed, i.e., changes in trigger prices, markets supply, farm profits and overall economic efficiency.

Subproject 4: Market structure and organization in agri-food value chains: An application to the German dairy sector

Short title: Market structure

Principal investigators: Hockmann / von Schlippenbach

The German dairy sector is facing a period of significant changes. The number of both farmers as well as dairy processors has drastically declined over the last decades. The wide literature tackling the adjustment processes in agricultural sectors often ignores retailing activities. As long as the retail sector was highly fragmented and constituted a “transparent” window between suppliers and consumers, this approach was appropriate. However, this has changed dramatically since the retail sector has been subject to a profound consolidation process. Due to the emergence of increasingly dominant agents at all different stages of the dairy sector, strategic interactions along the value chain have become more important. In particular, the increasing buyer power of retailers has raised concerns in recent years.

Against this background, we aim at analyzing the competitive forces along the value chain. So far, there exists no workhorse model that allows for the analysis of interdependencies in a three-layer structure where imperfect competition is assumed at all three stages. We close this gap by developing a general model that allows us to analyze the negotiation outcomes between retailers, food processors and farmers. Based on this framework, our research project is divided into two work packages that tackle two different issues of structural change in agricultural value chains:

First, we focus on merger incentives at the processors’ level. If products are both conventional and strategic complements a merger between processors may soften their bargaining position vis-à-vis retailers, while merged processors have a better bargaining position vis-à-vis farmers. In order to capture this trade-off, we construct a simple theoretical model that considers the negotiations of processors with both farmers and retailers. When analyzing potential drivers of structural change, we take into account how changing marginal costs at the processors’ level, the processing capacities as well as a variation of the number of upstream firms change the outcome in terms of endogenous market structure and delivery tariffs negotiated between processors and farmers as well as between processors and retailers. The empirical part of this work package focuses on the econometric modeling and estimation of market structure development at the processors’ level. The empirical model will be developed within an Olley-Pakes framework which in addition to the determinants of market structure provides consistent information about productivity differences among processors.

Second, we examine competition between different organizational forms like cooperatives and for-profit firms at the processors’ level. We endogenize the size of cooperatives in a mixed duopoly equilibrium. We aim at understanding how the differences in ownership structures affect the negotiation outcomes in vertical relations as well as the distribution of market power along the chain. We further intend to highlight how different ownership structures affect the endogenous quality choice of farmers and processors. The empirical investigation in the second work package focuses on the explanation of market performance and the identification of market power. Within this context a structural market model will be developed that combines the theoretical findings of both work packages.

Subproject 5: Between path dependence and path creation: the impact of farmers' behavior and policies on structural change in agriculture
Short title: Path dependence
Principal investigator: Balmann / Larsen

Compared to the regional heterogeneity of agricultural structures in Germany, the speed of structural change is slow and it cannot be expected that regionally different farm structures converge. This is puzzling considering that the regional heterogeneity is accompanied by the dominance of suboptimal farm sizes in many regions and – despite of huge subsidies – significant functional income disparities. One explanation for these observations is a path dependency of structural change. The main objective of this study is to get a better understanding whether structural change is indeed path dependent, what the determinants are, as well as whether and how path dependence eventually can be overcome.

This study will especially focus on the German dairy sector. The first reason is that structural change in this sector seems to be particularly lagged behind as a vast majority of dairy farms either operate with inferior techniques or apply them in a less economical way. Also the regional heterogeneity of farm structures is huge with, e.g., many small farms in Bavaria and a relatively low number of large dairy farms in Saxony-Anhalt. The second reason is that the dairy sector is particularly affected by the ongoing liberalization of the CAP. Accordingly, dairy farmers, their representatives and politicians are highly concerned about the future of this sector. A third reason is that many German farms are engaged in this relatively labor intensive business which is often located in disfavored grassland regions.

The underlying hypothesis of this project is that structural change in the dairy sector is path dependent. In particular, it is hypothesized that existing structures are not the result of a long-term optimal development but of historical events. Although historical events may have had a certain economic rationale, either dynamic inefficiencies accumulate over time (or at least persist) or the benefits of the incidents were exploited earlier. In order to analyze this, the concept of path dependence will be applied to identify and evaluate potential reasons. Factors that could help overcoming path dependence in the direction of a path creation or path breaking will furthermore be explored.

