Linkages: Economic Analysis of Agriculture in the Wider Economy

Input-Output Models and Qualitative Evaluation of the Common Agricultural Policy

Gunnar Lindberg
Faculty of Natural Resources and Agricultural Sciences
Department of Economics
Uppsala

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Abstract

This thesis consists of five papers, each contributing to an understanding of the role of agriculture in the wider economy, with particular emphasis on evaluation of the common agricultural policy (CAP). The first of these papers investigates the economic linkages between agriculture and the wider economy in Sweden. We develop a method for disaggregating the agricultural sector in the Swedish input-output (IO) table. Output multipliers are generally higher for livestock sectors compared to crop production and range between 1.52 and 2.20 for the open model. In the second study we develop a method for overcoming the aggregation bias associated with aggregated IO tables. Aggregation bias can be as large as 5-6 percent for agricultural sectors in a Swedish region and can be dealt with using limited and more available data to construct a disaggregated IO shock. We demonstrate how such an approach can be used for modelling reforms to the CAP. This approach minimises bias without the time and money required to do a full disaggregation of agriculture. The third paper deal with non-survey IO regionalisation. We reveal that the foundations are weak for applying standard location quotients to tables of indirect allocation of imports, so called technological coefficients. We demonstrate the sensitivity in regional multiplier analysis from doing so, using six different regional IO tables. Even the location quotient that scale down national IO coefficients the most show on average 12 percent higher regional multipliers when national technological coefficients are adjusted, rather than national trade coefficients. The fourth paper investigates the scope of hybrid governance in relation to agri-environmental and rural development policies of the CAP. We combine a survey, a case study and a stakeholder discussion and show benefits in both process and outcome that could possibly be utilised to a larger extent in implementing and developing the policy. In the fifth and final study we investigated the role of agricultural policies, specifically the environmental and rural development policies of the CAP, in promoting sustainable rural development. 20 stakeholder interviews were performed to evaluate the possibilities for agriculture and current policies to fulfil this role. One result is that environmental programs support many aspects of rural development, for instance by making some types of diversification possible.

Keywords: agricultural economics, input-output, multipliers, aggregation bias, regionalisation, CAP, hybrid governance, sustainable rural development.

Author's address: Gunnar Lindberg, SLU, Department of Economics,
P.O. Box 7013, SE 750 07 Uppsala, Sweden. *E-mail:* Gunnar.Lindberg@.slu.se

Dedication

To Terese

Contents

List of Publications

This thesis is based on the work contained in the following papers, referred to by Roman numerals in the text:

I Lindberg G & Hansson H (2009). Economic impacts of agriculture in Sweden: A disaggregated input-output approach. *Food Economics - Acta Agriculturae Scandinavica, Section C* 6: 119-133.

II Lindberg G, Midmore P & Surry Y (2010). Agriculture's inter-industry linkages, aggregation bias and rural policy reforms. Submitted to *Journal of Agricultural Economics*.

III Lindberg G (2010). On the appropriate use of (input-output) coefficients to generate non-survey regional input-output tables: Implications for the determination of output multipliers. (manuscript)

IV Lindberg G & Fahlbeck E (2009). New forms of local collective governance linked to the agricultural landscape: Identifying the scope and possibilities for hybrid institutions. Submitted to *International Journal of Agricultural Resources, Governance and Ecology*. Revised first round.

V Granvik M, Lindberg G, Stigzelius K-A, Fahlbeck E & Surry Y (2010). Prospects of multifunctional agriculture as a facilitator of sustainable rural development: Swedish experience of pillar two of the CAP. Submitted to *Norwegian Journal of Geography*.

1 Introduction

What is the role of agriculture in the wider economy? Obviously this question is complex and depends on how wide a scope we assign to the notion of the wider economy and where we draw the line between economics and other disciplines. However, agricultural economics covers a wide area of research and from an academic point of view the role of agriculture often touches upon economic, environmental and social aspects. Agriculture is a component of the economy, but it holds a special place as a provider of food and fibre. Hence, understanding how this sector functions and interacts with other elements of the wider economy has always been important and challenging. Therefore a major topic of research in agricultural economics has always been supply and demand analysis of agricultural sectors and commodities. Research into trade in food and the dimensions of food availability and food safety has always had a role in agricultural economics. As an activity that shapes our landscapes and rural areas, the agricultural sector also affects many aspects of our society. Expanding research areas in agricultural economics therefore include studies of how agriculture affects the environment, the topic of animal welfare, and the role agriculture has in shaping rural societies. However, the reverse is also a topic for research: what impacts do society and nature have on agriculture and what are the implications of climate change, urban sprawl and globalisation? Many of the aspects that concern agriculture also have normative components, such as what role agriculture should play in modern societies. Such questions become even more complicated and interesting once the role of agriculture as a producer of bio energy is taken into consideration.

The main aim of this thesis is to help understand the position of agriculture in the wider economy, mainly from an economic point of view. An additional aim is to develop methods for analysing the linkages and for

identifying the impact of agricultural policies upon the agricultural sector, as well as the wider economy and society. A clear trend in research into the role of agriculture, and in evaluations of the common agricultural policy, is to incorporate and use quantitative and qualitative methods in an integrated way to study interactions between agriculture and the economy, environment and society. This thesis is written with this perspective in mind. Three of the papers deal with quantitative investigation, while the remaining two are qualitative in spirit and scope.

Papers I, II and III deal with the role of agriculture in the wider economy from a strictly economic point of view and use a quantitative approach. Specifically, these papers evaluate the role of agriculture at the national or regional level and analyse agricultural policy impacts on the rest of the economy through the linkages between agriculture and the wider economy. The papers employ and develop a tool known as the input-output (IO) model. This approach is introduced more formally in a subsequent section. Paper IV is concerned with the possibility to improve the way agricultural policies work. The role of agriculture is evolving and the wider economy within which agriculture operates is also changing. This raises an interesting research question: how does the way in which policies are implemented affect their efficiency (uptake, costs, enforcement, *etc.*)? Paper IV investigates how the linkages between agriculture and organised local groups can improve both the process and the outcome associated with agricultural and rural development policy. The method used for the investigation is a combination of a survey, two case studies and a stakeholder discussion to analyse the scope that exists in the implementation of agricultural policy for what in institutional economics has emerged as the theory of hybrid governance. Paper V evaluates the possibility of agriculture to contribute to sustainable rural development through its linkages with other actors and activities. The analysis formalises the mechanisms that may facilitate multifunctional farming regimes to play a significant role in sustainable rural development. This was a positive analysis, but the issue of what sustainable rural development should include, and whether such aspects should be a priority within agricultural policy, is a normative one.

The role of agriculture in the wider economy is greatly influenced by agricultural policy and all five papers in this thesis deal with policy evaluation in one way or another, either from a practical or a methodological point of view. Therefore, as a general introduction to all the papers, this introductory chapter begins with a brief review of the common agricultural policy (CAP) of the European Union.

For the past 60 years, agriculture in Europe has been heavily influenced by the CAP. Although many other forces and influences have shaped agriculture (mechanisation, crop and animal modification, globalisation, *etc.*), it is widely accepted that specialisation, productivity increases, territorial distribution and many other aspects of European farming are heavily affected by this policy and its successive reforms. The CAP originated out of the need to feed Europe and support European farming and rural areas after half a century of wars. The initial objectives of the policy were to improve agricultural productivity, ensure the availability of safe food at a reasonable price and improve and sustain a fair standard of living in rural areas. The main features of the CAP during the twentieth century were a combination of intervention prices, import restrictions, export subsidies and EC preferences. Together with targeted research and development activities, mechanisation and extension services, this increased productivity and led to production well beyond any internal demand. At the same time, European prices were above world market prices for many commodities and products had to be either destroyed, kept in storage or 'dumped' on markets outside Europe, with the aid of export subsidies. This has been referred to as the productivistic era in European agriculture (Wilson, 2001). It involved a rationalisation of farming and high use of pesticides and nutrients and resulted in a farm sector that was shaped by policies rather than consumer demand. In this process the farm sector became less integrated in rural areas with regard to input resources, which were purchased to a larger extent from outside the rural areas, with regard to labour use, which diminished as faming became more mechanised, and with regard to the link between producer and consumer, with farmers producing for large wholesale customers and consumers interacting with supermarkets. Furthermore, this period saw high costs for agricultural intervention and criticism from world trade organisations and third world nations as markets were distorted by subsidised European agricultural exports[1]. At the same time, the standard of living increased in Europe and the emergence of environmental concerns together with the recognition of high costs of the CAP initiated a

[1] High cost accrued to intervention prices, which paid farmers to produce commodities that were not in demand within the European Union. At the same time, high tariffs and quotas limited imports and kept internal prices high. To reduce the need to store or destroy these goods, the EU exported to countries outside the union, but could only do so due to high costs of production, by using export subsidies. Besides the internal pressure to cut costs and reform the CAP, these export subsidies also flooded export markets and pushed down world market prices for other (often developing) countries. The pressure to reform the CAP was therefore also mounting within the World Trade Organisation (WTO).

fundamental change in policy through the MacSharry reform in 1992 and Agenda 2000.

The introduction of a second 'pillar' to the CAP clearly signalled the new rural and environmental ambitions. Hence, during recent decades, 'non-commodity' outputs generated by agricultural production have been increasingly recognised, both locally and in the political arena; not only within the EU. Open and diversified landscapes, cultural heritages of different kinds, environmental services and animal welfare are examples of such non-commodity outputs or public goods.

This is often referred to as the multifunctionality of agriculture, as many of these positive externalities are produced jointly with food and fibres. European countries had domestic programmes that stimulated the provision of such public goods, but these national programmes were harmonised by the introduction of regulation 2078 in the European Community during 1992. This regulation was a way to 'make the CAP greener', but has also been seen as a tool to adopt new and less trade-distorting measures to support farmers in rural Europe (Buller *et al.*, 2000). Within this regulation a targeted contract perspective was put forward under the 'pay for public goods' principle and this concept and policy design is still operated by member states within pillar two of the CAP.

The emphasis on agri-environmental and rural policies is probably going to be confirmed and reinforced in the next decade. The progressive reform process undertaken by the CAP, especially starting with the 2003 mid-term review of Agenda 2000, and the current debate on CAP reform for the 2014-2020 period confirm this long-term trend. This shift in agricultural policy moves the emphasis away from commodity support towards environmental contracts, diversified production practices and rural development (Diakosavvas, 2006)[2]. The delivery of policy, and any consequent economic shocks that might arise from its reform, has become increasingly territorialised, with impacts that differ according to local circumstances, the nature of regional economic structure, and the effectiveness of governance (Watts *et al.*, 2009).

[2] It should be noted, however, that the PSE (producer support estimate) for the EU is still 32 percent, *i.e.* 32 percent of farm income is made up of different types of direct and indirect support. This figure has fallen from 41 percent in 1986, but is still above the OECD average at 29 percent. Furthermore, intervention prices still exist for many crops, milk products and meat, and in 2006 the export subsidies still came at a cost of €1.8 billion per year in the EU. At the same time, all of pillar II was delivered in Sweden for the full period of 2000-2006 at a cost of €2.6 billion (56 percent of which was contributed by the Swedish government). On average, a farm in Sweden received 125 thousand SEK in 2005 as support and/or compensation for producing public goods.

