Decision Making Support by Evidence: Case Studies on Agriculture, Food Industry and Rural Development in Austria

Habilitation Dossier

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Part A: INTRODUCTION AND OVERVIEW

A. 1 Introduction

This section presents an overview of the habilitation dossier and provides an outline of my efforts to support decision making by evidence in agriculture, food industry and rural development in Austria. Ten articles on selected topics are reprinted in part B of the dossier. They are representative for my scientific work which is summarized in detail in the first sections of part C. Most of these analyses originated from research contracts for administrative bodies, for producer organizations and for other non-government organizations. The final section of part C gives an overview of university courses and lists dissemination activities addressing stakeholders and the general public. Even if the direct addressees of most of my work are not students, farmers or decision makers in agri-business, many of the findings are relevant for them.

The core of this habilitation dossier is a collection of articles that were published during the last two decades. In this section an attempt is made to carve out the elements they have in common, to indicate how they contributed to a better knowledge about agriculture, food industry, and rural development in Austria and to indicate directions of future research. The scientific papers listed in part C cover a broad range of topics and give an overview of my scientific career. Most of them focus on Austria the rest is on countries or regions in the EU. Even if the topics of the articles are very heterogeneous they can be clustered in three main thematic sets:

- One set of articles is on agricultural policies and their effects on farm incomes, supply responses, effects on the environment and distributive consequences.
- A second set of articles covers topics of the Austrian food market and markets of specific commodities.
- The third set of articles addresses topics of the rural economy, its exposure to natural hazards, and the farm household in the rural economy.

For each of these sets at least one representative article is reprinted in part B of this dossier. Most articles are on aspects of reforms of the Common Agricultural Policy (CAP) and its implementation in Austria. This policy was in the centre of my research interest at the start of my career. At the beginning of the CAP the number of policy objectives was already large and they have been valid until today. The aims are to increase productivity, to ensure a fair standard of living for the agricultural community, to stabilize agricultural commodity markets, to assure availability of supplies, and to ensure reasonable food prices (European Union, 2008). During the last decades even more objectives gained political weight (e.g. the provision of public goods, food safety, promotion of rural development, competition in food processing and retailing). Achieving these objectives is complicated and the interactions of policy instruments are frequently not well known when reforms are implemented. Research can contribute to improve the understanding and to quantify trade-offs. But in order to achieve that, it is necessary to deal with the complexity of issues and their interrelations not only in a stylized manner but by observing, describing and analyzing what happens in the real world. This requires a solid theoretical basis, a broad set of methods and the consequent development of data sets that are the basis of sound scientific evidence. The largest part of this introduction (section A.3) gives an overview of methods and data used in the analysis of the topics listed above. It also deals with challenges of empirical research and offers suggestions how to improve the current state.

One objective of empirical economic research is to provide reliable, theory based evidence. Following Sanderson (2002) policy making should be grounded on more reliable knowledge of 'what works'. Economic analysis can contribute to such an endeavor, because economists are trained to describe objectives in an operational manner, to identify synergies and conflicting objectives and to quantify and evaluate trade-offs. One of my conclusions is that policies and programs should be flexible in order to allow adjustments in case a policy instrument turns out *not* to work as intended. Sound analyses based on adequate data and methods should be part of accompanying evaluations. Moreover, scientific results need to be communicated to decision makers in such a manner that they are properly understood and finally considered valuable for their judgments. Section A.2 of this dossier reflects on the role of science and explores its contribution for better outcomes of (policy) decision making (see Sinabell, 2013a for a more detailed exploration).

Most of my research is dealing with empirical evaluations of outcomes in meeting multiple policy objectives in the agricultural and food sectors and rural economies. Using inter-disciplinary research and integrative analyses of economic, spatial and bio-physical impacts makes it possible to quantify trade-offs on multiple dimensions. To identify adequate ways to communicate trade-offs to decision makers has a high weight in my work. The emphasis on trade-offs comes from the insight that win-win situations and synergies between various objectives are less frequent than often assumed. Section A.4 highlights some of the challenges involved in working in interdisciplinary teams and summarizes the benefits from the perspective of my own experience.

The second to last chapter of this introduction and overview presents an outline of research objectives on household decision making and the rural economy. The interest is stimulated by the fact that the recent reform of the structural funds of the EU will introduce new objectives and instruments that are likely to affect rural economies in ways that are not yet well understood. Common provisions of the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund define overarching objectives and procedures (COM(2013) 246 final). Clearly stated goals, and well defined indicators will be used to measure progress and achievements of the new program of rural development (2014-2020) which will be designed in an equal manner. This program is of eminent importance for the agricultural sector, in particular for the Austrian one because of its large volume of transfers. Considering this development, evidence based decision support in rural policy making will become more important in the years to come. In order to provide it and to build the capacities that are necessary to draw the right conclusions, existing methods and tools have to be adapted and new ones have to be developed. How this can be realized is one topic of this introduction and overview (see A.5).

The final chapter summarizes the articles which are reprinted in section B of this dossier. The questions addressed, the data used for the analyses, and the methods employed to obtain results are briefly sketched. This gives an overview of the toolbox that can be used to provide evidence based support for decision making in agriculture, food industry and rural development.

A. 2 The role of researchers in evidence based support of decision making

Science and technology have been contributing to better outcomes in practically all fields affecting human life. Evidence based support of decision making has a long tradition in several economic disciplines. Health economics and the economics of the public sector are those in which the term 'evidence based' turns up most frequently according to recent EconLit research. In agricultural and food economics, the term 'evidence based decision making' has not such a long tradition. It is expected to be more widely used in future because terminable programs are put in places more frequently which are routinely evaluated. Decision support in this field is not restricted to policy makers or public administration. Firms operating in the market or organizations representing them also seek expertise from specialists working in research institutions. It is therefore useful to reflect on the role of researchers who are involved in such activities.