The methodological starting point will be the agent-based model AgriPoliS which will be used to analyze structural change in agriculture by simulation experiments. In addition to previous studies which applied AgriPoliS or its predecessor to analyze the impacts of sunk costs, market frictions and agricultural policies, this study will particularly focus on the role of behavioral issues for path dependences. On the one hand, participatory laboratory experiments involving human players (farmers, students) will be used to improve the agents' behavioral foundation in AgriPoliS. On the other hand, simulation experiments with AgriPoliS will be used in combination with stakeholder workshops in order to learn how farmers, officials, and other stakeholders from two selected case study regions (Stendal in Saxony Anhalt and Allgäu in Bavaria) perceive issues and trends of structural change and agricultural policies. This will facilitate a better understanding of whether mental models of individuals and the society affect the behavior of farmers and policy formation. At the same time, the workshops aim at validating AgriPoliS, its regional adaptation as well as at identifying realistic scenarios which will be analyzed jointly with the stakeholder.

Subproject 6: How should model linkages be designed to analyze global agricultural trade liberalization?

Short title: Assessment of model linkages

Principal investigator: Brockmeier / Offermann

The current round of WTO negotiations, also known as the "Doha Development Round", is an ambitious effort to make globalization more inclusive and help the world's poor, especially by slashing barriers and subsidies in farming. However, the ultimate impacts of a WTO agreement are far from obvious. Particularly the often extremely complex policies governing the agricultural sectors in many countries pose great challenges for scientific policy impact assessment. The implications of agricultural trade liberalization need to be analyzed considering specific policies and effects at the single country, region or farm level, while at the same time accounting for the influence of trade liberalization at the global level. Currently, none of the existing analytical tools is able to answer the relevant policy questions at the global, sectoral and farm level. Thus, a model linkage is needed that captures impacts at both the micro and macro level. Model linkages of this kind are of great current interest, but approaches and techniques are mostly still under development or in their infancy. Additionally, model linkages are increasingly developed for and applied in policy advice, so that results need to be delivered on a very tight schedule. Under these conditions it is hardly possible to thoroughly consider the implications of different options to link models.

The overall objective of the project is therefore not only to link models that deliver results disaggregated to various levels. It also attempts to analyze in detail the potentials and pitfalls of model linkages, and determines which links are mostly appropriate and feasible for the analysis of global agricultural trade liberalization. In addition, the project therefore aims to answer the following specific question: How does structural change at the farm level influence aggregate supply and technical progress? Under which conditions is it possible to derive macro-relationships from micro-relationships? How does the aggregation level influence the model results and how can possible problems be overcome? What role play bottom up and top down approaches in this regard?

These research questions will be explored using a linkage between GTAP (Global Trade Analysis Project) and FARMIS (Farm Modeling Information System) to analyze the impacts of global agricultural trade liberalization in the context of structural change of the German agricultural sector. Foremost, the definition and specification of variables common to both models, the model behavior as well as behavioral parameters will be aligned and harmonized for a common baseline scenario. To increase consistency and scope of results, the project will then investigate whether bottom-up- and top-down linkages are more appropriate to answer the research question raised. This will entail an analysis of the conditions needed for an exact or suitable approximated aggregation of farm level structural change to macro modeling or for disaggregating macro level structural change to micro models. Sensitivity analyses will be extensively employed throughout the project to systematically highlight the implications of different approaches to link the models.

Subproject 7: Structural impacts of including greenhouse gas emissions from agriculture and land use in the European climate policy
Short title: Climate policy
Principal investigators: Lotze-Campen / von Witzke

Ambitious goals in future climate change mitigation can only be achieved, if greenhouse gas emissions from agricultural production and land use change are included in the overall climate policy framework. However, measuring, monitoring and mitigating agricultural emissions of methane, nitrous oxide and carbon dioxide is much more complex than energy-related emissions. Moreover, the farming sector consists of a large number of relatively small emitters, in contrast to the energy sector with small numbers of large emitters. Hence, transaction costs of implementing climate policy measures in agriculture are an important issue.

In addition to direct climate impacts on agricultural yields in the future, the agricultural sector will be strongly affected by climate-policy related changes in relative prices. Energy prices, and hence fertilizer prices, will rise. Demand for emission-intensive food products, especially animal products, could fall (or rise more slowly) than currently expected. The demand for additional agricultural land could increase or decrease in different regions, depending on soil quality and carbon content. All this, in combination, could lead to large-scale structural changes in agricultural production in Europe and elsewhere. Policy strategies for integrated land use and full greenhouse gas management in agriculture need to be developed in the near future.

In this project we will undertake the following tasks:

1. Theoretical concepts and potential implementation of various policy instruments for emission mitigation in agriculture (e.g., emission taxes, emission trading, nitrogen taxes, offsets, etc.)
2. Spatially explicit modeling of emissions of nitrous oxide, methane and carbon dioxide with the land use model MAgPIE (Model of Agricultural Production and Impacts on the Environment)
3. Model-based analysis of land use change and structural effects under various policy instruments in Europe
4. Analysis of selected effects of emission mitigation measures at the farm level (introducing mitigation measures in the FARMIS model, SP6)
5. Analysis of market and trade effects of climate policy measures in agriculture (introducing mitigation policies in the ESIM model, SP8)

Results of this subproject may be used for harmonization and integration of sectoral policies related to agriculture, energy, climate and the environment.