Alongside and partly related to this, the economic importance of agriculture within the overall rural economy has diminished, with food manufacturing, tourism and public service employment increasing their respective shares (Copus *et al.*, 2006). In Sweden, less than 2 percent of the population are employed within agriculture primary production (a proportion that has fallen from 5 percent in 1985), but in some regions this proportion is as high as 15 percent[3]. Agriculture accounts for only 0.5 percent of value added in Sweden (Statistics Sweden, 2010), but this figure increases to 2 percent if food processing is taken into account (based on the Swedish input-output table for 2005). As a consequence, analyses that attempt to explain or predict the impacts of agricultural policy reforms must, if they intend to capture the full impact, both become more localised and extend their scope from sectoral microeconomic models to multisectoral general equilibrium approaches, which identify spill-over effects, both sectoral and spatial. Such impact multiplier effects are acknowledged and required for the purposes of European rural policy evaluation (European Commission, 2006).

In a wider context, OECD (2009) studied the impact of agriculture in rural regions across Europe and concluded that although the potential of agricultural policies to stimulate general economic development is weak, this ability varies across regions and needs to be considered for each specific case. Approaches that respond to region-specific problems and use the specific attributes and assets of each region are required. The OECD study also acknowledged that the role of farm households goes beyond agriculture and involves issues such as consumption of local goods and services and the creation of multiplier effects in rural areas.

Papers I, II and III of this thesis deal with these economy-wide aspects of agricultural policies; multiplier evaluation and development of models to study these aspects of CAP reforms. Multipliers are derived from models based on input-output (IO) tables. Papers I-III develop the traditional input-output (IO) model further to take into account the specific needs of agricultural policy evaluation. However, multiple policy goals make agricultural policy evaluation even more complex. Such evaluation is expected to investigate the impact of the CAP across regions and farm types,

[3] The distribution of agricultural employment between Swedish regions is such that 69 percent is found in predominantly rural areas where it constitutes 3.6 percent of total employment, 27 percent is found in intermediate areas (2.3 percent of total employment) whereas only 4 percent is in urban areas where it constitutes 0.4 percent of total employment (OECD, 2009).

while also taking into consideration interaction with other (mostly non-sectoral) policies aimed at achieving similar and/or interconnected goals (*e.g.* environmental and regional policies). Therefore it becomes even more important to understand the way policies work 'within the black box', and not just look at visible sectoral impacts. This is the message of Midmore *et al.* (2008, 2010), for instance. Even though programmes targeted at rural development (such as investment support or LEADER) can be evaluated based on 'value for money' or macro criteria, such as investments attracted, development contracts signed, employment created or patterns of migration, such evaluations do not express the full impact of the programmes, nor do they explain why a particular pattern is observed. There may also be problems with standardised approaches in evaluations focusing on complex and dynamic effects. When we are interested in the long-term impacts, the change in endogenous potential (education levels, the creation of networks, *etc.*) or indicators that were not considered at the outset, it is even more important to understand *how* policies work at the local level. Case studies can be one important component in this type of evaluation, but a case study can also include a quantitative component, such as a multiplier analysis. Papers IV and V investigates the impact of implementation, rural (endogenous) resources and rural-agricultural interactions on the way policies are perceived and whether they are effective or not. Both papers use qualitative methods to go deeper into the processes that shape how programmes work in rural areas.

Paper IV is partly motivated by opening the 'black box' in policy evaluation and is to some extent inspired by the work of Eleanor Ostrom. Her work examines and analyses the phenomenon of common property resource management and tries to explain what characterises successful common resource management in terms of groups, resources and external factors. Paper IV deals with such issues, set in the Swedish countryside and with agricultural non-commodity/public goods as common property resources. It is based on the fact that many local groups exist and work on public goods, or common property resources, linked to the agricultural landscape, public goods with the characteristics of nature, culture and rural development. According to the seminal article by Coase (1974), some goods that should possess pure public good characteristics, such as perfect non-excludability and non-rivalry, are in fact managed either privately or as club goods to the benefit of many. Apparently many of the groups in Sweden are conversant with Ostrom's theory about what should characterise successful

local management[4]. They deal with public goods as Coase predicted and together with farmers they set up club-like solutions. Some groups also provide public goods from reasons of altruism, personal utility or 'warm glow' (see Andreoni (2006) for an introduction to altruism in public contributions). Paper IV provides a new understanding about some interactive processes that are underway in rural areas, between farmers and other actors. It offers suggestions on how these processes can be internalised into future policy development, as well as implementation, monitoring and enforcement, in a process known as hybrid governance.

A report from the Swedish Board of Agriculture (Jordbruksverket, 2005) studied the possible interactions between economic, environmental and social sustainability in rural areas in Sweden. It defined economic sustainable development as economic growth and increased productivity. Environmental sustainability is concerned with ecosystems, cultural heritage, biodiversity, a healthy environment and sustainable production capacities. Social sustainable development is described *e.g.* in terms of equality, democracy, health, services and identity. Based on a theoretical and literature-based analysis, it was determined that these three aspects of sustainable development interact and that they affect each other both positively and negatively. Paper V investigates if, and how, policies targeted towards agriculture can contribute to a sustainable rural development. The above-mentioned report for example points out that an attractive landscape (sustained through agricultural production) attracts new residents and tourists and that successful farming, although relatively capital-intensive, contributes to rural employment and uses local commodities and services. The aim of Jordbruksverket (2005) was to determine the empirical relationships between these aspects of sustainability, but this proved impossible owing to limited data availability and uncertainties about the indicators of each sustainability category. Paper V relates to Jordbruksverket (2005) in that it tries to capture these interactions and dimensions in a Swedish county, and perhaps it can guide future work to find empirical results by clarifying relationships and endogenously identifying sustainability indicators.

Together, Papers I-V are an attempt to understand the agricultural sector better and to identify some of the interactions and processes, mainly

[4] The very short version of Ostrom´s theory is that successful common property resource management is often correlated with small groups with shared norms and supportive external institutions, dealing with smaller, well defined projects, which have clear boundaries and are situated close to the group. Low transaction costs, well defined systems for solving problems and transparent sanctions against free riding are also essential.

economic and social, that are important when evaluating reforms of the EU CAP. This introductory chapter will now continue with an introduction to some theoretical and methodological concepts.

1.1 Input-output modelling at a glance

The concepts of IO tables and IO modelling are explained in Papers I-III, but an introduction to the subject is relevant to facilitate understanding of the summaries provided in this thesis[5]. The IO table is an accounting entity that statically describes the linkages within an economy at a specific point in time. Influential texts on IO modelling include Leontief (1966), Miller and Blair (2009) and Ten Raa (2005). The IO table records the various interdependencies between sectors or commodities in an economy, *i.e.* their integrated consumption of intermediate goods and services, with the possibility to distinguish between domestically-produced and imported goods and services. The transactions within the table are described either as interactions between commodities or between sectors. The table also reports the final consumption expenditure by households, government and other institutions, including exports, as well as investments and stockpiling. For each sector, it is possible to distinguish payments to households, cost of capital, taxes and subsidies, as final payments. The IO model assumes that the economy can be divided into a specific number of well-defined sectors or commodities. The sector or commodity groups can be large or small, depending on the level of aggregation. For instance, in the official Swedish IO table, the activities of all agricultural firms are aggregated into a single sector called 'agriculture', whereas, as in this thesis, it may sometimes be necessary to disaggregate a larger sector into smaller components.

The IO table is a fixed price equilibrium model utilising the fixed proportion (Leontief) production function. Some important economic assumptions of the IO model should be acknowledged and borne in mind in the analysis of economic systems. The first assumption is that each sector produces only one good[6]. The second is that production uses inputs in fixed

[5] Theoretical backgrounds are usually not included in academic papers and in addition to the books and references mentioned here, the interested reader can look at Lindberg and Hansson (2009), which is the working paper behind Paper I where we include a longer theoretical discussion and a more thorough literature review.

[6] In the MAKE and USE tables (which are mentioned below), both primary and secondary products of each sector are recorded. However the multiple-product characteristics of sectors are not explicitly shown in the IO model, since the use of certain assumptions about production technology allows for simplifications of the model into either a sector-by-sector or commodity-by-commodity framework.

proportions, implying constant returns to scale. The third assumption is that there is no lack of capacity within the economy. This implies that the economy is assumed to immediately satisfy the need for extra production inputs.[7]

Technological coefficients indicate the use of intermediate inputs in each industry regardless of their country of origin. Trade coefficients indicate the use of intermediate inputs produced domestically in each industry.[8] If we take a_{ij} as denoting the coefficient of production inputs from sector i that are involved in the production of sector j, then we can write $a_{ij} = Z_{ij} / X_j$, where Z_{ij} denotes the production input originating from sector i in the production of sector j and X_j denotes the total production of sector j. By collecting all the coefficients a_{ij} into a matrix **M**, we can express the vector of outputs, **X**, as $\mathbf{X} = \mathbf{MX} + \mathbf{Y}$, where **Y** is the vector of final demand. This simplifies to $\mathbf{X} = (\mathbf{I} - \mathbf{M})^{-1}\mathbf{Y}$ and $\Delta\mathbf{X} = (\mathbf{I} - \mathbf{M})^{-1}\Delta\mathbf{Y}$ expresses how a change in exogenous final demand ($\Delta\mathbf{Y}$) affects total output ($\Delta\mathbf{X}$) through backward linkages in the economy, which correspond to output multipliers $(\mathbf{I} - \mathbf{M})^{-1}$. This relationship is often referred to as the Leontief inverse and is the centre of attention in most applied IO analysis.

In the model outlined above, final demand (**Y**) is exogenous and not part of the interrelated production system. Considering the wages earned by households and their consumption of goods and services, it is debatable whether this component of the economic system can be treated as exogenous in impact analysis. Instead, the economic flows to and from households can be included in vector **X**, thus making households endogenous to the model. This procedure is called *closing* the IO model with respect to the households. This amounts to including an extra row and an extra column in the model showing (in the column) the domestic share of household consumption for each sector or commodity and (in the row) the wages earned in each sector or in the production of each commodity. The effect of including this increase in wages and the subsequent consumption of households in the multiplier analyses is called the *induced*

[7] It is often stressed that IO tables in their standard format take no account of positive or negative externalities that might accrue to sectors of the economy, *e.g.* environmental externalities where the price of a product does not take into consideration the social costs of emissions. Some IO models (notably Loizos *et al.*, 2000) have started to incorporate carbon emissions from production, as well as the use of damaging inputs, to take into consideration how scaling up or down production affects the environment. Indeed Miller and Blair (1985) included a chapter about environmental input-output modelling and a chapter about energy in IO analysis.

[8] Trade coefficients are the relevant measure in most cases for analysing impacts for a region or nation.

effect. A model that disregards the induced effects of household earnings and consumption is referred to as *open*. Multipliers are known as either open or closed according to the type of model involved. If these multipliers are combined with knowledge about physical labour inputs in each industry and the wages from the IO table, it is possible to compute employment and income multipliers.