Advances in empirical methods used in economics and notably the interaction of economist with scientists from other disciplines help to support decision making. One role of science in society is to contribute to rational political discourse, and to identify policy options with better outcomes. The objectives of a given policy are often heterogeneous, sometimes overlapping and in many cases contradictory. In most cases the determination of the policy objective is not a task of science but the responsibility of policy makers. But in some instances fundamental normative concepts like the economic principle are brought into the political debate from economists. The contribution of science at the stage of finding an agreement on the objectives of a policy can make a significant difference. Scientist can and should contribute to the process of making clear definitions of objectives (e.g. to increase farm household income versus farm profits), to evaluate trade-offs and to identify measures and instruments that are necessary to reach stated objectives efficiently. Scaling down the intensity of policy intervention on markets and reducing administrative barriers should be among the first ones to consider when considering options in agricultural markets.

Two examples: economists have identified the eminent roles of market liberalization and competition in order to make innovations happen. These insights paved the way for reforms of telecommunication markets. The low costs and the broad scope of telecommunication services we observe today would have been unimaginable two decades ago. Insights in agricultural and trade economics laid the foundations of the MacSharry reform of the CAP in 1992 (named after the European Commissioner for Agriculture, Ray MacSharry). Even two decades later, reforms are still not yet fully implemented (e.g. the milk quota system will be abolished only in 2015). But today the EU farm sector is tightly integrated in global markets, more competitive than at the time when the reform was launched and in most cases the environmental performance is better (OECD, 2013). The scientific basis for the policy decisions to open telecommunication markets and to reform the CAP were developed by economists but policy makers made the reforms happen. The role of science is not only to identify the adequate instruments (market liberalization) and to show which objectives can be reached (innovation, lower prices). Its role is also to describe preferred social outcomes and thus to contribute to setting the agenda of political debate (in this case to point out the benefits for consumers). Another function of science is to establish empirical evidence for theoretical findings that allow exploring the interrelation between policy instruments and effects in real world situations.

In pluralistic societies, policy advice is provided by competing institutions: consultancy firms, think tanks, advocacy tanks, research departments of interest groups, research institutes and university institutes. From the perspective of a policy maker the limiting resource is time devoted to listen to policy advisers (Lammert, 2011) and not the number of experts capable or willing to give advice. Viewed from this perspective, the quality of advice does not have the highest priority for decision makers in policy (Döhrn, 2005). Therefore, scientists may be tempted to put more efforts into being noticed by policy makers instead of putting more resources into better research results.

For scientists at research institutes and university departments the priority is clearly to promote theoretical insights and to excel in the use of scientific methods. Science based policy advice is a necessary but not a sufficient condition according to Weingart and Lentsch (2008). Researchers involved in evidence based policy advice should meet several criteria.

- *Distance*: The economic and personal interests of a scientific policy adviser should not have an influence on her or his judgment. Researchers at think tanks or consultancies with one major client are exposed to more conflicts of interests than staff from university or research institutes which are financed not only from contract research.

- *Plurality*: Policy questions are complex and in most cases there are no simple solutions. Policy advice therefore frequently has to be based on multi-disciplinary findings. Science based advice has to be theory based. Theories and methods to test them are mainly developed at universities. Applying them on a special policy question is frequently done at research institutes. But in many cases the complexity of the real world makes theoretical and methodological advances necessary. According to Wagner (2005) the only option to come to rational judgments in situations with blurred and contradictory findings is to invest more in fundamental research and theory building.
- *Transparency*: In many cases, scientists disagree on a specific question. In policy making a majority has to find an agreement. In many cases, the smallest common denominator is the result of a compromise. Good science based policy advisors point out findings and truths that are widely accepted in her or his discipline and clearly define those questions that require more scrutinizing. How this information is used and whether decision makers make a compromise or spend more resources to explore an open question in order to obtain better evidence is not up to the scientist (an insightful example is presented by Siefken, 2006).
- *Publications*: Researchers at universities and research institutes gain reputation by publishing their results and find acknowledgement among their peers if their work brings new insights and theories or enhances established methods. However, in several cases they do not only find acknowledgement but are exposed to harsh criticism and rebuttals of their conclusions (see Reinhart and Rogoff, 2013 and Herndorn, Ash, and Pollin, 2013 for a recent example). Without making public the methods and also the data used for an analysis, scrutinizing checks by other research teams would not be possible. In the first phase of such a debate, policy makers or other decision makers may be alienated if they based their decision on contradictory evidence but eventually an open debate will make additional expertise available and provide a more solid basis for decisions. Researchers at consultancies or at think tanks in many cases must not disclose how they obtained results and which methods they used due to non-disclosing rules of their organizations. This fact makes their results less reliable.

As reported by Lammert (2011) evidence and suggestions for policy improvements of scientific advisers are not scarce. In several cases there is even too much (and often contradictory) evidence for decision makers. From the perspective of a policy maker another problem is that proposals for solutions are not detailed enough for a given situation or that the real challenge is to find support for what seems evident for scientists. By adequately training students who eventually work in the administration or in committees preparing policy decisions or making decisions, universities can make a substantial contribution to alleviate this problem. It is therefore helpful if researchers actively involved in advisory services share their knowledge with students to make them familiar with the conventions of science based decision making and communication skills.

A final note of caution seems to be appropriate at this stage. Not every policy intervention is welfare enhancing. The benefits of intervening in markets have to be weighed against the total cost of intervention including administrative costs, transaction costs, external costs, and the costs of public funds in case that transfers from taxpayers are involved. The first question of an economist therefore is to ask whether or not there is substantial evidence for benefits of an intervention at all. This is often at odds with the intention of policy makers who want to make things happen instead of letting things happen.