Subproject 8: Energy from biomass: Linkages between the agricultural and the energy sector in the EU

Short title: Energy from biomass

Principal investigators: Blesl / Grethe

Over the last three decades real energy prices have increased relatively to real prices for agricultural products. As a consequence, bioenergy as a share in total energy demand has increased world wide and is expected to increase further. Partly, this tendency is due to the market mechanism: relative market prices are such that biomass is turned into energy, e.g., sugar cane into ethanol in Brazil or solid biomass for heating private homes also in many industrialized countries. Partly, however, this tendency is policy driven. Due to a broad variety of drivers (climate policy, the security of energy supplies, agricultural and rural policy motives), many governments in industrialized as well as in developing countries are supporting the conversion of biomass into energy by means of tax exemptions, mandatory blending, subsidies and other policies. This also holds for the EU, where the production of fluid biofuels is policy driven and would not happen at market prices.

As a consequence, the potential supply of biomass for energy production (which depends on prices) has an impact on the future energy balance, and demand for energy from biomass has an impact on agricultural markets. This interrelationship has often been analyzed either based on energy system models, assuming a given biomass supply, or based on agricultural sector models assuming a given biomass demand for energy. Alternatively, some studies address this market interdependencies based on general equilibrium models with a very stylized representation of the energy sector.

The objective of this subproject is to ex-ante analyze the interdependence between the energy and the agricultural sector in the EU under energy as well as agricultural policy scenarios. In order to address the weaknesses of existing simulation models, the analysis will be based on the combined use of two well established partial models: the Integrated Markal Efom System (TIMES) PanEU Model, which is a bottom up dynamic energy system model with a rich technology representation of the EU energy system, and the European Simulation Model (ESIM), which is a partial equilibrium comparative static agricultural sector model with a rich representation of EU agricultural policies and market interdependencies. Both models are programmed in GAMS and both models already include, although in a rudimentary form, linkages between agricultural and energy markets: ESIM depicts the impact of an exogenously given demand for biofuels on agricultural markets, and the TIMES PanEU model depicts the effect of an exogenously given supply of biomass on the EU energy system.

The work program includes the identification and creation of relevant interfaces and exchange variables for both models, the conceptualization of the regional dimension of bioenergy markets, the further development of both models (e.g., the integration of agricultural by-products relevant for energy production such as straw and manure in ESIM), as well as scenario development and analysis. Close interrelations exist with subproject 6: the interface with FARMIS in the first project period allows addressing regional and farm specific effects of energy policy scenarios; and subproject 7: the inclusion of agriculture in EU climate policy will have effects on the potential of the agricultural sector to supply biomass for energy, which will be taken into account in the ESIM/TIMES PanEU framework.

Subproject 9: Econometric evaluation of CAP impacts in Germany

Short title: Impact evaluation

Principal investigator: Petrick

The aim of this subproject is to develop and apply regression models that analyze the effects of agricultural and rural development policies in German regions. Following the overall goal of structural econometric modeling of policy impacts, there are three stages to this process. First, microeconomic models of farm behavior will be developed that can accommodate the range of measures currently embodied in the Common Agricultural Policy (CAP). Second, econometric models are devised which address the identification problems inherent to a CAP-related empirical impact analysis. In a third stage, the econometric models will be applied and their performance assessed. The research agenda of this subproject directly builds upon work in the ongoing subproject on “Econometric impact analysis of rural development policies” within the DFG Research Unit 986.

Currently, the EU spends around 5 billion Euros annually on decoupled direct payments to German farmers. In addition, agricultural policymakers have been relying increasingly on differentiated measures for ‘rural development’ which, besides supporting agricultural enterprises, should also assist environmental aims and bolster the economic strength of rural areas in general. The most important instruments in Germany – by relative budget allocation – for the recently expired aid period 2000 to 2006 included agro-environment measures, measures for village regeneration, farm investment support, and payments for farmers in less favored regions. In this period about 8.7 billion Euro of European Union funds were distributed in Germany for rural development; for the current aid period 2007–2013, 8.1 billion Euros are budgeted. The question must therefore be asked whether these measures will influence structural change in the agricultural sector in a way that is socially desirable.