One obvious limitation of the conventional IO table is that it is simplified and only shows the production of one output for each sector or commodity. However, the IO table is usually constructed from national MAKE and USE matrices, which record the production of both primary and secondary products for all sectors, based on their use of inputs.[9] To analyse firms producing more than one output, as is often the case for farms, the analysis can initially be carried out in the more general MAKE and USE matrix system and this allows multipliers to be calculated for either sectors (industries) or commodities.

IO models have been used extensively in applied work all over the world and for many different sectors. In the introduction to their chapter (Ch. 21) in the Handbook of Regional Growth and Development Theories, Oosterhaven and Polenske (2009) humorously report a search on the internet that produced 1 090 000 hits for impact analyses and IO models. Given the caveats to this exercise, they go on to commend the usefulness of the IO model, both in economic impact assessments and for studying wider issues such as the environment, energy, transportation, land use and other types of impacts. Midmore (1990) demonstrates the usefulness of IO models in analysing the agricultural sector, while Midmore and Harrison-Mayfield (1996) discuss the application of IO models to study rural economies. The list of applications of the IO model to agriculture and forestry is long, but some examples can be given from around the world: Hodges *et al.* (2006) analysed the food and natural resource sectors in the economy of Florida and Deller (2004) analysed the impact of agriculture in Wisconsin. Sharma *et al.* (1999) applied the model to agriculture on Hawaii, while Tanjuakio *et al.* (1996) assessed the economic contribution of agriculture in Delaware. Fujita (1989) used the IO framework to analyse the impact of agricultural production quotas in a Japanese region. In a European context, Johns and Leat (1988) applied a regional IO table to study the Grampian region in Scotland, with the emphasis on the agri-business and food sectors. Roberts

[9] The use of terminology when it comes to these matrices is somewhat different in different parts of the world. In the EU the terms SUPPLY and USE matrices are extensively used (see for instance the Eurostat manual of supply, use and input-output tables (Eurostat, 2008)) whereas in North America the MAKE and USE terminology is applied.

(1994) studied the effects of further reducing the milk quotas in the UK and Roberts (1995) investigated the linkages between the UK agriculture and the wider economy. Doyle *et al.* (1997) analysed the effects of agricultural support on farm output with implications for the regional economy in Scotland. Leat and Chalmers (1991) described an application of a disaggregated agricultural sector within an IO model. Psaltopoulos (1995) studied the importance of the forest industry in relation to other primary production in Scotland, while Eiser & Roberts (2002) investigated how different types of forest contribute to the economy of Scotland. As far as Sweden is concerned, one early example of IO analysis of agriculture is Rabinowicz (1982), who studied the relative importance of the primary sectors in a particular region (Lycksele) compared with the secondary and tertiary sectors.

It is difficult to compare multipliers from different studies that are calculated for different countries, regions, sectors, years, *etc.* Léon and Surry however (2009) present a comprehensive review of employment, income and output multipliers from studies in various countries and regions, providing a great illustration of the way multipliers differ across sectors and regions. OECD (2009) reports multipliers from a multitude of studies (including the above-mentioned survey by Léon and Surry) and draws some general conclusions. First of all, multipliers vary greatly between regions and for sectors within regions. For instance, for Wales open output multipliers ranged between 1.6 for cereal and 2.67 for pig meat in Midmore *et al.* (1997). A study for Brittany (Bossard *et al.*, 2000) found open output multipliers ranging from 1.6 for mixed crops to 1.85 for pigs and poultry. In the same study, multipliers for food industries ranged between 1.46 for the animal feed industry to 2.39 for bovine meat. For some regions described in Mayfield *et al.* (2005) agricultural multipliers are as high as 2.3, whereas for other regions that are smaller, more influenced by imports or have a fairly un-integrated agricultural sector, the potential for agriculture to stimulate the wider economy is as low as a multiplier of 1.04. It is generally the case that the more intensive livestock production sub-sectors have higher multipliers than crop production, due to higher use of inputs and labour in most types of livestock production. In addition, agro-food sectors usually show higher multipliers than primary production and service sectors usually show high multipliers when wage earnings are included (closed models).

In order to study regional economies, methods have been developed to 'regionalise' national tables. The reason for this is the high cost associated with producing survey-based regional tables. Early works on regionalisation include Hewings (1971), Round (1978), Jensen *et al.* (1979), Isserman

(1980) and Ralston *et al.* (1986), who developed location quotients based on structural differences between regions and nations. Location quotients have been adjusted to take into consideration regional size and the relative size of the selling and purchasing sectors (Flegg *et al.*, 1995; Jackson, 1998; Swanson *et al.*, 1999; Lahr, 2001). Today, many regional tables are based on an adjusted cross-industry employment location quotient, which is being tested and calibrated against regional survey tables (Flegg and Webber, 2000; Tomho, 2004; Flegg and Tomho, 2008).

Paper I develops a method for disaggregating the single agricultural sector in Sweden in order to perform a more detailed multiplier analysis based on seven farm types and 10 commodities. The method can also be applied to other farm types and commodities. The main contribution of Paper I is that: i) it shows a practically feasible and theoretically consistent way of producing disaggregated IO tables; and ii) it develops a fully operational IO model based on this disaggregated table for Sweden. Paper II takes this work further by demonstrating how important the problem of aggregated IO tables really is. By using the disaggregated Swedish table at a regional level, as well as a similar table for East Wales, it was possible to demonstrate the size of the aggregation bias and the sectors for which it is most important, *i.e.* the magnitude of bias that can be expected in multiplier analysis if aggregated agricultural accounts are used rather than disaggregated accounts. However, based on Paper I and other attempts to disaggregate IO tables, we know that such analyses are both time-consuming and costly.

If practitioners, academics or policymakers need to provide answers quickly and accurately and cannot benefit from already disaggregated IO tables, full disaggregation is not a feasible option. Hence Paper II develops a 'short cut' method for solving this problem when the IO table needs to be used as a model tool for assessing policy reforms. Together with partial equilibrium results from agricultural sector models, it is possible to use an aggregated IO table together with exogenous data (such as gross margin budgets or similar information) to describe accurate economy-wide impacts without going through the process of disaggregating the IO table.

Paper III complements the work in Papers I and II by examining the best ways to regionalise an IO table using location quotients. It was noted in the work in Paper II that regionalisation is a somewhat neglected topic in the IO literature and that there is an ambiguity when it comes to practically regionalising a national IO table using non-survey techniques. Therefore Paper III examines the rationale and logic behind regionalisation and empirically shows the sensitivity associated with different, commonly used, regionalisation approaches. The work in Papers I-III thus expands the

toolbox for performing applied evaluation/impact assessments of agricultural policy reforms, nationally or regionally, as well as other types of applied IO analysis.

However, for policy evaluation this analysis needs to be expanded. As already mentioned in the introduction, the fact that agricultural activities are becoming more diverse and that agricultural policy objectives are now more multifaceted means we must improve our contextualisation of evaluation and combine multiple approaches.

1.2 Introducing post-productivism and new associationalism

In order to evaluate and describe the impact of policies that are becoming more multifaceted, it is important to understand the processes that are taking place within the agricultural sector and between this sector and other sectors and actors. The concept of post-productivism describes a process that is taking place in parallel with industrialised farming practices. It captures some aspects of modern farming, as well as government programmes that encourage farmers to become more environmentally friendly and diversify into various forms of public goods provision and diversification. Post-productive regimes have been generally described in terms of ideology, actors, food regimes, production, policies, techniques and environmental impacts (Wilson, 2001, p. 80-81). Other proposed definitions of post-productivism are based on the change from quantity to quality in food production, farm diversification and the growth of agri-environmental schemes (Ilbery and Bowler, 1998; Evans *et al.*, 2002). According to Wilson (2004), current agri-environmental policies and rural development programmes in Europe can be defined as post-productivistic, based on the objectives and instruments of the schemes in operation. This is defined by Wilson as endogenous post-productivistic policy design and implementation (Wilson, 2001, 2004).

This 'post-productivistic turn' also implies that agricultural policy is becoming more integrated with rural development. Measures to sustain a fair standard of living in rural areas have traditionally been implemented through structural funds and national development agencies. With the integration of rural development aspects into agricultural policy, the two programmes are beginning to overlap. Even though there is a distinction between agricentric and multi-sectoral views towards rural development, as we demonstrate and discuss for instance in Paper V, it has been recognised (*e.g.* by Knickel and Renting, 2000) that farming, especially post-productivistic farming, plays an essential role in rural development. Van der

Ploeg *et al.* (2000) acknowledge that farming systems, as they are fundamentally related to rural areas through the land-based production processes, play a vital part in social, economic and environmental sustainable rural development. Furthermore, the environmental and rural development schemes within the CAP target positive and negative externalities from farming, as well as the development of new activities, farm diversification, investments and education activities. In relation to this new component of the policy, Marsden *et al.* (2002) conclude that farming is now facing a 'new associationalism' that must re-emphasise the territorial aspect of agriculture as a newfound component of competitive advantage. This will force farmers to operate in a more complex web of consumers, institutions and environmental/local stakeholders as they develop their production or diversification. While associationalism for farmers was previously apparent in the interactions with suppliers of inputs and large buyers of bulk commodities, this new associationalism captures how modern farming must understand the limits of the environment and the possibilities of nature and region in diversified products or activities, and must interact with local and central government, other entrepreneurs and consumer interests.

Multifunctional outputs such as agri-tourism and local quality products, as well as public goods such as environmental services and landscape amenities, are often local by default and territorial assets and idiosyncratic knowledge are therefore important aspects of this provision. As such, provision of these goods requires interaction between national and regional actors and cooperation between regional development interests and agricultural developers. Government schemes to support these interactions were developed as part of rural development programmes, but are now integrated into the agricultural policy (CAP). LEADER is the most striking example of such a scheme and is based on local action groups (LAGs) acting as catalysts for projects that support rural development[10].

In parallel to these government schemes, voluntary work is well developed in Sweden with groups of different size and intensity stewarding rural areas with respect to environmental and non-environmental issues. As shown in Paper IV, up to 50 000 days each year are put into voluntary provision work related to agri-environmental, farm-based local development

[10] LEADER stands for (in French) the 'link between rural development actions'. The LEADER programme was first initiated in 1991 as a tool for delivering rural development funds in an alternative and more flexible way. The purpose was to encourage innovative responses to old and new rural problems, approaches which could then be transferred and used in other regions. In 1991, LEADER was not part of the CAP, and was only integrated into pillar two in 2007.

and cultural issues. Many of these efforts involve cooperation between a local non-governmental organisation (NGO) and farmers.

As farmers continue to develop new and diversifying activities and systems thinking is further emphasised in rural development, the question of collaboration emerges. It is evident that multiple stakeholders are already active in the 'arena'. Could a deliberative turn that utilises more organised participatory approaches to regional systems planning improve how farmers and other actors deal with the environment, 'new associationalism' and rural development? In other words, what aspects of collaborative approaches (*e.g.* joint learning processes, idiosyncratic knowledge and agility) could be positive for the way policies are implemented, and what is the scope for such approaches to be successful? These are the issues dealt with in Papers IV and V and it is evident that such research must benefit from both quantitative and qualitative methods. For the purpose of analysing a contemporary phenomenon within a real-life context, when the boundaries between phenomenon and context are not clearly evident, Yin (1994) defines the case study research method as an empirical inquiry approach. Since a case study approach was employed in Papers IV and V, a general introduction to the methodology is provided below, with some reflections about this method that could not be included in the papers.