A. 3 Data, methods, and models used to provide science based evidence for agriculture and food industry

Data - the material of evidence based decision support

Access to data and data organization with a focus on the situation in Austria

Access to data, efficient data management, capacity and investments in data generation and storage are essential for empirical research. Agricultural and food economists frequently have better access to official statistics and administrative data than other scientists. Because sufficient supplies of food have traditionally been a high ranking policy goal and because data on properties - in particular land - have been essential for tax collection reasons, official data on the agricultural sector are abundant compared to other sectors. In other sectors of the economy privately owned data sets are far more important (e.g. cash register data or household panel data) and access to them is frequently harder to get or costlier. However, official statistics and administrative data sets are not primarily designed to support evidence based (policy) analyses.

Most frequently data from official sources are available at an aggregated level. Even if it is possible to get access to individual data which are the basis for aggregation, such data sets mostly do not contain all the information that was available when the primary data were collected (e.g. geographical information, certain attributes, meta-information or information on control groups). My own experience is that the work on data collection and the preparation of data sets typically is at least equally and sometimes more resource consuming than the work on the data analysis tasks.

It is therefore essential to continuously invest in consistent, well organized and frequently updated data sets. Better and more research results could be possible if existing data sets could or would be used more frequently. Nevertheless, access to data of the Austrian agricultural and food sector is well established as far as administrative data are concerned. A regularly updated handbook on data sets (Hofer, et. al. 2011) is available and there is the possibility to apply for specific data sets via the research platform DaFNE of the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Another best practice example is the journal Agricultural Economics which makes the data of empirical articles available.

The situation could be further improved by making it a routine in research contracts that complete data sets are a standard output of research projects. So far, this is only the case if researchers provide data sets on their own initiative (e.g. www.landnutzung.at/Ergebnisse_info.html). It would definitely be better if data sets would be associated to the research reports which are delivered in electronic form anyhow.

The situation is by far more difficult when it comes to data collected by Statistics Austria. Access to individual data is restricted to a small set of survey data (e.g. Mikrozensus data, EU-SILC data), administrative hurdles to link existing data sets from different domains are eminent and this situation prevents that specific topics (e.g. innovation economics) can be analyzed with state of the art tools in Austria (Sinabell, 2013b; Reiner and Schibany, 2012).

In order to improve data availability it is necessary that the scientific community is actively taking initiatives. In the short run, investments in data infrastructure and data organization seem to be scientifically not rewarding because higher reputation is usually associated with the development of new methods or results. One option how the situation could be improved in Austria would be to follow the example of the social- and economic data organization in Germany (details see www.ratswd.de). Improving access to data sets collected by administrative bodies is only one of many steps. Empirical research in many cases involves the collection of data that cannot be taken out of the shelf (interviews among producers and consumers, households, policy makers, stakeholders, researchers). Making better use of such data sets is an equally important research objective.

Aggregated data from official statistics, administrative and proprietary data sources

Traditionally, empirical research in agricultural and food economics has been based on aggregated data. Many research questions can be adequately addressed either by relying on data collected by a statistical office or by administration or combinations of various sources (examples of such analyses in Austria are Sinabell, Schmid and Hofreither, 2012; Salhofer, Tribl and Sinabell, 2012; Sinabell, 2010; Sinabell and Kniepert, 2008). Due to the special situation in agriculture described above, most topics in agricultural and food economics can therefore be treated in a quantitative manner. But even in situations where sector specific information is easily accessible, the preparation of data sets is often a burdensome operation. Frequently, various sources have to be screened and long time series on specific variables can not be taken from readily available sources but have to be developed in a special task which makes an analysis costly.

In many cases, it is possible to add more detail to routinely published data sets with little efforts. An example are the economic accounts of agriculture at NUTS-3 level. This data set was developed specifically for an evaluation project of the program of rural development (Sinabell et al., 2011). Using the NUTS-3 level data, it was possible to differentiate predominantly rural regions form integrated regions and predominantly urban regions. These data can be used for other interesting research questions, in particular in combination with the data on other sectors and from the regional economic accounts, demographic data, and labor market data (a recent example is the analysis Bock-Schappelwein, 2013). Aggregated FADN (farm accountancy data network) statistics (mostly average values of weighted farms in the sample) are available at NUTS-3 level in Austria as well. However, this source is not widely used in economic analysis because researchers prefer the direct access to individual farm data which is possible in Austria.

Not only policy makers are interested in disaggregated data analyses at low geographical scale and along down-stream and up-stream industries. In a study for the chamber of veterinarians, data on their members were combined with special reports on income statistics from the statistical office. Thus it was possible to identify regions in Austria where opening a veterinarian practice looks profitable (Sinabell at al., 2012). The combination of proprietary data sets (e.g. investments in hazard control measures) with routinely published statistics from official sources (e.g. regional economic accounts) can be detailed enough to allow for econometric analyses to measure the effectiveness of policy interventions (e.g. the effectiveness of investments in hazard control measures; see Sinabell et al., 2008).

A specific challenge is to develop data sets when more scientific disciplines are involved. Data used in natural and engineering sciences are usually project and location specific. Economic data are usually available at the level of a firm, household, or administrative unit (e.g. NUTS). In order to develop data sets that can be used in interdisciplinary research, GIS techniques are frequently employed and if this is the case, specific data management processes have to be developed (e.g. to derive site specific weather data from distant monitoring points; details see www.landnutzung.at).