Developing appropriate econometric methods for such an analysis and their application at the administrative district level (Landkreise) in selected German Länder is at the core of this subproject. The approach followed here aims at a quantification of policy effects at the regionally aggregated level. Basing the analysis on territorial observation units also allows investigating those instruments which are not directly aimed at agricultural enterprises, e.g., the measures for village regeneration which are of particular importance in eastern Germany. The subproject draws on recent literature dealing with multiple, continuous treatment effects in a panel data setting. Building on ongoing work from the first phase of this subproject, the primary focus will be on three extensions to existing models: (1) strengthening the microeconomic underpinnings related to CAP effects on farmers’ behavior, (2) explicitly considering dynamics of farm structures in the econometric models, (3) relaxing the linearity assumptions that are typically central to these models.

The subproject addresses a central methodological aim of the research unit, namely the development of a methodological framework for analysis and shaping of structural change in the agricultural sector. Parameter estimates provide an important foundation for further analysis in other subprojects.

Subproject 10: Policy support for rural development and structural change using interactive programming

Short title: RD policy support

Principal investigators: Kirschke / Weingarten

Rural development (RD) policies have increasingly gained importance in the European Union (EU). However, various problems have to be solved for sound policy-making in this field. Major problems relate to many actors at multiple levels, to multiple objectives with limited operationalization and considerable trade-offs, and to limited knowledge on policy impacts. Also, co-financing of several budgets, linkages between measures and budgets, and regional differences (preferences, measures, impacts, funding) have to be taken into account. Facing such a complex policy-making problem, the basic research question is how policy decision-making for rural development can be supported effectively. In the context of the research unit the subproject looks at the policy impact on rural development and, thus, on structural change.

The overall objective of the subproject is to provide and test a master programming framework for integrative rural development and structural change. The approach comprises key RD policy measures and is based on interactive programming. The analysis will sharpen the view on the power and applicability of interactive programming in RD policy support and further develop its theoretical foundations.

Three specific objectives are pursued. The first one is to assess the impact of RD policies comprising measures of the European Fund for Regional Development, the European Social Fund and the European Agricultural Fund for Rural Development. The analysis will be based on expert judgment using a broad basis of stakeholders and experts. An internet-based expert survey will be carried out. The second specific objective is to develop the interactive programming tool focusing on measures, objectives and constraints considered and integrating relevant budgets and financing options into the approach. Parametric linear optimization and solver-based Visual Basic Applications in Excel are key methodological features. The third specific objective, then, is to develop RD strategy options for specific regions using the information provided and the tool developed. The methodological approach comprises focus group discussions and workshops. A strategy working group will define scenarios and evaluate results for two regions in Germany and for the post-2013 EU financing period.

Interactive programming in RD policy support can be a powerful tool to understand and handle complexity in policy decision-making, to guide rural development and structural change, and to avoid oversimplification or arbitrariness in policy-making. Subproject 10 should find out how this perspective can best be achieved.

Subproject 11: Dynamics of technological, institutional and structural change – The case of genetically modified crops in European agriculture

Short title: Institutions and GM crops in European agriculture

Principal investigators: Hagedorn / Beckmann

In the European Union, genetically modified (GM) crops have sparked complex processes of institutional and structural changes oscillating between hierarchical, cooperative and market governance. Although member states have agreed on centralized procedures of risk assessment for market approval at the European level (directive on deliberate release into the environment 2001/18/EC) and have regulated common market issues concerning traceability and labeling as well as safe use for food and feed (Regulation (EC) No 1829/2003 and 1830/2003), they are still discordant regarding the risk management of GM crops. This is reflected in the different voting behavior of member states on GM crop approval within the committee of experts, the diversity of national coexistence regulations and the use of the safety clause based on Art. 23, 2001/18/EC in order to ban GM crops nationally.

As a consequence, by the year 2009 only one genetic event has been approved for commercial cultivation in the European Union, MON810. The genetic modification confers resistance to maize against a very common maize pest, the European Corn Borer (ECB, *Ostrinia nubilalis*). Adoption patterns of this GM crop vary within the European member states. Currently, cultivation of Bt maize MON810 takes place in six member states on a total area of 108.000 ha. At the same time, six countries have explicitly banned the cultivation of MON810. Thus, different adoption patters might not only be grounded in structural differences, such as occurrence of the target pest, importance of maize cultivation and farm structures but also and maybe foremost in socio-political factors. Such a factor is also the increasing number of GM free zones throughout Europe where farmers and other actors in the agricultural sector promote the renouncement of GM crop cultivation and even cattle feeding and food processing. However, the interaction between EU policy, national policy, GM crop adoption and the establishment of GMO free zones is still poorly researched.