1.3 The case study approach

Using a qualitative or case-based approach is not the most common method in agricultural economic research. However, Kennedy and Luzar (1999) make 'the case for the case study' as a way to understand and explain an economic and social problem. They argue that if we want our research to be relevant to a wider audience of scholars, policymakers and interest groups, we need to include such methods as cases alongside our more quantitatively-orientated research.

A case study can be used for different purposes, for instance description, theory testing, theory building or testing future areas of study (probing). Whatever the intentions, a case study should be demarcated so that researchers know exactly which theory they want to test and what they choose not to study. When the objective is to test or build theory, existing theory can be allowed to guide the selection of cases and the development of research questions. In this case, the generalisations from case studies are made to theoretical propositions. In other words, analytical rather than statistical generalisations are made and multiple cases are viewed as different experiments or repetitions, as opposed to multiple observations in a sample.

Yin (1994) and Bennet & George (2005) specify phases that a researcher should go through in case study work. The overall phases are 'design', 'implementation' and 'conclusions', with most emphasis on design. The design phase defines which questions to study and why, while it also defines the method and the technique for analysis. The procedure for the design phase includes specifying the purpose of the study (*e.g.* description or some kind of theory testing), defining variables to test and the strategy for doing so, choosing cases and deciding on the unit of analysis (*e.g.* similar cases, opposite cases or outliers and whole groups or their members). Questions that match the data requirement must also be formulated; homogeneous questions should be used to ensure that data are comparable between cases. Finally, the criteria for analysis and for linking data to propositions or hypotheses must be determined.

In all phases of a case study (design, implementation and analysis/conclusions), validity is a central concern. A general discussion of validity includes the concepts of external, construction, internal and conclusion validity. Papers IV and V both try to cover a wide and representative frame for the investigations in order to obtain external validity. In Paper IV this wide scope is pursued in the survey, whereas the interview stage includes only two groups and thereby reduces the external validity. In Paper V we conduct 20 stakeholder interviews and cover a wide scope of different interests and activities in the region. Construct validity is also related to generalisation, but whereas external validity relates the results to the sample, construct validity refers more to the way a study can actually be used to draw conclusions on the phenomenon it sets out to study. The main problems in construction validity encountered in Papers IV and V are mono-operation and mono-method biases. Operation bias refers to the fact that if only a few observations are made, the full width of the concept of interest may not be captured. Method bias refers to the use of only one measure to capture a concept, with the risk of capturing only parts of the concept of interest. Obviously the operation bias is larger in Paper IV, whereas the method bias is equally important in Papers IV and V.

Operation and method bias are so-called 'design' or 'researcher' orientated threats. Other risks, such as interaction of treatments and interaction of testing, refer to the interaction with reality and are always an issue when conducting interviews or surveys. Alternative forms of general validity, as discussed by Guba and Lincoln (1989), assume that qualitative research should have its own set of standards for judging research. These standards are analogous to the conventional standards but have partly different meanings. The concept of transferability is primarily the responsibility of the

person doing the generalising. Transferability can be guided by a good description of the research context and the general assumptions made. However, those who wish to transfer results are responsible for this process. Other criteria are: dependability, which refers to the fact that reliability in replication is never possible and that the researcher should instead discuss the way in which results are sensitive to context; and confirmability, which deals with documentation, analysis and how alternative analyses from the data will enhance the validity of conclusions actually made.

One important part of the design is to choose a single or multiple case approach. Single cases are often used for analysing critical, extreme or unique cases, but also when performing a probing investigation for further research. Multiple cases require more resources and time, but when the rationale for the single case approach is not met, multiple cases give more compelling evidence and are believed to be more robust. Cases are not to be viewed as multiple respondents in a survey, but as multiple experiments. Replication logic as opposed to sampling logic is used when generalising from cases. When working with either one or multiple cases, the researcher still tries to build the case using different sources of data. Interviews or surveys can be complemented with documentation, maps and visual observations. A case can also include combinations of qualitative and quantitative methods.

To ensure internal validity, the method of analysis should already be specified in the design phase, before implementation and analysis. Different strategies might include relying on theoretical propositions, answers to how and why questions, or case description. Different methods are discussed in the literature and three commonly described are: i) Pattern matching (the collected material is compared with an *a priori* theoretically determined pattern); ii) explanation building (this method stipulates a set of causal links, then the case study findings are compared with the initial theoretical assumptions and revisions are made); and iii) time series analysis (investigation of a chain of events happening over time based on a hypothesis on the order of events, *i.e.* repeated cause and effect sequences).

When it comes to implementation, case study work does not only include interviews. The collection of background data, complementary information and the relationship between one's own results and other results (qualitative and quantitative) are important components, and should address at least some aspects of method bias. There are different ways of gathering qualitative data. Examples are in-depth interviews, direct observations, participatory activities or scrutiny of documents. The structure of interviews can differ quite substantially. The interaction between researcher and

respondent is usually set around some core concepts, but the interaction can be either free or strictly guided by protocols and questions. In both Paper IV and V, a semi-structured interview approach was used. In Paper IV we designed a multitude of questions from which content concentration was possible from the responses. This protocol was followed quite strictly but some time for comments and anecdotes was allowed at the end. In Paper V a few main questions were formulated corresponding to the area we wanted to investigate (the rural area/economy and CAP reforms). Respondents were asked to speak freely on these questions and the use of anecdotes or stories was encouraged. Interviews were not time-constrained and most interviews lasted between 90-110 minutes.

In the analysis, three major processes are of importance for how we worked with the interview data within Papers IV and V. These consist of *cleaning and organising* the data for analysis, *describing* the data and *testing* hypotheses and models (Trochim (2006) discusses these processes further). In Paper IV we chose to organise the interview data by content concentration and to describe the data as case descriptions used in the process of analyses and conclusions. In Paper V we began by cleaning our data with audiotape transcription carried out by a professional transcriber. We designed this to distinguish in written form all interviewees and interviewers. Final interviews consisted of 20-30 pages of text, which comprised the raw material for the analysis. Analysis initially consisted of coding the material, a line by line process in which each interview was individually processed in fine detail. Stories and anecdotes had to be processed by the analyst and placed into categories or nodes. Lines of text that had been assigned particular codes were then brought together to form bodies of text relating to each of the categories or causal relationships.

Morse (1994) notes that one problem with qualitative analysis is in fact that investigators do not push their analyses far enough and that they often settle for simple content analysis. It is up to the researcher to use earlier knowledge and theory to ask questions about the data that create links and to discuss the implications of the collected material. Morse (1994) also discusses different theoretical concepts in data analysis, *i.e.*: comprehension; synthesising; theorising; and recontextualisation. Comprehension is the process of learning all there is to know about the setting being studied. This includes doing the background work (in our case getting to know the theories, earlier work, in Paper IV the groups and networks and in Paper IV the region and its actors), reading relevant material (in our case policy documents and earlier evaluations) and going into the interview process with an open mind and interacting to gain information from the

participants. There are two complementary methods for synthesising the material, *i.e.* merging the material to find patterns. First, entire transcripts can be compared and differences or similarities in their content can be used to analyse categories. Secondly, the process of 'decontextualisation' can be applied, in which already categorised text can be brought together in a new document and used to describe categories. Theorising can be used to test alternative explanatory models against the data. Theory gives qualitative data structure and hypotheses are tested to see which one is most in line with the results. The process of theorising involves asking questions on the data that create links to the present theory and place the emerging theory in the context of previous research and established theory.

These thoughts conclude the introduction to this thesis. I now move on to provide a brief summary of Papers I-V. This is followed by a discussion and conclusions on the five papers, individually and together.

2 Summaries of appended papers

In the previous section, the questions dealt with in Papers I-V were put into a broader context and discussed in terms of the common purpose of analysing the agricultural sector and agricultural policy in Sweden. In this section, Papers I-V are summarised separately and in more detail. Methodologies and results are only touched upon briefly and the interested reader is encouraged to read the individual papers.

2.1 Summary of Paper I

Paper I investigates the economic linkages between agriculture and the rest of the economy in a quantitative way, and also with the ambition to say something about the role of agriculture in promoting rural development. Rural development encompasses a wide array of aspects including sustainable economic, environmental and social development. Paper I deals mainly with economic issues and is partly motivated by the recognition in the Swedish rural development programme for 2007-2013, which builds on the EU rural development programme, that economic sustainability, *i.e.* economic growth and employment (combined with environmental targets and support for social development) is an important factor for sustainable rural development. From an economic point of view, Psaltopoulos and Thomson (1993) stipulate that a rural development policy should *'identify the sectors with the most favourable prospects for development and the sectors of which the development would significantly contribute to the economic development of the area'* (p. 351). From the policymaker's point of view, the agricultural sector is often considered the main target of rural development programmes. The purpose of Paper I is hence to investigate the economic impact and potential of agricultural sectors and commodities in Sweden. In so doing, we

disaggregate the single agricultural account of the Swedish national input-output table as presented in the MAKE and USE format. This format, presented here in Table 1, gives us the ability to deal with the heterogeneous nature of the agricultural sector, where many farm types produce more than one product. The major information in Table 1 should be read in the following way. The MAKE matrix shows, in a rows-to-column way, the sectors that produce all the commodities in the economy. The USE matrix shows, in a row-to-column way, the inputs these sectors use. An analysis of the disaggregated MAKE and USE system confirms the heterogeneous nature of farm types as regards their production and shows their use of intermediate inputs. All this information can be used to calculate multipliers for either farm types or commodities.

Paper I presents a way to disaggregate the agricultural sector in the Swedish MAKE and USE system based on theoretical foundations, earlier work in other countries and the available data at our disposal in Sweden. This disaggregated matrix system is used to provide descriptive information on the disaggregated MAKE and USE tables, as well as multipliers for output, employment and income, for seven different farm types and 10 different commodities. One example of the information provided in Paper I is reported in Table 2, which shows the output multipliers for the different commodities. Similar tables are provided in Paper I for three types of multipliers (output, income and employment) and for both an IO model that is based on commodities and one based on farm types (*i.e.* sectors). High multipliers generally accrue to livestock production and commodities, specifically poultry and eggs. This would indicate that livestock sectors have a greater potential to stimulate output, employment and income throughout the economy. It cannot be stressed strongly enough that these multipliers are developed for use in impact assessments together with exogenous changes in final demand (*e.g.* changes in household demand or exports). They should not be used together with total output values as a proxy for the current importance of each sector. It should also be mentioned here, as it is in Paper I, that the IO model is based on strict assumptions about constant returns to scale, no bottlenecks in expanding production and no externalities. Hence, the scenario we postulate, for instance in Table 2, with a 10 percent increase in demand for a sector, should be viewed in the light of these model specifications.

