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Structural Change in Swedish Agriculture

An analysis of factors affecting structural change in the Swedish primary sector with a particular focus on dairy farming

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Abstract

During the latter half of the 20th century there has been a continuous decrease in the number of farms in Sweden and agriculture's importance in economic terms has fallen considerably. This has had significant effects on economic activity in rural areas, on the environment and on the location and size of the food processing industry. Studying the size and the effects of this structural change in agriculture has therefore become important both from an economic as well as from a social and environmental perspective.

This study looks at the patterns of change in agricultural production in Sweden between 1995 and 2005 and analyzes some of the factors that have contributed to structural change both in the agricultural sector as a whole as well as in particular in the dairy sector. The analysis is based on existing literature on structural change combined with available national and international data.

The main findings are that structural change has been significant in Sweden during the period between 1995 and 2005. The decrease in farms numbers has been more dramatic in the dairy sector than in the agricultural sector as a whole. The Swedish farm population is ageing rapidly and only a small number of young operators are entering the sector. In order to financially continue farming, the majority of Swedish farms are run on a part-time basis. After EU accession costs of production have risen significantly and in combination with decreasing output prices farmers are becoming more dependent on different forms of government aid. The sector has become more concentrated both in terms of the size of farms as well as regionally. This has meant that in particular certain areas in the north and center of Sweden have lost production to the south of Sweden. The study also shows that the special national aid available to the North of Sweden has not managed to significantly slow down structural change in the region.

Keywords: Structural change, dairy farming, Sweden, CAP, Nordic Aid.

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1. Introduction

1.1 Background and motivation

During the past 40 years there has been a continuous decrease in the number of farms in Sweden and the importance of farming in economic terms has fallen. Migration of people from the countryside towards urban centers has occurred, which has been detrimental both for remaining economic activity and for the environment in rural areas. In Sweden, due to the geographical nature of the country, policy makers have been interested in finding ways to slow down this phenomenon in order to maintain all parts of the country alive in economic terms.

Structural change in agriculture indicates changes that occur to the number and size of farms as well as to their concentration inside a country. These are driven by technological change, which affects labor use and production possibilities, and economic factors (e.g. producer prices, demand for products, subsidies for production). From an economic perspective structural change which leads to more efficient farms in terms of costs and productivity is positive. However, if this comes at the cost of a significant reduction of farm numbers and farm workers and leads to production concentrating only in a few areas it can be seen as a negative effect.

Analyzing factors of structural change in Swedish agriculture is extremely important in order to be able to find appropriate policy measures that could slow down the trend and allow farming to continue in all parts of the country. It is an interesting field of study due to the fact that the existence and survival of primary production is interconnected to so many other sectors (e.g. the food processing sector), which are important employers and significant contributors to the national economy. This is also the reason for putting a special emphasis on structural change in dairy farming, as it represents in many ways the cornerstone of agricultural production and is directly linked to the large dairy processing sector. As Sweden is a member of the European Union (EU), its agricultural policies are affected by those of the common agricultural policy (CAP) of the EU. Studying the effects of the CAP on both the primary sector and rural development is essential as the CAP takes up a significant share of the EU budget and has been an issue of debate for many years on both the Union level and in international contexts.

1.2 Objective of the study and research question

The aim of this study is to look at the patterns of change in agricultural production in Sweden between 1995 and 2005 and analyze some of the factors that have contributed to structural change. The scope of the study is Sweden but the EU context is kept in mind throughout the study. The time period was chosen in order to be able to see what the effects of EU membership have been on agricultural production. This study does *not* try to predict what the future will look like but rather analyze the current structural changes in order to see where this could lead Sweden in the future. The research question of the thesis is: how has structural change affected agricultural production (and more in particular dairy production) in Sweden between 1995 and 2005 and based on this how can we expect agricultural production to evolve in the future?

1.3 Research method and limitations

This study is carried out as an analysis based on existing literature on structural change combined with available national and international data. No empirical model is analyzed but instead simple calculations and projections of the future are made which together with the literature allow an examination of the factors affecting structural change. Structural change in agriculture is a large field of study and agricultural production is influenced by a myriad of different factors. It is impossible to include all of these in an analysis and thus the conclusions drawn are not exhaustive. In addition EU policies and the global economic environment change rapidly and thus all forecasts of the future involve a significant degree of uncertainty.

1.4 Data

The main data source for Sweden is the Swedish board of agriculture's (SJV) annually published yearbook of agricultural statistics. For the section on profitability of dairy farms, data from the Farm Accountancy Data Network of the EU has been used. The FADN provides income data for agricultural holdings in the EU collected every year through sample surveys. A major difficulty faced when studying agricultural economics is how to divide up a country. Often the administrative division of a country is not useful as it does not reflect the specific climatic and

land conditions of areas. Therefore in Sweden the notion of agricultural production areas is often used in statistics. I decided, however, to use a division of the country into 21 counties as this was helpful when working with the data. However, in some cases production areas are used as well as a specific division used by the FADN. Maps on the geographical areas can be found in appendix A. In most cases the data covers the years 1995 to 2005 but in some cases where data is not available, shorter time periods have been used and, where necessary, longer time series are shown.