Against this background, the subproject seeks to analyze the spatial and temporal dynamics of institutional and structural changes concerning GM crops in European agriculture at the farm level and at the policy level as well as their interactions. The analysis will be based on theories of institutional change with particular reference to new political economy, the distributional and cognitive theory of institutional change in combination with the theory of technology adoption and the theory of social movements. In the first step, quantitative data on farm structures, adoption and GM crop opposition for each member state will be gathered and evaluated. Data analysis will be complemented by document analysis regarding national policies. The objective is to identify different patterns in the spatial and temporal development across the EU and to identify possible drivers such as farm sizes, share of organic farms or people’s perception and preferences. As far as possible, econometric techniques will be applied to study the relationships between key variables. In the second step, expert interviews with different actors at the EU level such as representatives of the member states, the regions, NGOs, the GM industry and the EU administration will serve to describe actors’ constellations, mental models and power plays, which might allow to reconstruct the current developments and to predict future development paths to a certain degree.

5 Interdisciplinary cooperation and project management

5.1 Cooperation and synergy effects

The projects in Research Unit 986 cover a wide range of topics with regard to content as well as methods. This enables us to look at processes of structural change from a broad perspective and offers enormous opportunities and at the same time also challenges for cooperation. Cooperation has been very successful in the first period (see Section 3.2 above) and we can build on these experiences and linkages among projects in many cases, but also want to explore new options for cooperation. Many of the complementarities and interdependencies among subprojects are depicted in Figures 5 and 6.

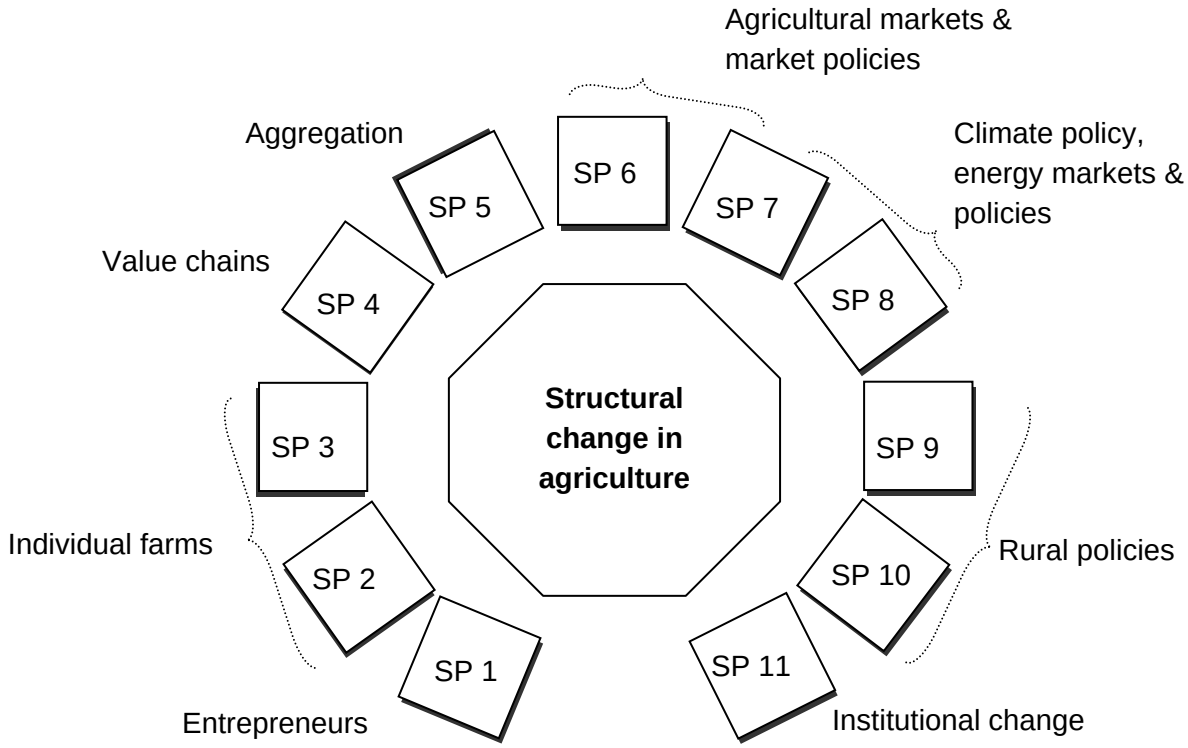
Figure 5 shows the logical order of subprojects circled around “structural change”. Moving around the circle clockwise, the focus of the analysis becomes wider and aspects which were treated as exogenous before become endogenous when moving to a higher stage of aggregation. On the left hand side of the figure the focus is the decision process of individuals (SP 1). On the opposite side (SP 11), the focus is on the institutional framework under which the agricultural sector as well as agricultural policy operate. In between is the decision process of single firms (SP 2 and 3) and SP 4 concentrates on the organization of value chains. SP 5 and 6 employ farm group models as well as multiagent systems, which both allow to aggregate results to a higher level or disaggregate results to a lower level. SP 6 explicitly addresses the questions arising from linking micro and macro analyses. Some of the traditional sectoral agricultural policies such as price policies and direct payments are analyzed in SP 6 and to some extent in SP 8. The focus of SP 7 and 8 is on the analysis of policies which are of relevance beyond the agricultural sector such as climate policies and energy policies. Finally, SP 9 engages in an ex-post analysis of rural development policies and SP 10 researches the process of the formation the policy process itself.