Table 1. Structure of IO table based on MAKE and USE matrices[11]

	Commodity (n)	*Sector (m)*	*Final Demand*	*Total*
Commodity (n)		*USE matrix* ***(U)***	***Y***	***Q***
Sector (m)	*MAKE matrix* ***(M)***			***X***
Payment sectors		***W***		
Total	***Q'***	***X'***		

Table 2. Commodity output multipliers

Commodity	**Output multipliers**[a]		**Impact of 10% increase in output**[b]
	Open	**Closed**	
Agriculture	1.83	2.61	9 429
Milk	1.88 (3)	2.77 (5)	2 647
Beef	1.87 (4)	2.84 (4)	1 068
Pig	1.91 (2)	2.54 (6)	862
Poultry and eggs	2.20 (1)	2.90 (2)	530
Sheep	1.82 (6)	3.10 (1)	48
Cereals	1.52 (10)	2.43 (8)	1 037
Forage	1.78 (7)	2.26 (10)	333
Other crops	1.78 (7)	2.42 (9)	1 551
Other animals	1.85 (5)	2.52 (7)	560
Services to agriculture	1.78 (7)	2.88 (3)	870

[a] Numbers in brackets indicate the internal ranking of multipliers.

[b] Impact (in million SEK) of an increase in final demand corresponding to 10% of the output value of each commodity.

[11] Sometimes, the product and industry accounts are given in the opposite order. In Table 1 the following matrices, which are not mentioned in the text, should be defined: **Y** denotes a matrix containing vectors of final demand from *e.g.* households, government and exports, **W** is a matrix including vectors of payments to *e.g.* labour and capital, **Q** is total commodity output and **X** is total output from sectors. **Q′** and **X′** indicate transposed matrices of **X** and **Q**. It should also be mentioned that the representation of imports (competitive and non-competitive) is an important and complicated issue in applied IO analysis. In this schematic representation this is not discussed further; it is however pursued and discussed in papers I and III.

The potential for incorporating input-output results into the assessment of rural development, more explicitly than just by the economic importance of each farm type or commodity, is also discussed. We show in a more disaggregated fashion the sectors outside agriculture that are stimulated by expansion of either one of the agricultural sub-sectors. In other words, we can investigate the sectors in a region (or as in Paper I the nation) that are stimulated by an expansion in different old or new activities related to agriculture.

2.2 Summary of Paper II

Paper II builds on Paper I and attempt to find a way of assessing the impact of agricultural policy reforms in the IO framework, but without the use of time and money to fully disaggregate the IO table as we did in Paper I. In other words, we use the IO table from Paper I as a benchmark for investigating the importance of the problem of aggregation and for identifying the steps can be taken to find shortcuts that solve this aggregation bias when investigating the impact of exogenous shocks on agricultural sectors or commodities. The reason for using the (regional) IO model together with partial equilibrium results, as we do in Paper II, is that as stated in the introduction, agricultural policy reforms have shifted the emphasis away from commodity support towards environmental contracts, diversified production practices and rural development. Hence, the delivery of policy and any consequent economic shocks that might arise from its reform have become increasingly territorialised, with different impacts according to local resources, the nature of regional economic structure and the effectiveness of governance (Watts *et al.*, 2009). As a consequence, analyses that attempt to explain or predict the impacts of policy reform must, of necessity, become more localised, and extend from sectoral microeconomic models to multisectoral general equilibrium approaches that identify spill-over effects, both sectoral and spatially. Such impact multiplier effects are required for the purposes of European rural policy evaluation (European Commission, 2006, p. 8).

When linking input-output models with other models, such as partial equilibrium models used to assess policy reform impacts on the agricultural sector (for example Jones *et al.*, 1995; Helming and Peerlings, 2003; Mattas *et al.*, 2008; Neuwahl *et al.*, 2008), there can be a serious loss of information. Such partial models (which describe the adjustments in the agricultural sector) often describe changes in terms of animal numbers, crop acreage and

grassland area. Applying this information in terms of the value of an overall final demand change to national or regional input-output models, where agriculture is normally aggregated into a single sector, creates aggregation bias. Furthermore, there is some manipulation involved in determining the relevant way to transform these results into an appropriate shock in the IO framework. First of all, we show the size of aggregation bias resulting from a unit change in output in each of the disaggregated agricultural production sectors. We do this using an aggregated and disaggregated version of the IO table for two regions, Östergötland in Sweden and East Wales in the UK. Table 3 summarises these results by major sectoral groups in each region. Aggregation bias can be positive or negative, since the effect throughout the economy from a shock to the aggregated sector compared with a shock more accurately modelled to a specific disaggregated sector will depend on whether the multiplier, or the linkages with other sectors in the economy, is stronger or weaker than that of the aggregated sector. Therefore, the first column shows total bias (where positive and negative effects can cancel each other out), whereas the final column shows the sum of positive and negative differences (absolute bias).

This demonstrates that in most cases, there are significant offsetting biases. In Östergötland, large bias resulting from use of an aggregate multiplier occur in the other animal, cereal and forage sectors; the largest masking of positive by negative biases is in the poultry and egg production sector. This poses a major problem when results from partial equilibrium, or other models, are to be used together with aggregated IO tables.

It has been shown by Morimoto (1970) that the aggregation bias can be divided into first round and consecutive round effects. The first round bias is the most important bias and as long as the sectors that are affected by an exogenous change are disaggregated, the aggregation bias is small. In fact, as long as for instance the agricultural sector is disaggregated, and this is where the shock is taking place, it could be argued that most of the other components of the IO table could be aggregated without any creation of aggregation bias. However that is the opposite of what we have in reality, as the agricultural sector, which we know to be highly heterogeneous (see Paper I), is usually aggregated into one or two sectors. Hence what we should do is try to find a way to 'move' the first round effect of the shock away from this aggregated sector.

Table 3. Comparison of aggregation bias in Östergötland and East Wales

	Total	Total (absolute)
Östergötland		
Dairy	0.14%	2.35%
Cattle	-3.11%	3.86%
Sheep	-0.27%	2.32%
Pigs	-1.96%	3.40%
Poultry	0.49%	10.65%
Other animals	-6.41%	6.67%
Cereal crops	4.85%	5.67%
Other crops	-0.65%	3.45%
Forage	-3.69%	6.06%
East Wales		
Dairy	14.36%	14.37%
Cattle	-1.04%	5.53%
Sheep	-3.38%	7.13%
Pigs & poultry	30.02%	30.02%
Main crops	-0.15%	9.18%
Forage	3.32%	5.22%
Misc. output	-0.53%	5.25%

We show in Paper II that with some additional information on variable costs in agriculture, the shock can be transformed from a direct change in agriculture to the suppliers of inputs. This provides an impact close to that which could be calculated if the input-output system had indeed been disaggregated. We set out a relatively simple method for dealing with aggregation bias in regional (or national) input-output (IO) tables. This method is based on the fact that most of the indirect (and induced) impact of a shock to an IO table is captured within the variable cost changes emerging from the first round of the direct effect. This approach, which we denote the variable cost approach, can also be used in linking partial equilibrium results to IO tables to perform general equilibrium predictions. We test our approach using partial equilibrium results generated from a positive mathematical programming model (Arfini *et al.*, 2007). The results are summarised in Table 4 and are in favour of using this approach in impact studies where the researcher does not have the time or funding available for

completely disaggregating the IO table. In Paper II we used fairly accessible data for constructing the variable cost shock, gross margin data for both regions. This means that we distributed the direct effect from the agricultural sector to only a limited number of supplying sectors. Looking at the indirect effects in each subsector in the regions, we are still far away from the predictions of the fully disaggregated IO table, even if the overall predictions for the economy are similar. Using farm accountancy data to estimate input parameters for the production that is simulated to shift in the partial equilibrium model would improve this method (specifically the predictive power *within* each sector) without excessively high costs or effort.[12]

Table 4. Impact throughout the regional economy of Östergötland and East Wales from predicted partial equilibrium changes in herds and hectares

	Östergötland	East Wales
Disaggregated model	- 3.38	- 72.63
Variable cost approach	- 3.45	- 73.56
Aggregated model	- 4.04	- 82.60

(Changes shown in million €)

2.3 Summary of Paper III

The analysis in Paper II was performed at the regional level and much of the contemporary IO analysis is regional. While regional input-output (IO) tables have been constructed for more than 50 years, regional economic analysis experienced a revival at the end of the last and beginning of the present century. An interest in regional and rural development, combined with increased availability of data, has spurred the creation of quantitative models based on regional, inter-regional and multi-regional input output tables (Dissart, 2003; Madsen and Jensen-Butler, 2004, 2005; Oosterhaven and Polenske, 2009). Regional IO tables have been used to study regional and rural development and to analyse specific sectors in a region. See Midmore and Harrison-Mayfield (1996) for an introduction to IO methods in relation to rural economic modelling and Mattas *et al.* (2008) for a recent

[12] For instance EU FADN (Farm Accountancy Data Network) data could be used in this process to construct the relevant columns within the USE matrix which could be used to transfer the shock to the appropriate suppliers of inputs.

regional application. For applications to specific sectors, see for instance Hodges *et al.* (2006), Deller (2004), Eiser and Roberts (2002) or Sharma (1999). Furthermore, the use of IO tables to assess the environmental impacts of different sectors and lifecycles of various products has re-accentuated their usefulness in economic analysis (Kratena, 2004; Suh, 2004; Jones and Munday, 2007;).

There are many methods for constructing regional IO tables and even though the analysis of regional tables in applied work is extensive, there are still neglected issues regarding their construction. Basically, regional input-output (IO) tables are constructed as either scaled-down versions of national tables or by means of surveys. Surveys are expensive and time-consuming and regional survey tables are only available in some countries. Therefore mechanically constructed, non-survey regional tables are often the choice in applied work, even though these are often updated with all available data so that the non-survey approach turns into what is commonly known as the hybrid method. The non-survey approach with some updating is used in Paper II and in this approach location quotients (LQ) are constructed, usually based on employment structures, to account for differences between a nation and a region. A LQ is designed to scale down national (input-output) coefficients to representative regional coefficients, which are then used to derive regional multipliers. In this process there are two main approaches to define regional input-output coefficients. The first relies on national technological coefficients that show the use of intermediate inputs regardless of origin. In the second approach, regional input-output coefficients are derived from national trade coefficients, which allow us to distinguish the source of origin of intermediate inputs. Therefore, it is important to be aware of both the implicit effects of the design of LQs and the implications of applying a particular LQ to a specific coefficient. There appears to be some persistent ambiguity in the regionalisation literature about the proper application of LQs. On the one hand, Jensen *et al.* (1979), in developing the GRIT regionalisation method, favour reallocation of imports to create technological coefficients before applying LQs. On the other hand, Flegg and Webber (1997, p. 801) apply their quotient (the FLQ) to the trade coefficients. Paper III shows that it is inappropriate to apply LQs on the basis of the technological coefficients, as the resulting regional multipliers are likely to be overstated, since they generally fail to account for the absolute imports (leakages) required in the process of regional production. To illustrate this point, six regional tables are

constructed by applying three different LQs, on the basis of either technological or trade coefficients[13]. The findings indicate substantial discrepancies in the size of the regional multipliers, depending on the type of coefficients used. One example among the sectors is the multipliers for the agricultural sector in Östergötland, shown in Figure 1.