The use of grid data and data derived from GIS layers has become more important recently in interdisciplinary research. However, most economic data are not (yet) coded appropriately to use them in geo-referenced work at levels lower than municipalities. The Austrian statistical office offers mainly demographic but not economic data in grid format. One method to deal with this situation of limited data is to use averages as done in the case of estimating the expected damage due to floods like done by Url and Sinabell (2008). In this study information was available whether a building was situated in a hazard zone or not. There was no information on the value of the specific properties therefore assumptions had to be made. Working with average values may be appropriate if the results are used at aggregated scales as in this case. In the context of project appraisals site specific information is essential.

Microdata

Traditionally, microdata were available in agricultural and food economics only if topic specific surveys were conducted. In many cases, collecting data in this way is still the only option to obtain the necessary information for a research question at hand. Using the internet to gather the information is very cost effective if enough respondents can be motivated to fill in the questionnaire (see Sinabell et al., 2012). One has to be aware that special precautionary measures have to be taken in order to obtain a sample of respondents that is representative for the population under consideration.

Access to microdata for research in agricultural and food economics has not yet a very long tradition. According to my knowledge, the evaluation of the agri-environmental program conducted by Hofreither et al. (2000) was the first agricultural research projects in Austria in which administrative microdata were used to derive region specific results (in that case for the Marchfeld region). After becoming aware of the value of microdata for evaluation studies, the Federal Ministry of Agriculture, Forestry, Environment and Water Managements made available administrative sources and access to microdata. In most cases, individual farm data derived from administrative sources are only used to make specific statistics at aggregate levels. To apply econometric methods which are routinely used in policy evaluation studies are still an exception in agricultural policy and market analysis. Examples of such analyses are Sinabell and Streicher (2005), Sinabell, Salhofer and Karagianis (2006), and Karagiannis, Salhofer and Sinabell (2011).

In the publications cited above farm survey data were used. Farms gave consent to use their data as part of the contract that established their participation in the program of rural development. In the past years, it was the case that almost any Austrian farm participated in at least one of its schemes but only few in many of them. In empirical research it therefore was relatively straight forward to identify control groups in the sample compared to a situation where there is no information at all on non-participants. It is likely that such situations will become more frequent in agricultural policy analysis in future. Probably less farmers will participate in the program of rural development in the future due to more stringent obligations and higher opportunity cost for participants. It is therefore necessary to broaden the scope of methods used for evaluation studies (examples are given in the next section) or/and to invest in additional data sets that cannot be derived from administrative sources as well as to convincing farmers to provide data for research, which should be of value for them as well.

During the last few years data on households have become available. Two different sources were used in my own research so far:

1) EU-SILC data are from a European household panel. The data cover a wide range of household characteristics. The data set has already been frequently used in analyses of income distribution on gender wage gap and other topics related to the social situation of households (an overview of recent studies in Austria is available at the EU-SILC user conference web-site of Statistik Austria[1]). EU-SILC data can be used for agricultural analyses because farm incomes can be identified (see Sinabell and Fensl, 2013). Because population density in the dwelling place of respondents is coded as well, it is also possible to use the data for analyses on topics in regional economics.

[1] http://www.statistik.at/web_de/ueber_uns/veranstaltungen/mz_silc_konferenz_2013/index.html

2) FADN data are an important data set on farm book keeping data. The Austrian data contain many more variables beyond book keeping requirements. The characteristics of the Austrian farm households are therefore known in a detailed manner. Matching data from the FADN data set with those of the EU-SILC survey in a way similar to Böheim et al. (2013) would provide a data set that can be used to address many questions in rural development.

Microdata are not only useful to analyze the effectiveness of agricultural programs or the characteristics of farm households. Data on household characteristics and their expenditures can be used in various ways to conduct studies in food economics. Pennersdorfer and Sinabell (2010) used data from the RollAMA/AMA-Marketing household panel on food expenditures to analyze whether or not food retailers were able to exert local market power. An updated set of data from this panel is currently used to explore factors that explain the willingness to pay for higher quality food items. A data source that has not been used frequently in food economics so far is the consumer survey of Statistik Austria.

Methods and models

In order to support decision making it is necessary to have a well equipped toolbox at ones disposal. The range of tools has to be broad because the scope of relevant research questions is broad as well and the tools have to steadily be improved. In interdisciplinary research projects it is sometimes hard to communicate that certain methods are preferred from an economic perspective and it is sometimes necessary to invest a considerable amount of time in identifying a tool set that can be employed effectively in a given team.

In many cases, decisions on public interventions are based on elements of cost-benefit analyses. Some policies explicitly require this method to be used (e.g. the Water Framework Directive or the Austrian legislation concerning flood and torrent control measures). In practice, elaborated cost-benefit assessments are rarely carried out in such a detailed manner as required by the literature (e.g. Pearce, Atkinson and Murato, 2006). Many important elements (see Jones, 2005) like general equilibrium effects or the marginal social costs of public funds are not accounted for in quantitative terms in practical cost-benefit analyses because of insufficient funding and lacking data (e.g. Hofreither, Jumah and Sinabell, 1993). In practice, cost-effectiveness analyses, impact analyses, multi-criteria analyses and others are more frequently carried out.

Results of cost-effectiveness analyses are easier to communicate to audiences with no or little background in economics (e.g. Schmutz et al., 2003; Köppl and Sinabell, 2003; Schmid and Sinabell, 2005) results. Researchers with a background in engineering are familiar with discounting and accept positive discount rates while researchers with a background in ecology frequently are not willing to use this concept at all. In many cases, it is very difficult to communicate the usefulness of non market based valuation methods or the statistical value of life concept in interdisciplinary teams. Nevertheless, a cost-benefit analysis is the method of choice in many instances but the necessary resources are made available only in rare cases. If a cost-benefit analysis cannot be made because of intangible benefits or costs, to quantify all environmental effects in terms of physical indicators is already a step forward.