In order to display the most important interdependencies among subprojects (there are many more, but to depict all of them may make the figure very intransparent) they are shown in the matrix of Figure 6; more detail is given in the subproject proposals (Section 5.2). Interdependencies can be categorized into six different forms:

1. The application of common methods and their further development in order to address different questions.
2. The integration of empirical evidence in order to address certain objectives.
3. The joint definition of scenarios to be analyzed.
4. The exchange of results between complementary models.
5. The comparison of results from competing models or theories.
6. Joint research experiments

In the following, some of these interdependencies are highlighted as examples.

Figure 5: Complementary perspectives of the subprojects



Ad 1: The application of common methods and their further development in order to address different questions

- An example for the use of common methods are SP 2 and SP 9, which work on very different topics with regard to content but both employ panel econometric methods and have cooperated successfully in the past in the exchange of experiences and discussion of these methods in both subprojects. This cooperation is envisaged to be continued.

Ad 2: The integration of empirical evidence in order to address certain objectives

- Subproject 5 further develops the agent based AgriPoliS model which will be used to analyze structural change in agriculture. It will particularly focus on the role of behavioral issues for path dependencies and will integrate results on bounded rationality generated in SP 1.
- Behavioral experiments carried out in SP 1 will provide evidence on disinvestment choices of boundedly rational actors which will be integrated in SP 2 and 3.

Ad 3: The joint definition of scenarios to be analyzed

- For the interpretation of results as well as for the coherent use of simulation models at different aggregation stages and with a different focus, the common definition of framework scenarios containing assumptions on macroeconomic variables as well as policies is envisaged. First experiences with such an approach are made within the first phase of the research unit (#Deppermann, Grethe and Offermann, 2009#) and will be extended to cover more model applications within the remaining period of the first phase of the research unit and in the second phase. Such joint policy scenarios are elements within certain subproject proposals (e.g. for FARMIS and GTAP, SP 6; for ESIM and Times PanEU, SP 8), but also among subprojects (e.g. GTAP, ESIM and FARMIS).

Ad 4: The exchange of results between complementary models

- The exchange of results between complementary models has been an objective since the beginning of the research unit and has been implemented for example between ESIM and FARMIS in the first phase of the project period. Such an exchange of results among simulation models at different aggregation stages has become the explicit focus of SP 6, in which the methodological basis for model linkages is analyzed and the effects of a potential conclusion of multilateral trade negotiations are downscaled to the German agricultural sector. Another simulation model linkage which is envisaged in SP 8 is between ESIM and TIMES PanEU which will allow addressing the interdependencies between agricultural and energy markets. Linkages developed in the first phase of the research unit will allow to downscale results to farm groups in the German agricultural sector (ESIM-FARMIS) as well as to take into account a consistent set of macroeconomic parameters (GTAP-ESIM). Especially the downscaling option based on FARMIS is a very interesting option, as it allows for depicting the impact on specific farm groups as well as on farm structure based on the work done in the first phase of the research unit.

Ad 5: The comparison of results from competing models or theories

- Subproject 7 will analyze the effects of greenhouse gas emission mitigation policies on the agricultural sector. This will be done based on a global land use model (MAgPIE) with relatively little socio-economic detail. The set of mitigation policy instruments which will be developed in SP 7 will also be implemented in the ESIM/FARMIS framework to compare results with respect to the German and the EU agricultural sector.

Ad 6: Joint research experiments

- SP 5 will carry out behavioural experiments on bounded rationality in close cooperation with SP 1.