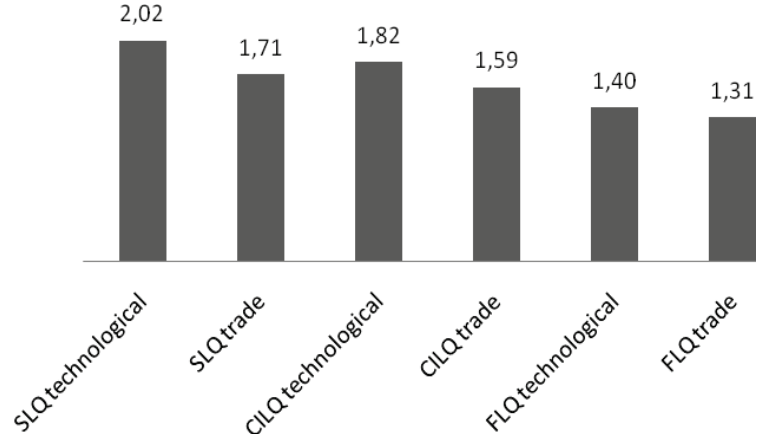

Figure 1. Comparison of open regional multipliers for the agricultural sector in Östergötland, based on the starting point of the regionalisation (technological, trade) and the choice of location quotient (SLQ, CILQ, FQ).

The general conclusion of Paper III is that the theoretical foundation for reallocating imports before applying location quotients is weak. Doing so substantially overestimates regional multipliers in impact analysis and policy evaluation. Furthermore, the issue deserves more attention in the regionalisation literature and one should not simply settle for current methods for non-survey regionalisation.

[13] The LQs applied in Paper III are the Simple Location Quotient (SLQ), the Cross Industry Location Quotient (CILQ) and the Flegg et al. Location Quotient (FLQ). The SLQ is a 'rows only correction' LQ, the CILQ allows for correction of each cell based on the relative nature of selling and purchasing sector, whereas the FLQ is a modification of the CILQ to take into consideration regional size.

2.4 Summary of Paper IV

There is a continuous focus on rural development and the provision of public goods within the common agricultural policy (CAP). Many researchers emphasise that this implies a need for new ways of implementing policy and innovative collaboration between various actors. Policymakers also acknowledge such needs. In managing complex systems, Hodge (2007) encourages what he calls adaptive co-management. Similarly, Marsden *et al.* (2002) argue for a new form of *hybrid governance* to manage the opportunities and problems associated with new associationalism, *i.e.* the farm business as part of an economic, social and ecological network. From the farmer's point of view, new associationalism describes the various actors and markets with which farmers need to be associated and interact in order to make use of the potential for developing new products and services. Local action groups and organisations have a significant potential in this new rural development context. Such local groups can form the basis for a hybrid governance of public goods and sustainable rural development.

Paper IV defines *hybrid governance* in relation to new associationalism as the interaction between layers in a multi-level arena of stakeholders involved in developing and implementing agri-environmental and rural development policy. The potential benefits of such governance in terms of reduced transaction costs, better results and synergies in rural development are identified. These are based on earlier research on the benefits that exist from managing complex systems in this way. Some of this research is summarised in Table 5. In order to investigate the possible scope for hybrid governance, we conducted a survey to determine the overall activity of such groups dealing with agri-environmental and rural development projects in Sweden. Following this descriptive survey, we targeted two groups for an in-depth case study investigation of the groups, their interactions and their activities. Finally, we used stakeholder discussions to test and generalise our understanding.

Table 5. Characteristics of potential benefits from adaptive co-management and hybrid governance[14]

Hodge (2007) Management of complex systems might appear to be inefficient, and it is a challenge to overcome fragmentation and duplication of authority, policy inconsistencies and high transactions costs. Possible benefits of adaptive co-management might include:	• Providing a planning framework for local interests to express their goals and priorities. • Tailoring regulatory activities to local conditions. • Informing potential applicants of local objectives, facilitating processes and prioritising applications. • Coordinating land management decisions across holdings/ providing a context for development of collective agri-environmental contracts (holistic contracting). • Facilitating individual landholder participation.
Birner and Wittmer (2004) Wätzold and Schwerdtner (2005) The management of a natural resource or an ecological system is in fact a transaction. Costs and benefits are associated with decision making, implementation and monitoring and enforcement.	• Different government structures, with different idiosyncratic knowledge, might affect the conservation quality of a resource system. • Hybrid governance, with simplified decision making, implementation (administration and targeting) and monitoring, can lead to reduced transaction costs.
Segerson and Miceli (1998)	• Implementation that allows cooperation, or relies on voluntary mechanisms, offers greater flexibility and possibilities of finding cost-efficient solutions. Such implementation reduces the negotiation time as well as the risk of future conflicts, since it provides an opportunity for the agents to interact.

[14] This table is a shortened version of the table which can be found in paper IV.

As Paper IV shows, organised local interest groups can play a crucial role as key partners in such hybrid governance structures. We identify a wide array of potential benefits, including improvement in the processes and outcomes of the management of complex social, economic and environmental systems. Based on our investigation, it is evident that local interest groups can act as building blocks in a new form of hybrid governance directed towards landscape amenities and rural development in close relation to farming and agricultural policy. At a time when diversification is an important aspect of European agriculture, it is evident that such cooperation can play a part in internalising positive externalities into products and can help farmers develop new products and activities. The case studies show that local groups are actively and directly involved in areas of policy implementation and uptake, while the survey indicates that such initiatives may be fairly widespread. However, since such local groups are not recognised or targeted within the CAP, their broad competences and identified resources have so far not been utilised in any systematic manner. Recognition of their role could be the next step in a post-productivistic agricultural policy. In a future hybrid governance structure local groups, and their combination with interested farmers, could also form the core of a 'new associationalism' in agricultural systems.

2.5 Summary of Paper V

Paper V is an investigation into the efficiency of current CAP policies to stimulate sustainable rural development. We investigate the scope that exists for agriculture to be the driving force in sustainable rural development, given that agriculture is still one of the dominant activities in rural areas across the European Union, not least with respect to land use and its impact on landscapes. From a rural development perspective, the Agenda 2000 reform of the CAP in the EU marked a shift in policy by introducing rural development as a second pillar and an integral part of the agricultural policy. Paper V focuses on the second pillar of the CAP and its aim to support sustainable development and diversification of rural areas. A broad range of measures are found within pillar two, such as: environmental, farm adaptation, processing and marketing of agricultural products, training and development, social and cultural measures and infrastructure. These measures can be viewed as an attempt to stimulate the interaction between actors and activities in relation to endogenous resources (human, environmental and economic) in rural areas.

It has been pointed out that farming, more than any other rural activity, has a role to play in integrating the environmental, cultural and socio-economic aspects of rural development (Knickel and Mikk, 1999; Knickel and Renting, 2000; Van der Ploeg *et al.*, 2000; Marsden *et al.*, 2002). It has also been recognised that evaluation of rural development policy is becoming more complex, as schemes cannot be evaluated merely on quantitative grounds. It has been suggested that it is essential to open up the 'black box' in policy evaluation and investigate how and why policies work (Midmore *et al.* (2008), *i.e.* to investigate the schemes in the context in which they are applied, and study the regions and the people to whom the measures apply. Taking into consideration these new challenges in policy evaluation, the main research question of Paper V is *if and how the Second Pillar of the CAP has contributed to sustainable rural development*. Does the policy content of this programme, and the way it is implemented, contribute to sustainable rural development? Does it create synergies between agriculture and other actors in rural areas and does the policy conform with other policies? These issues are investigated using a case study approach where we analyse 20 stakeholder interviews conducted in the Swedish province of Östergötland.

The results are analysed in the context of environmental, economic and social sustainability. Some main findings are that: i) Pillar two policies are effective in identifying and supporting new opportunities in farm diversification; ii) the traditional agricultural landscape can be seen as a key component in various diversification activities in rural areas, contributing to economic, social and environmental sustainability; iii) the 'LEADER initiative' offers significant potential to combine various schemes of the CAP to take advantage of synergies and to develop networks between agriculture and other actors; iv) there is an obvious risk that rural development is interpreted with an (excessively) strong 'sectoral farming focus' and that the fact that policies are included within the CAP hampers the possibility to make full use of the knowledge and competence of local administration; v) the subsidy system has to some extent created a 'funding dependency culture'; and vi) there is a risk concerning the kind of effects agri-environmental support will have in the long run, either when the subsidies are terminated or when farmers retire. To make agri-environmental measures and the links between these measures and diversification and rural development sustainable in the long run, the schemes must also help change the mindset of those receiving the support and motivate them to continue even if the support is cancelled.

3 Concluding remarks

Taken together, Papers I-V provide insights into the linkages between agriculture and other sectors and actors in the wider economy. They also contribute to the modelling and understanding of regional impacts of agricultural policy and to the identification of new systems for governing policy. Evaluation of the common agricultural policy (CAP) has become more complex as the policy evolves towards rural development objectives. Today, agricultural policy includes components of income support, market intervention, rules and legislation, agri-environmental payments and schemes, support for farm diversification and rural development schemes targeted towards both the agricultural sector and other sectors and actors. Therefore evaluations undertaken by the European Commission and within its targeted research activities usually involve both quantitative and qualitative methods.

Papers I-V are set against this background and are a natural result of my involvement in the CARERA research project, where both approaches were used to evaluate the employment impacts of reforms to the CAP in a regional context. Other similar projects conducted elsewhere during recent years include the TOP-MARD and REPBALK projects. Hence, even though Papers I-V can be read independently from each other, contributing to their own more narrow area of research, the intention is to have a common goal of unity.

Even though the input-output model employed in this thesis is fairly limited in its assumptions and in the way results can be generalised, it is a useful tool for both *ex-post* and *ex-ante* evaluations. In an article in a recent special issue of EuroChoices, focusing on CAP rural development policy evaluation, Johnson *et al.* (2010) emphasises the usefulness of IO-based models (IO models, Social Accounting Matrices and CGE models). Even though the IO model is the most 'restrictive' when it comes to dynamic

effects, such as price responses, substitution effects, marginal consumption patterns, *etc.*, it forms the basis for more refined models. The IO transactions table is a major component of the SAM model and an important 'database' for most CGE models. Therefore, understanding how this model operates, how to refine it (*e.g.* disaggregation) and how to modify it (*e.g.* regionalisation) is important.

The major contribution of Paper I is to develop and explain a simple approach, based on earlier experience, for disaggregating the single sector of an IO table. Paper I shows that it is possible, based on available registers of data (such as the FADN database), to produce a disaggregated table. However, this obviously still requires quite some time and effort, which is partly why we carried out the work in Paper II. In addition to explaining the approach for disaggregating the agricultural sector, Paper I also provides justification for doing so when the results are examined. It is evident that the agricultural sector is heterogeneous and USE, MAKE and multiplier tables show this heterogeneity. It is obvious that the potential bias from not disaggregating the sector in applied work is significant. As a final contribution, the empirical investigation of multipliers in Paper I show that livestock sectors have higher multipliers than crop and cereal sectors. More specifically, poultry and egg production, due to its structure of fairly industrial and input-intensive production (where the inputs, *e.g.* chicks, feed and energy, often come from within the nation), has large potential in stimulating the wider economy.