In principly, many EU reforms and regulations are designed to be evaluated.[2] If the practical implementation is accounting for this aim, the effects of policy measures and the success of intervention are reported regularly. In many cases, policies are adjusted according to observed outcomes or changed fundamentally depending on the results. Such an approach of policy making was probably reinforced by the advances made in causal inference and improved empirical evaluation techniques (see Pearl, 2009; Imbens and Wooldridge, 2009). Such methods have been applied in agricultural policy evaluation only in a few studies (among them Sinabell and Streicher, 2004; Sinabell, Salhofer and Karagiannis, 2006). The

[2] European Commission, (1999a-f) is detailed handbook on this topic from an administrative perspective.

European Evaluation Network for Rural Development[3] promotes advanced methods and best practice examples. In addition, a large research project was carried out with a specific focus on methods to ex-ante and ex-post evaluations of rural development programs in the EU[4]. However, compared to other fields (e.g. labor market policy, education policy, development policy or technology policy) advanced econometric program evaluation are still not very common in agricultural policy evaluation.[5] One reason is that the data necessary for such methods are not (made) available or that the analysis of causal effects is not in the interest of a program initiator. Another reason is that during the phase of designing a program less attention is given to evaluation than to other issues and that data requirements are ignored until the end of the program period.

Model analyses are often performed in ex-ante evaluations or in evaluations on programs which address outcomes that cannot (yet) be observed or directly quantified. Examples are single market models (e.g. Salhofer, Hofreither and Sinabell, 2000), single sector models (e.g. PASMA; see Schmid and Sinabell, 2005) or multi sector models of the regional economy (e.g. MultiREG - see Fritz, Streicher, Zakarias, 2005 - or FIDELIO 1 - see Kratena et al., 2013) which have been developed to analyze many policy related questions. Traditionally, these models cover a large number of products or sectors. Such models are frequently linked to analyze spillovers from one sector the others in more detail (an example is provided in Sinabell et al., 2010) and they also can be linked to bio-physical models like EPIC (see Koland, Schönhart and Schmid, 2013). Some of these models (e.g. GLOBIOM, CAPRI, MAGNET) are designed to analyze problems of continental or global scale.

A recent survey on agricultural and trade models (Sinabell, 2012) made it evident that such models are not well suited to deal with phenomena of volatile markets. How to cope with volatile markets has become a major challenge for decision makers on farms and in the food processing industry during the last decade. Price volatility in food market has become a policy issue mainly because of high food price inflation. Many studies so far deal with analyzing the sources of volatility (among them Strauss, Sinabell and Kniepert, 2012), to analyze spillovers in vertically linked markets (e.g. Fernández Amador, Baumgartner, and Crespo Cuaresma, 2010) or to explore the bio-physical sources of output volatility (Strauss, et al. 2010). Econometric time series models cannot only be used to identify causal links between markets but also their impact. Stochastic dynamic general equilibrium models which have been developed to analyze financial market volatility have - according to my knowledge - not yet been applied to agricultural and food markets.[6]To specify agricultural and food in such models seems to be a promising path for future research.

A. 4 The value of team work and interdisciplinary research

In the previous section, the metaphor was used that data are the material and methods and models are toolboxes which are necessary to make a sound basis for evidence based decision making. To use this metaphor again, economics could use massive bricks to construct walls of a solid house but in order to be able to live in it, many more elements are necessary. Many decision makers are not satisfied in bricks and walls but need a complete building that is connected to other ones. While it is standard routine in construction engineering that many specialists are collaborating in a project, multidisciplinary research is the exception, not the rule. But this situation is changing and problems that require teams of specialists of more than one discipline are becoming more frequent.

[3] See http://enrd.ec.europa.eu/evaluation/

[4] See ADVANCED-EVAL http:// www.advanced-eval.eu/home

[5]Otherwise it would not be necessary to initiate further research in this field (see Call for Tender N°AGRI-2013-EVAL-06)

[6] An example of such models is GIMF developed at the World Bank (Anderson et al., 2013).

In a team of economists communication between its members is usually not a problem because of a standardized terminology and a rather homogeneous mind set concerning basic concepts (e.g. welfare or costs). Economists are also familiar to the different schools of thought in their discipline and therefore establishing a team working on a particular topic is usually not a major problem. In an interdisciplinary team many concepts that are usually taken as given without discussion in economics may become a topic of debate. Members of interdisciplinary research teams have to work on broadening their understanding of a given problem and to be open to views that are not shared universally (Neumeier, 2007). My own experience is that working in an interdisciplinary team can be very effective if the partners from different disciplines agree to start working on positive aspects of a problem and to deal with normative aspects later when results of the team effort are available. Standard routines of science are used in all disciplines like working on clear definitions, making the process of work transparent and reproducible, trying to reduce complexity, to make phenomena describable and if possible quantifiable. Effective scientists of various teams therefore can work together in a goal oriented manner if the design of the research project is well made. If an interdisciplinary team is successful, it is possible to establish results that are considered to be improvements over the state of art by all involved researchers (see www.landnutzung.at).

Besides making the partners of the team smarter it is even possible to make methods that are established in one discipline useful in another as well. Hence, it may be possible that the toolbox gets larger. Many real world questions in agricultural or food economics can only be addressed adequately with integrative assessments (see Schmid, Sinabell and Liebhard, 2004 and more recently Mitter, Schmid and Sinabell).