Figure 6: Important interrelations between subprojects

Delivering Subprojects	Receiving subprojects										
	1	2	3	4	5	6	7	8	9	10	11
1		Evidence on disinvestment choices of boundedly rational actors	Evidence on disinvestment choices of boundedly rational actors		Improvement of agents in AgriPoliS; Coop. on experiments; Evidence on optimality of different auction types					Cooperation on experimental study on rational policy decision-making for RD	
2	Modeling skills in real options theory		Exchange on farm cessation; Comparison of results	Insights about structural change at farm level	Reaction of farmers to quota removal	Insights about reaction of farmers to quota removal			Exchange on econometric model. of farm exits & policies		
3	Modeling skills in real options theory, Modeling of boundedly rational agents	Exchange on farm cessation; Comparison of results			Comparison of results Cooperation in model development	Evidence on relevance of bounded rationality at a sectoral level		Risk aversion as a production motive for perennial biomass crops?	Cooperation on theoretical foundations of structural adj.		
4		Insights about determinants of exit decisions	Insights about determinants of exit decisions								
5	Modeling of boundedly rational agents; Behav. Predictions from genetic algorithms & simulation procedures; Theory of land markets	Insights about determinants of exit decisions	Comparison of results Cooperation in model development								
6		Understanding of policy impacts					Farm group specific results of mitigation policies	Downscaling of ESIM results; Reg. biomass supply			
7						Mitigation policies		Mitigation policies GHG emissions per product			
8					Dairy market results	Market results, especially from energy and climate policies; Dairy market results	Market and trade effects of mitig. policies; Farmgroup spec. effects (ESIM-FARMIS linkage)				
9	Exchange on econometric modeling of farm exits and policy measures		Cooperation on theoretical foundations of structural adj.					Data on production effect of DP and RD policies?		Parameter estimates for inter-active LP; Member strategy group	Coop. on quant. policy analysis at regional level
10	Coop. on experimental study on rational policy decision-making for RD										
11									Coop. on quant. policy analysis at regional level		

5.2 Project organization

As before, Martin Odening and Harald Grethe are the designated coordinator and deputy coordinator, respectively, of the proposed research unit. They are responsible for the coordination and the coherent implementation of the research project as a whole. The fact, that the competencies and research areas of Grethe and Odening complement each other, eases the coordination task. While Grethe mainly works on agricultural markets, agricultural policies and partial as well as general equilibrium models, Odening's research activities are related to farm management, investment analysis, efficiency analysis and microeconometric modeling. Though Grethe left Berlin in 2008 and moved to Hohenheim, the collaboration between both coordinators was intensive and effective.

We found it also helpful that the responsibility for individual subprojects is shared by two researchers (without increasing the requested funds proportionally!). With the exception of subprojects 1 and 3, all subprojects involve two applicants. This comes along with the advantage that more scientific competences are fed into the subprojects and the organizational burden is shared by more researchers.

The following organizational instruments turned out to be effective and will therefore be continued:

- The SIAG seminar constitutes a regular meeting for all members of the research unit. In view of the spatial distribution of the participating researchers the seminar takes place four times within each semester and lasts half a day. The main purpose of the seminar is the exchange of information on the work progress of the individual subprojects. Thereby we ensure that the individual projects do not drift apart or lose sight of the common research idea. Each subproject is in charge of organizing a presentation twice a year. This is usually a project development report given by the PhD students. Furthermore, external experts are invited who discuss and review the concept or comment on preliminary results attained in the subprojects.
- In addition to the SIAG seminar two two-day workshops are planned. They will take place during the semester breaks in Liebenberg (near Berlin). These internal workshops are devoted to the discussion of strategic issues of the research unit such as the readjustment of the research agenda to current topics, cooperation projects or outreach activities.
- Apart from the aforementioned seminars and workshops, which involve the entire SIAG group, self-organized informal meetings of cooperating subprojects will take place on demand where details of joint research activities and publications are discussed.

Much effort will be spent on outreach activities and the dissemination of our research output. Highest priority is given to the publications in peer reviewed journals. The SIAG working paper series offers a platform for publishing results and receiving a feedback before submitting them to refereed journals. Of course, papers and posters will be presented at all important national and international conferences in agricultural economics. The working papers and a list of all other publications is accessible through the SIAG website.

We also intend to organize a forum that allows presenting the research unit as a whole or at least major parts of it at the end of the second funding period. The exact format has not been

decided yet. Possible alternatives are an EAAE seminar, similar to that one in 2010, an organized session or a mini-symposium at the occasion of an IAAE or an EAAE congress.

Next to this large scale event with a strong outreach component, we also want to organize two smaller workshops which will comprise subsets of the members of the research unit as well as external guests:

- A theory workshop on structural change in agriculture aiming at taking stock of current theoretical approaches to understand structural change in European agriculture. While there have been various attempts to look at this topic in a synergetic way in the past (Goddard et al. 1993, Harrington and Reinsel 1995, Mann 2003), the theoretical focus often has been less pronounced and recent theory developments (such as from behavioural economics, the real options approach or evolutionary theories) have not been taken into account. This workshop aims at an overview and critical discussion of the main theoretical approaches, their specific assumptions, behavioural models, and implications for understanding change in agriculture. #Responsible person#

- A workshop on the interfaces between political decision makers, public administration, and (potential) beneficiaries of agricultural and rural policies on the one hand and academic researchers on the other. The focus will be on methodological and institutional issues: How can stakeholders involved in the policy process be a useful source of insight for researchers and how can scientists contribute to policymaking at local, national and global levels? (Feindt et al. 2008, Hagedorn 1985, Kropp 2007) Responsible person: #Martin Petrick#.