Multipliers are presented for output, employment and income and it should be mentioned that the analysis of multipliers should always be carried out in relation to the 'framing of the shock' and knowledge about the sectors and the regions. For instance, the closed multiplier for sheep accrue to high employment figures in the statistics for that sector, but there is little information about the amount of wages actually related to sheep production, which is a rather limited, although expanding, economic activity in Sweden.

Paper II confirms that aggregation bias is a serious problem in applied IO work, in our case in the agricultural sector and in evaluations of the CAP reforms. Major conclusions are that the aggregation bias can be both positive and negative within the same sector and may or may not cancel out in aggregation. Generally, for both regions in our study, aggregation bias, in total and absolute terms, is important. Therefore, based on the notion of first order bias, we propose to 'move' the shock away from those sectors that are aggregated. In other words, as long as the sectors that are affected by an exogenous shock are not aggregated, most of the rest of the IO table can be

aggregated. We would not need to go as far as that in current IO tables, since we can easily invert large matrices using computers. However, since agriculture is often aggregated and since this is where the exogenous shock is felt, one way of solving the problem could be to analyse the first round impact and transfer it away from the agricultural sector. Hence, it would suffice to disaggregate agriculture as long as all other sectors are as one.

An alternative approach where this is not possible is to use the aggregated tables that are often available and disaggregate the shock instead. The conclusion is that this is possible based on those gross margin budgets that are often available in developed countries and using FADN data available within the EU. The better the data available for disaggregating the shock, the closer to the disaggregated solution one should come. In demonstrating the approach we only use simple gross margin data for a limited number of input accounts. We are able to produce an aggregate impact that is substantially closer to that of the disaggregated table. However, in examining the impact on a sector by sector level, we are still some distance from the disaggregated result since we could implement our shock only for those inputs we could isolate using our data. Using the approach outlined in Paper I, but only for the columns of the USE matrix, saving time and money, would improve the approach in Paper II and facilitate better and faster analysis of *e.g.* CAP reform.

Paper III shows that in producing regional tables, there are many issues to address in the non-survey class of regionalisation methods. The major conclusion from Paper III is that there are no clear theoretical foundations for reallocating imports in an IO table before applying location quotients in regionalisation. The location quotients currently employed widely in applied work are not designed to scale down the technological coefficients created if this is done. Therefore it is more advisable to follow an approach where location quotients are applied to trade coefficients, as this will not overestimate regional purchase coefficients and regional multipliers. In relation to applied work in agriculture, Paper III demonstrates the sensitivity of choice of transaction coefficient and location quotient when it comes to the multipliers. Non-survey approaches are often criticised for overestimating regional multipliers, and it is possible that this is due to the combination of simple quotients and technological coefficients.

Together, Papers I-III offer some very important insights. First of all, they illustrate the complexity of input-output work at a methodological level. That is not to say that input-output is complicated, but it is complex. At a first approach IO tables are easy to understand and produce results (for instance from multipliers) that are fairly easy to communicate to others and

include in case studies. However, the curse of the simple method is that it is easy to use but also easy to misuse. As a brief example, IO multipliers are often used together with total output, rather than the correct change in exogenous demand. As multipliers show the relationship between output and final demand, and can predict total effect on output due to exogenous changes in final demand, multiplying such multipliers by output values involves double counting. As stated by Oosterhaven and Stelder (2002, p. 534) *'when the claims of all sectors in an economy are added an (implicit) estimate of the total size of the economy will result that is many times larger than its actual size'*. However, with some modification, multipliers can be used together with changes in output, but only exogenous *changes*.[15]

Papers I-III show that there are caveats in regionalisation, aggregation and multiplier analysis. Taken together, Papers I-III illustrate at a methodological level how applied work with IO models can be performed in the agricultural sector. The applied work shows a heterogeneous sector with some sub-sectors showing more potential than others for stimulating the wider economy, strictly economically or in employment. The impacts of CAP reforms are complex but using an IO model shows that effects are distributed across many sectors delivering to agriculture, and those linked to those sectors as well. Impacts are augmented by multipliers and, even at the regional level in a Swedish county, such multipliers are in the order of 1.2-1.3 for agriculture. We should also expect leakages of these impacts to other regions.

We can learn a lot about the agricultural sector and the impacts of policy reforms from quantitative investigations, but if we want to know more about *how* policies work and *why* some policies work in some regions but not in others, we need to go beyond purely quantitative indicators in policy evaluation. If we want to get as much impact as possible from agri-environmental and rural development policies, it is important to find efficient ways for managing actors, activities and resources that make up these economic, environmental and social systems. This is one way to improve the way in which scarce resources are managed. Paper IV provides some understanding of how such systems can be managed and the potential benefits of hybrid governance. One novel insight is that there are actually activities out there which in parallel, and together with farmers, work

[15] This procedure amounts to making the output of one or more sectors exogenous, for such approaches see for instance Johnson and Kulshrestha (1982), Papadas and Dahl (1999) or Eiser and Roberts (2002). Roberts (1994) also show how adjusted demand driven multipliers can be used to predict changes in output throughout the economy from changes in output in one or more exogenous sectors.

towards the provision of public goods, an interesting solution in itself since these goods are characterised in the economic literature by market failures and underprovision. The cooperative regimes studied in Paper IV seem to hold some possibilities when it comes to improving the design, implementation and evaluation of agricultural policies targeted towards environmental and rural development objectives. Such networks seem to be able to reduce the transaction costs associated with policies and improve the quality of the outcome, while at the same time supporting more long-term cooperation between farmers and other actors to improve uptake, reduce conflicts and support long-term provision.

Paper V improves the overall picture of how agricultural policies are perceived in rural regions and of the extent to which agricultural, sector-based, policies can support rural development. One important conclusion from Paper V is that some policies, for instance agri-environmental contracts, stimulate or form a base for diversification activities. Activities in rural areas are closely linked together and in the same way that economic activities stimulate each other in the input-output model, activities can stimulate each other on other levels. Open and diversified or in other ways appealing landscapes attract new residents, as well as tourists. They provide the basis for other services or activities. Activities can support each other with knowledge and synergies in other ways, sharing the same customers for instance. Hence, the linkages between agriculture and other actors and activities go beyond multipliers in the traditional meaning. According to Paper V, we should also be aware of that the impacts of current policies within pillar two, for all types of sustainability, are probably limited in time to the duration of the program periods.

Papers IV and V taken together could be viewed in the light of Wilson and Hart (2001), who analyse how contextual factors, *e.g.* contractual approaches versus more communicative delivery, shape the way farmers view agri-environmental policy. They conclude that schemes should be accompanied by information and education programmes to improve conservation-orientated thinking among farmers. This would push farmers from being passive adopters of agri-environmental policies to being active adopters who can identify with, and see opportunities within, the environmental goals of the schemes. One clear policy implication from Papers IV and V is that sustainable agricultural policy must ultimately change the mindset of farmers so that they become active in providing environmental or landscape services, as well as participating in rural development, even if subsidies are cancelled.

References

Andreoni, J. (2006). Philanthropy. In Kolm, S C & Mercier Ythier, J. (Ed.) *The Handbook of Giving, Reciprocity and Altruism*, Amsterdam: North-Holland, 1201-1269

Arfini, F., Donati, M., Landini, F. & Gigante, R. (2007). *A Report on the Effects on the Farming Activities and Employment Levels*. Deliverable 9 of the CARERA project, available at: http://www.eng.auth.gr/mattas/carera/deliv.htm

Bennet, A. & George, A.L. (2005) Case studies and theory development in the social sciences. The MIT Press, USA.

Birner, R. & Wittmer, H. (2004) 'On the 'efficient boundaries of the state': the contribution of transaction-costs economics to the analysis of decentralisation and devolution in natural resource management', *Environment and Planning C: Government and Policy* 22, 667-685.

Bossard, P., Léon, Y., Quinqu, Y. & Surry, Y. (2000). La filière bovine en Bretagne et la crise de la 'vache folle' de 1996: un analyse interindustrielle, *Cahiers Economie et Sociologie Rurales* 57.

Buller, H.., Wilson, G. A. & Höll, A., (2000). Introduction: the emergence of regulation 2078. In: Buller, H., Wilson, G. A. & Höll, A. (Ed.) *Agri-environmental policy in the European union,* Ashgate Publishing Company, USA.

Coase, R. H. (1974). The Lighthouse in Economics. *Journal of Law and Economics* 17 (2), 357-376.

Copus, A., Hall, C., Barnes, A., Dalton, G., Cook, P., Weingarten, P., Baum, S., Stange, H., Lindner, C., Hill, A., Eiden, G., McQuaid, R., Grieg, M. & Johansson, M. (2006). *Study on Employment in Rural Areas*, (SERA) Final report for the European Commission, DG AGRI, Brussels

Deller, S. C. (2004). Wisconsin and the Agricultural Economy. Staff Paper. No. 471. University of Wisconsin-Madison, Department of Agricultural and Applied Economics. U.S.

Diakosavvas, D. (ed.) (2006). *The Development Dimension: Coherence of Agricultural and Rural Development Policies*. Paris, OECD.

Dissart, J. C. (2003) Regional Economic Diversity and Regional Economic Stability: Research Results and Agenda. *International Regional Science Review* 26 (4), 423-446.

Doyle, C. J., Mitchell, M, & Topp, K. (1997). Effectiveness of farm policies on social and economic development in rural areas. *European Review of Agricultural Economics* 24, 530-546.

Eiser, D. & Roberts, D. (2002). The Employment and Output Effects of Changing Patterns of afforestation in Scotland. *Journal of Agricultural Economics* 53, 65-81.

European Commission (2006). *Rural Development 2007-2013: Handbook on Common Monitoring and Evaluation Framework*, Brussels, European Commission Directorate General for Agriculture and Rural Development.

Eurostat (2008). Eurostat manual of supply, use and input-output tables, Eurostat, Luxembourg.

Evans, N., Morris, C. & Winter, M. (2002). Conceptualizing agriculture: a critique of post-productivism as the new orthodoxy. *Progress in Human Geography* 26, 313-332.

Flegg A. T & Tomho T. (2008) Regional Input Output Models and the FLQ Formulae: A Case study of Finland. Discussion Paper 0808, Department of Economics, University of the West of England.

Flegg A. T & Webber C. D. (1997) On the appropriate use of location quotients in generating regional input-output tables: Reply. *Regional Studies*. 31(8), 795-805.

Flegg A. T & Webber C. D. (2000) Regional size, Regional specialization and the FLQ formula. *Regional Studies*. 34(6), 563-569.

Flegg A. T, Webber C. D & Elliott M. V. (1995) On the appropriate use of location quotients in generating regional input-output tables. *Regional Studies*. 29(6), 547-561.

Guba, E.G. & Lincoln, Y.S. (1989). *Fourth generation evaluation*. California: Sage Publications

Helming J. & Peerlings J. (2003) Effects of EU dairy policy reforms for Dutch agriculture and economy; applying an agricultural programming / mixed input-output model. *Contributed paper at the 25th international conference of agricultural economics*, August 16-22, Durban, South Africa.