Once efforts were made to integrate concepts and results of one discipline it is often easier to integrate findings of another discipline. An example: A well designed model of agricultural land uses (e.g. PASMA) can be a starting point for adding other types of land uses (e.g. forest land, nature reserves, urban areas) or even water bodies into a more comprehensive integrated model. A more detailed and broader model allows analyzing of research questions that arise, for instance, in the context of implementing the Water Framework Directive (WFD). The WFD aims at improving the quantitative, physical, chemical and biological status of water bodies (groundwater and surface water) and measures have to be identified according to cost-benefit criteria. At the first glance, the link to land uses may not be obvious. But most economic activities take place on land and many of them have a direct impact on the quantitative and qualitative status of water resources (e.g. extraction for drinking water, irrigation, disposing of affluent from diffuse and point sources, limiting water courses to reclaim land). Water policy is only one example (see e.g. Schmid and Sinabell, 2005), integrative assessments with land use models are also useful in biomass and bio-energy research (e.g. Stürmer et al., 2013) and biodiversity research (e.g. Rüdisser et al. 2011) and in climate policy research (e.g. Mitter, Sinabell and Schmid, 2013).

By referring to the metaphor mentioned at the begin of the section, one can observe that architects get educated and trained in specific courses at universities, whereas 'designers of interdisciplinary research projects' have to acquire their skills in a learning by doing way. It is therefore a good training for students to get in contact with scientists and students of different disciplines during their curriculum. But this is only useful if they are able to mastering the most frequently used concepts and tools of their own scientific discipline.

A. 5 Analysis of household decision making in the rural economy: a research objective

Detailed data which contain spatial information have become more frequently available in recent years. This is partly due to the fact that the CAP has shifted the focus from sector specific objectives to a more integrated set of objectives that address problems of rural regions. The improvement of the environmental situation, the provision of landscape amenities by agriculture and enhancing the viability of rural regions have become important policy objectives. From an economic perspective, rural development can be analyzed in the context of "regional development" (see Sinabell, 2009 and Sinabell, 2008 for a more elaborated treatment).

Low population density and remoteness are the main characteristics of rural regions. Such regions are therefore a special case in regional development. But the main objectives of policies focusing on rural development or regional development are the same: the promotion of economic development and employment. Figure 1 conceptualizes the objective outcomes of regional development: high quality of life and high standard of living of the population (see the top of a pyramid). In order to compare regions or to measure whether the performance of a regions improved or not, it is necessary to observe how wellbeing changes over time. To measure wellbeing directly is often not possible but more recently efforts have been made to identify sets of indicators that are closely related (e.g. Kettner et al., 2012). The EU-SILC-data set mentioned above contains several variables that can be used to measure many aspects of it. This has not yet been done in Austria.

More frequently used indicators of economic development are related to value added or other competitiveness indicators (Lengyel, 2004). Annual data on regional gross value added for agriculture and forestry, the manufacturing and service sector are available in Austria and all EU member states at NUTS-3 level. Using these data makes it possible to gauge the economic performance of a region relative to others. The regional gross value added is not the best but definitely a good indicator of the well-being of the population of a region. Its changes reveal how well a region is adjusting to the changing economic situations.

Regional performance is a consequence of its productivity which can be measured by two other indicators: labor productivity and employment. Labor productivity is an important indicator because "a country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker" (Krugman, 1992). But focusing only on productivity and not on employment as well, may be counterproductive. If the least efficient firms close and workers are laid off, productivity growth may not be associated with an overall increase in output. But output matters because it determines the level of the living standard."Employment reduction is a negative route to raising regional productivity, and is to be contrasted with regions that have both high productivity and employment" (Gardiner et al., 2004).

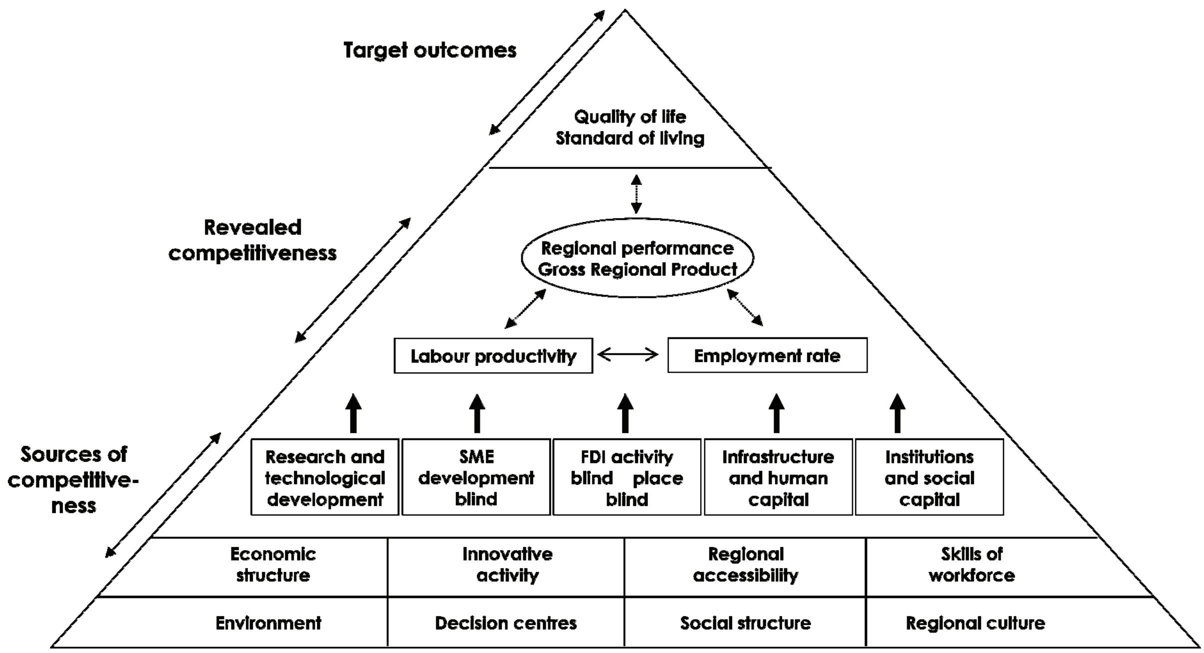

Figure1: A model of regional development,competitiveness, and wellbeing

Source: Gardiner, Martin, Tyler (2004) and Lengyel (2004).
Notes: SME small and medium sized enterprises, FDI foreign direct investments.