Finally, we will pursue the creation of steadiness and sustainability with regard to research on structural change in agriculture. Obviously, there will be further demand for scientific work in this arena subsequent to the end of this research unit. In view of the achievements of the research unit and the human capital, which has been accumulated so far, it would be a pity to terminate the research activities abruptly after six years. Thus we will explore opportunities for a continuation such as a priority program of the DFG or ###.

5.3 Promotion of young scientists

The promotion of young scientists is a major strategic objective of the Department of Agricultural Economics at Humboldt-Universität zu Berlin and of all other institutions that participate in SIAG. Currently, the principal investigators of SIAG supervise # PhD students and they coach # post-doctoral researchers. Between 2007 and 2009 38 dissertations and 4 post doctoral theses (Habilitationen) have been successfully completed at the Department of Agricultural Economics in Berlin. As mentioned above, two (formerly) young researchers of the SIAG team, namely Harald Grethe and Oliver Mußhoff, have been appointed as Professors at the Universities of Hohenheim and Göttingen, respectively. The research unit also had positive externalities in terms of capacity building for junior researchers. Humboldt-Universität agreed to establish a junior professorship for “Quantitative Agricultural Economics and Microeconometrics” at the Department of Agricultural Economics. A close collaboration with SIAG is explicitly mentioned in the terms of reference for this position.

A clear indication of the desire to promote junior scientists is the fact that three young researches appear as new applicants for the second funding period. Silke Hüttel, who wrote her PhD thesis within subproject 2 in the previous funding period, now shares the application for this subproject together with Martin Odening. Similarly, Karen Larsen, who worked within subproject 5 as a post-doc, is now a co-applicant of Alfons Balmann for the second period. Finally, Vanessa von Schlippenbach will be in charge of the new subproject 4 jointly with Heinrich Hockmann. All of these junior scientists have excellent publication records. #examples, merits# During the next funding period Hüttel, Larsen, and von Schlippenbach will work on their post-doctoral theses. Their integration into the research unit offers an opportunity for gathering further experience in coordinated research programs and thus constitutes an important step in their scientific career. #Sandri? Petrick?#

PhD students and junior researches played an important and active role in the generation and dissemination of scientific results of the research unit. Table # summarizes the most important activities. These activities, especially the participation in scientific conferences, would not have been possible without the travelling grants provided by the DFG.

Table #: Participation of young researches in scientific events

SP	Name of young researcher	Topic of thesis (doctoral or post doctoral)	Involvement in scientific activities		
			Scientific event	Date	Activity
2	Hüttel, Silke	Structural Change in Agriculture – An Empirical Analysis	IAAE congress, Peking	2009	paper
			EAAE congress, Ghent	2008	paper
			AAEA annual meeting, Portland	2007	paper
	Narayana, Rashmi	Dynamic efficiency measurement and Structural Change in Agriculture.	Tropentag, Hamburg	2009	poster
			International Biofuels Conference, New Delhi	2009	paper
			EAAE congress, Ghent	2008	paper
	Zinych, Nataliya	Ukrainian Agriculture in Economic Transition: The Role of Financing and Capital Access for Investment.	IAAE congress, Peking	2009	poster
			MACE Green Conference, Berlin	2008	paper
			EAAE-IAAE seminar, Budapest	2007	paper
#	###, ###	###	###, ###	####	####

The education of PhD students within SIAG benefitted largely from their participation in the coordinated PhD program “Agricultural Economics” (Promotionskolleg Agrarökonomik), which has been established in 2005 by the Agricultural Economics Departments of the Universities in Berlin, Halle, Kiel and Göttingen together with IAMO Halle and vTI Braunschweig (www.agraroekonomik.de). Most of the SIAG researches contribute actively to this program by offering modules which are more or less related to their research topics in the research unit. All PhD student involved in SIAG were encouraged to take courses in economic theory, empirical methods, and scientific writing. Due to the success and the high acceptance of the PhD program during the last years it is intended to extend the existing network of cooperating institutions and to integrate other agricultural faculties, namely Bonn, Gießen, Hohenheim and Munich. As a result the pool of existing PhD courses will be further enlarged and thus can fully meet the demand of young researchers for theoretical and empirical methods as well as for important soft skills.

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