Hewings G. J. D. (1971) Regional input-output models in the UK: Some problems and prospects for the use of non-survey techniques. *Regional Studies*. 5, 11-22.

Hodge, I. (2007) 'Presidential address: The Governance of Rural Land in a Liberalised World', *Journal of Agricultural Economics* 58 (3), 409-432.

Hodges, A. W., Rahman,i M. & Mulkey, W. D. (2006). Economic Impacts of Agricultural, Food, and Natural Resource Industries in Florida in 2004. Food and Resource Economics Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. U.S.

Ilbery, B. & Bowler, I. (1998). 'From agricultural productivism to post-productivism', In Ilbery, B. (Ed.), *The Geography of Rural Change,* 57-84, Essex: Longman, Harlow.

Isserman, A. M. (1980). Estimating export activities in a regional economy: A theoretical and empirical analysis of alternative methods. *International Regional Science Review*. 5(2), 155-184.

Jackson, R. W. (1998). Regionalizing national commodity by industry accounts. *Economics Systems Research*. 10(3), 223-238.

Jensen, R. C, Manderville, T. D. & Kuranaratne, N. D. (1979). *Regional economic planning: Generation of regional input-output analysis*. Croom Helm, London

Johns, P. M. & Leat, P. M. K. (1988). The application of modified Grit input-output procedures to rural development analysis in Grampian region. *Journal of Agricultural Economics* 38, 243-256.

Johnson, T. G. & Kulshrestha, S. N. (1982). Exogenizing agriculture in an input-output model to estimate relative impacts of different farm types. *Western Journal of Agricultural Economics*, 7(2), 187-198.

Johnson, T. G., Roberts, D. & Wojan, T. R. (2010). Model-Based Evaluation of Rural Development Policies. *EuroChoices* 9(1), 30-36.

Jones, C. & Munday, M. (2007). Exploring the Environmental Consequences of Tourism: A Satellite Account Approach. *Journal of Travel Research*, 46(2), 164-172.

Jones, P.J., Rehman, T., Harvey, D.R., Tranter, R.B., Marsh, J.S., Bunce, R.G. H. & Howard, D.C. (1995). *Developing LUAM (Land Use Allocation Model) and modelling CAP reforms*. CAS Paper - Centre for Agricultural Strategy, University of Reading

Jordbruksverket, 2005. *Konflikt eller samverkan mellan ekonomiska, sociala och miljömässiga mål på landsbygden*. Rapport 2005:4, SJV. Jönköping.

Knickel, K. & Mikk, M. (1999). Linkages between rural development and the agri-environmental programme. Development of an agri-environmental scheme in Estonia (ES 9507.03.01), Tallin: Ministry of Agriculture.

Knickel, K. & Renting, H. (2000). 'Methodological and conceptual issues in the study of multifunctionality and rural development', *Sociologia Ruralis* 40(4), 512-528.

Kratena K. (2004). Ecological value added' in an integrated ecosystem-economy model- an indicator for sustainability. *Ecological Economics* 48(2), 189-200.

Lahr, M. L. (2001). Reconciling domestication techniques, the notion of re-exports and some comments on regional accounting. *Economics Systems Research* 13(2), 165-179.

Leat, P. M. K. & Chalmers, N. (1991). Analysing agricultural adjustment in Grampian using an Input-Output model of the agricultural and food complex. In: Midmore, P. (Ed.) *Input-output models in the agricultural sector*, Aldershot: Avebury.

Léon, Y. & Surry, Y. (2009). Les effets d'entraînements du complexe agro-alimentaire au niveau local. (Assessing the induced effects of the agri-food complex at the local level). In Aubert, F., Piveteau, V. & Schmitt, B. (Ed.) *'Politiques agricoles et territoires'* Editions QUAE, Paris. 21-48.

Leontief, W. W. (1966). *Input-Output Economics*. New York: Oxford University Press.

Lindberg, G. & Hansson, H. (2009). Economic impacts of livestock production in Sweden - An input- output approach. Working Paper Series 2009/1, Department of Economics, Swedish University of Agricultural Sciences (SLU). Uppsala 2009.

Loizos, S., Mattas. K., Tzouvelekas, V., Fotopoulos, C. & Galanopoulos, K. (2000). Regional economic development and environmental repercussions: An environmental input-output approach. *International Advances in Economic Research* 6, 373-386.

Madsen B. & Jensen-Butler C. (2004). Theoretical and operational issues in sub-regional economic modeling, illustrated through the development and application of the LINE model. *Economic Modeling*. 21, 471-508.

Madsen B. & Jensen-Butler C. (2005). Spatial accounting methods and the construction of spatial social accounting matrices. *Economic systems research*. 17(2), 187-210.

Marsden, T., Banks, J. & Bristow, G. (2002). 'The social management of rural nature: understanding agrarian based rural development', *Environment and Planning A* 34, 809-825.

Mattas, K., Arfini, F., Midmore, P., Schmitz, M & Surry, Y. (2008). Impacts of CAP reform on rural employment: A multi-modelling cross-country approach. Paper presented at the 109th EAAE seminar, Viterbo, Italy, 20-21 November.

Mayfield, L., Courtney, P., Trantner, R. & Jones, P. (2005). The role of small and medium-sized towns in rural development. Final Report, EU project QLRT-2000-01923. Centre for Agricultural Strategy, University of Reading, UK.

Midmore, P. (1990). Estimating input-output coefficients from regional farm data: a comment. *Journal of Agricultural Economics* 41(1), 108-111.

Midmore, P. & Harrison-Mayfield, L. (1996). Rural economic modelling: Multi sectoral approaches. In Midmore, P. & Harrison-Mayfield, L. (Ed.) *Rural economic modelling: an input-output approach*, Wallingford: CAB International.

Midmore, P., Langstaff, L., Lowman, S. & Vaughan, A., (2008). Evaluating Pillar 2 employment impacts: case study methodology and results for East Wales, Paper presented at the XII Congress of the European Association of Agricultural Economists, Ghent, August 2008.

Midmore, P., Medcalf, R. & Harrison-Mayfield, L. (1997). Regional input-output analysis and agriculture. *Cahiers d'Economie et de Sociologie Rurales* 42-43, 8-31.

Midmore, P., Partridge, M. D., Olfert, R. m., and Ali K. (2010). The evaluation of rural development policy: macro and micro perspectives. *EuroChoices* 9(1), 24-29.

Miller, R. E. & Blair, P. D. (1985). *Input-Output Analysis: Foundations and Extensions*. London: Prentice-Hall.

Miller, R. E. & Blair, P. D. (2009). *Input-Output Analysis: Foundations and Extensions*. Second Edition, Cambridge University Press.

Morimoto, Y. (1970). On aggregation problems in input-output analysis. *The Review of Economic Studies* 37(1), 119-126

Morse, J. M. (1994) 'Emerging from the data': the cognitive processes of analysis in qualitative inquiry. In Morse, J. M. (Ed.) *Qualitative research methods*. London, SAGE Publications Ltd.

Neuwahl, F., Löschel, A., Mongellia, I. & Delgadoa, L. (2008). Employment impacts of EU biofuels policy: Combining bottom-up technology information and sectoral market simulations in an input–output framework. *Ecological Economics* 68(1-2), 447-460.

OECD. 2009. The Role of Agriculture and Farm Household Diversification in the Rural Economy: Evidence and Initial Policy Implications. Paris OECD

Oosterhaven, J. & Polenske, K. R. (2009). Modern regional input-output analyses. In Capello R & Nijkamp P. (Ed.) *Handbook of regional growth and development theories*. Edward Elgar.

Oosterhaven, J. & Stelder, D. (2002) Net multipliers avoid exaggerating impacts: with a bi-regional illustration for the Dutch transportation sector. *Journal of Regional Science*, 42(3), 533-543.
Papadas, C. T. & Dahl, D. C. (1999) Supply-driven input-output multipliers. *Journal of Agricultural Economics*, 50(2), 269-285.
Psaltopoulos, D. & Thomson, K. J. (1993). Input-Output Evaluation of Rural Development: a Forestry-centered Application. *Journal of Rural Studies* 9, 351-358.
Rabinowicz, E. (1982) Input-output studies of agriculture in regional economy – some problems of method. *European Review of Agricultural Economics* 9, 87-101.
Ralston, S. N., Hastings S. E. & Brucker, S. M. (1986). Improving regional I-O models: Evidence against uniform regional purchase coefficients across rows. *The Annals of Regional Science* 20 (1), 65-80.
Roberts, D. (1994). A modified Leontief model for analyzing the impact of milk quotas on the wider economy. *Journal of Agricultural Economics* 45, 90-101.
Roberts, D. (1995). UK agriculture in the wider economy: The importance of net SAM linkage effects. *European Review of Agricultural Economics* 22, 495-511.
Round, J. I. (1978). An interregional input-output approach to the evaluation of non survey methods. *Journal of Regional Science*, 18, 179-194.
Segerson, K. & Miceli, T. J. (1998). 'Voluntary environmental agreements: good or bad news for environmental protection?', *Journal of Environmental Economics and Management* 36, 109-130.
Sharma, K. R., Leung, P. S. & Nakamoto, S. T. (1999). Accounting for the linkages of agriculture in Hawai's economy with an input-output model: A final demand based approach. *Annals of Regional Science* 33, 123-140.
Statistics Sweden (2010) Jordbruksstatistisk årsboks 2010. Statistics Sweden, Örebro, Sweden.
Suh, S. (2004). Functions, commodities and environmental impacts in an ecological economic model. *Ecological Economics*, 48(4), 451 - 467.
Ten Raa, T. (2005). *The economics of input-output analysis*. Cambridge University Press.
Tomho, T. (2004). New developments in the use of location quotients to estimate regional input-output coefficients and multipliers. *Regional Studies*. 38(1), 43-54.
Trochim W. M. K. (2006) www.socialresearchmethods.net/kb/. Last accessed: 10/20/2006.

Van der Ploeg, J. D., Renting, H., Brunori, G., Knickel, K., Mannion, J., Marsden, T., de Roest, K., Sevilla-Guzmán, E. & Ventura, F. (2000) 'Rural development: from practices and policies towards theory', *Sociologia Ruralis* 40(4), 391-408.

Watts, D.C.H., Ilbery, B. & Maye, D. (2009). Implementing Pillar II of the Common Agricultural Policy in England: geographies of the Rural Enterprise Scheme and Processing and Marketing Grant. *Land Use Policy* 26(3), 683-694.

Wätzold, F. & Schwerdtner, K. (2005). 'Why be wasteful when preserving a valuable resource? A review article on the cost-effectiveness of European biodiversity conservation policy', *Biological Conservation* 123, 327-338.

Wilson, G. A. (2001). 'From productivism to post-productivism…and back again? Exploring the (un)changed natural and mental landscapes of European agriculture', *Transactions of the Institute of British Geographers* 26(1), 77-102.

Wilson, G. A. (2004). 'The Australian Landcare movement: towards 'post productivist' rural governance?', *Journal of Rural Studies* 20, 461-484.

Yin, R. K., (1994). *Case Study Research*. Thousand Oaks: Sage.

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