As conceptualized by Figure 1, there is not only one factor or process that determines the revealed competitiveness of a region but there are many sources of competitiveness. Several can be measured relatively easily and can be used in regional models like MultiREG (Fritz, Streicher, Zakarias, 2005) as explanatory variables. This type of model allows evaluation of the impact of a rural development program on employment and value added in regions and the whole economy (see Sinabell et al., 2011). By linking a model like MulitREG to an elaborated land use model like PASMA it is even possible to evaluate environmental outcomes by accounting for the spatial dimension. But in order to better understand the process of rural development, it is necessary to learn more about the direct and indirect channels by which agriculture affects the regional performance.

- Direct channels: Agriculture produces not only food and fibre, but also other products or services. Such outputs are a direct component of the gross value added and labor force of rural regions (e.g. community services or farm tourism). Activities of farms have consequences on the profitability of other rural firms via input and output relationships.
- Indirect channels: Agriculture produces not only commodities and services traded on markets. It also affects other sectors and households either due to positive or negative external effects. To measure or model them requires monitoring and a common concept of development.

Some factors that are listed on the basis of the pyramid model of regional performance (e.g. environment) can be accounted for in quantitative evaluation studies at least in terms of indicators. But as Figure 1 shows there are more factors that are known to have an influence on rural development and there is not yet a clear understanding how they affect the other processes because the causal relationships are not yet well understood.

Nevertheless, there is a substantial body of literature to build on. Social structures and decision centers build on social capital which can be defined as "the shared knowledge, understanding, norms, rules, and expectations about patterns of interactions that groups of individuals bring to a recurrent activity" (Ostrom, 2000). This is seen to be a prerequisite to solving social dilemmas or coordinating collectiveaction situations based on trust. Improving social capital in rural areas is therefore viewed as one option to strengthen such positive effects for rural society as a whole (Ruben and Pender, 2004).

Microdata sources like EU-SILC contain many variables related to well being. They can be an important input for empirical research in rural development because regions can be differentiated by population density. This fact gives the opportunity to learn more about those factors explaining rural development that are not yet well understood. The combination of several different sets of microdata (e.g. FADN data plus EU-SILC-data plus administrative data) is on the horizon but not yet undertaken. Possible research topics are to learn more about the strategies of farm households to supply labor to the market for off farm activities compared to on farm work or to education or leisure. The existing models on the Austrian agricultural sector (like PASMA - see Schmid and Sinabell, 2004 - or FAMOS - see Schmid, 2004) are not well suited to incorporate the household decision making process. Therefore, it will be necessary to develop a micro-simulation farm household decision making model in order to analyze the raised research questions.

A. 6 Structure of the habilitation dossier

Section B of the habilitation dossier includes a selection of ten articles covering a range of topics in agricultural and food economics with a focus on the rural economy. Most of the papers are on Austrian case studies. The articles can be classified in groups. In the first group, there are articles that deal with distributive (Salhofer, Hofreither, Sinabell, 2000; Sinabell, Schmid and Hofreihter, 2013) or environmental (Schmid and Sinabell, 2007; Schmid, Sinabell and Hofreither, 2007) effects of agricultural policies. Some of them look at specific programs (Salhofer and Sinabell, 1999; Sinabell and Streicher 2004). In the second group on the food market there is only one representative paper (Salhofer, Tribl, Sinabell, 2012). The third group contains articles on the rural economy and regional topics (Sinabell, 2008; Falk and Sinabell, 2009). The articles are listed in chronological order with the most recent one being the first.

The paper on market effects of countryside stewardship policies by Salhofer and Sinabell (1999) is an example of a policy oriented analysis. It was written in the context of an EU 5th framework research project that dealt with various economic effects of agri-environmental programs. In the early 1990s, when these policies were implemented, three major challenges had to be addressed by the CAP: (i) the problem of surpluses on agricultural markets, (ii) negative external effects due to intensive farming, and (iii) to establish a mechanism that would compensate famers for the provision of public goods. At the time of writing this paper, the effects of extensive farming practices at farm level were already well understood and statistics with comparisons of conventional and organic farms had been established. The first novelty of the analysis was to evaluate effects of agri-environmental policies for the farm sector instead of representative farms. The second novelty was to look at an unintended effect of direct farm payments. Such payments were deemed to compensate farmers for income losses. However, a survey revealed that most farmers used them to finance farm investments. The analysis showed that restrictions on land due to the agri-environmental program reduced farm output as intended. However, the countervailing effect due to higher investments could be stronger in certain instances so that in the end higher outputs were possible.

Salhofer and Sinabell (1999) did not look at the environmental outcomes of agri-environmental policy. At that time, the necessary tools for an integrated assessment were not yet developed in Austria. A first step in this direction was made in a policy evaluation report by Hofreither et al. (2000). The authors showed that a combination of administrative data of agri-environmental programs with data on farm management and with bio-physical data on soil and climate conditions could be used in an integrative analysis. Environmental and economic outcomes of an agri-environmental program could thus be analysed simultaneously. The effects of the program were shown by comparing agri-environmental model outputs calibrated to the observed situation with a counterfactual of model results assuming no policy intervention. The expertise obtained in this project was further developed into two complementary approaches:

a) Econometric analyses using microdata sets that were specifically designed for ex-post policy evaluation purposes (see Sinabell and Streicher, 2004).

b) An agricultural sector model that accounted for the spatial structure and for the complexity of the Austrian agri-environmental program and which turned out to be well suited for ex-ante policy analyses (see Schmid and Sinabell, 2007; Schmid, Sinabell and Hofreither, 2007).

In Sinabell and Streicher (2004), two data sets were combined in order to evaluate the outcomes of the program of rural development in Austria. The first set was derived from administrative data collected from program participants and the second data set was based on book keeping records of participating and non-participating farms. The main question was whether or not farmers enrolled in the program of rural development had an improved market position. The results showed that the program could be considered a 'success' or a 'failure' depending on the method employed to measure its outcomes. Using a naive approach by comparing economic indicators of participants with non-participants would indicate that some programs were 'effective'. However, a more adequate method for program evaluation (difference-in-difference estimates) did not corroborate this view.

In the analysis of Schmid and Sinabell (2007), a normative model of the Austrian agricultural sector was used to analyze effects of the 2003 reform of the CAP. The model uses the positive mathematical programming approach for parameter calibration and represents the regional and structural diversity of Austrian agriculture in a detailed manner (Schmid and Sinabell, 2004). According to the model results, the CAP reform was likely to bring about the intended results: lower agricultural outputs, less farm inputs, less nitrogen surpluses and incentives for environmentally friendly farm management practices. A similar study by Schmid, Sinabell and Hofreither(2007) looked at the same policy reform from a different perspective. The research question was whether or not the abolition of administrative prices of farm commodities would be environmentally beneficial. The model based ex-ante analysis showed that this would likely be the case. A follow up study carried out several years later compared the ex-ante estimates of economic and environmental indicators with observed outcomes and concluded that the expected outcomes of the policy reform were generally reached (Sinabell and Schmid, 2011).

Two of the selected articles deal with distributive effects of agricultural policies. The first one (Salhofer, Hofreither, Sinabell, 2000) focuses on Austrian agricultural policy prior to the accession of Austria to the EU. At this time market price support and trade restrictions were the dominating farm policy instruments. The paper evaluates how rents emanating from farm policy intervention were distributed among farmers and upstream and downstream industries. Two different approaches were employed in order to derive the empirical results and both showed that upstream and downstream industries benefited considerably more than farmers did. The authors concluded that supporting farmers directly could reach the redistributive aims stated in the Austrian farm law at lower social costs. The CAP reform of 2003 and follow up reforms of specific markets made this happen by introducing direct payments that were no longer linked to farm outputs. In a second paper on distributive effects of farm policies, Sinabell, Schmid and Hofreither (2013) look at the concentration of direct payments within the agricultural sector. They compare the country specific distribution of output linked direct payments in 2000 with mainly non-output linked direct payments in 2010 in the EU. One result is that 20 percent of holdings received 80.7% of direct payments in EU-15 in 2000. A comparison with 2010 data showed that the concentration of direct payments in EU-15 slightly decreased. But this was not the case in every member state. In some of them (e.g. Sweden, Finland, Netherlands, Italy, Denmark) concentration rates actually increased. Obviously country specific factors determine whether or not direct payments are distributed more equally within a country.

Four articles presented in the next section deal with topics beyond the agricultural sector. Three of them look at issues related to rural and regional development and spatial aspects of the economy. The paper of Sinabell (2008) refers to the concept of multifunctionality of agriculture (OECD, 2001 and 2002) and analyses how rural development is linked to commodity and non-commodity outputs of agriculture. The general finding is that supporting the production of farm commodities is not a preferred strategy to promote rural development. One reason is that in most OECD regions growth is driven by other sectors. In case that spillovers from agriculture benefit other sectors (e.g. landscape amenities provided by agriculture may be an input for tourism) their provision should be stimulated according to cost-benefit criteria. The paper of Falk and Sinabell (2009) is a follow up study based on a data set developed by Sinabell (2008). An elaborated set of economic and demographic data from 1,084 regions in the EU was combined with a distance matrix of the regions. The spatial information was used in a regional growth model to estimate the relationship between the average growth rate of GDP per capita and the volatility of the growth rate. The results show that the relationship between growth and volatility is significantly positive in twelve EU-15 countries. The article of Url and Sinabell (2008) shows another application of integrating spatial information into an economic analysis. In this case detailed GIS data on properties and their exposure to natural hazards (floods) were combined to estimate expected losses due to floods in Austria at municipylity level. This article is not specifically focussed on agriculture or the food industry. However, it represents analyses that deal with natural hazards (e.g. floods, torrents, avalanches, droughts) which have been topics of my work. It is also a reference to the currently ongoing work which deals with food security in times of climate change.

The food sector, in particular milk production, the dairy industry and dairy retailing in Austria was the topic of a large research project (Sinabell et al., 2010) which involved several stakeholders and researchers. Two articles addressed market power in the Austrian milk market (Pennersdorfer and Sinabell, 2010; Salhofer, Tribl and Sinabell, 2012). Pennersdorfer and Sinabell (2010) did not find evidence for spatial price discrimination in the market of consumer milk products. In the paper of Salhofer, Tribl and Sinabell (2012), a detailed model of the vertical structure of the Austrian milk market is presented. The results suggest that market power of retailing exists towards consumers (in particular in the case of drinking milk) and towards input suppliers (in particular in the case of butter and other milk products). However, the impact of oligopsony power on input suppliers is stronger than the impact of oligopoly power on consumers.

Section C in the habilitation dossier lists my scientific output, my involvement in teaching and training and my contributions to science community services which are relevant for the habilitation and the venia docendi in agricultural and food economics at the University of Natural Resources and Life Sciences, Vienna. It gives an overview of my work that covers a broad range of activities like data preparation and data generation, model development, model specification, quantitative analyses, organisation of scientific events and communication of results for a scientific audience and the general public.

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PART B: SELECTED PUBLICATIONS

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