1.5 Main findings

Structural change has indeed occurred in Sweden and the decrease in farms numbers has been more dramatic in the dairy sector (-48,1% between 1996 and 2005) than in the agricultural sector as a whole (-14,3% between 1995 and 2005). The Swedish farm population is ageing and there is a lack of young operators in the sector. The majority of farms are run on a part-time basis meaning that most farmers have an occupation outside the sector which enables them financially to continue farming. Costs of production have risen significantly after EU accession and in combination with decreasing output prices farmers are becoming increasingly dependent on subsidies and other forms of government help. Concentration in the sector has mostly been towards larger farm sizes but some regional concentration is also visible. This has meant that areas which to begin with had less and smaller farms have lost production mostly to the south of Sweden. The study also shows that the special national aid available to the North of Sweden has not managed to significantly slow down structural change in the region.

1.6 Structure of the study

The rest of the study is structured as follows. The second chapter gives an overview of the CAP and how it has evolved during the past 20 years. Chapter 3 describes more in detail the Swedish agricultural sector and specific agricultural policy measures. The existing literature on structural change is reviewed in chapter 4. Chapter 5 contains the analysis on structural change in Sweden based on the reviewed literature and available data. Chapter 6 concludes.

2. Background

This chapter gives a brief overview of the current agricultural policy in the European Union and how it has evolved in the past 20 years. The different aid forms of the common agricultural policy and their effects will be covered and some information on the dairy sector in the EU will be given.

2.1 Birth of the CAP

The common agricultural policy (CAP) of the European Union (EU, formerly the EEC) is a system of agricultural subsidies and programs. The CAP has been a complex and debated issue since its birth in the late 1950s. The objectives of the CAP were first stated in article 39 of the Treaty of Rome signed in 1957. At the time, Europe was suffering from post-war shortages and it needed to find ways of becoming self-sufficient in food and agricultural production. European leaders believed that in order for Europe to prosper and for a common market to be formed, it was vital that it had a functioning agricultural sector and that consumers had a stable supply of food at affordable prices. For a functioning common market, no obstacles to free trade could exist and thus agricultural policy needed to be harmonized on a community level. The five objectives of the CAP in article 39 were: increased productivity, equitable living standards for the farm population, market stabilization, self-sufficiency and reasonable consumer prices. These objectives were in 1962 combined with three principles (a unified market, financial solidarity and community preferences), which together formed the framework for the CAP. The aim of the CAP was to guarantee farmers a minimum price for their products, protect farmers from competition arising from imported products and to subsidize European agricultural exports. In practice, these objectives were achieved through market intervention mechanisms and structural policy measures. (Cardwell, 2004.)

Market intervention in the CAP was done mainly by setting internal intervention prices, using import tariffs and quotas as well as paying direct subsidies to farmers. Several problems arose from the use of interventionist measures, and as laissez-faire type principles became more common, also the CAP price policy mechanisms changed. In the early days of the CAP import

tariffs were flexible and fluctuated with world prices thus leading to a stable internal EU price level. However, tariffs tend to result in inefficiency both on the production as well as on the consumption side and lead to consumers suffering a welfare loss. Intervention prices, on the other hand, initially worked well and boosted agricultural production, but with time the system led to oversupply on the European market. The EU resorted to intervention buying (which drove prices up and allowed the stocks of goods to be sold when supply fell) and to the use of export subsidies. However, intervention buying was very costly and proved difficult to administer. It also raised concerns outside the EU, as EU agricultural products were dumped (i.e. exported at below world market prices) on third world markets leading to a lowering of the world market price and difficulties for producers in these countries.

The EU reached the goal of agricultural self sufficiency but the interventionist measures became very costly in monetary terms and the CAP proved to be beneficial mainly for big farms.[1] In addition the price support mechanism led farmers to produce more than was necessary, as the more they produced the more subsidies they received, but as land is fixed this had to be done through more intensive production. This on the other hand increased the use of fertilizers and pesticides and led to environmental problems.

When the Treaty of Rome was signed, agriculture accounted for approximately 12% of the GNP of the six founding members' economy, and about 20% of the workforce was employed in the agricultural sector (McCormick 2002 p.180). It is paradoxical that agriculture has throughout the years maintained its special role in the EU, though its importance has constantly declined in economic terms. There are, though, several reasons which justify the importance placed on agriculture even today. Agricultural prices fluctuate a lot more than prices of other goods while demand is largely inelastic, thus creating negative consequences for both producers and consumers. In addition, farmers are vulnerable to natural disasters and face constraints that other sectors of industry do not. Today a very important aspect is the consideration of farmers as custodians of the rural environment and as an integral means of sustaining a rural population.

[1] In fact there was no evidence of farm incomes in general becoming more in line with those of other sectors.

2.2 Major reforms to the CAP

During the first 30 years of its existence, the CAP remained largely unchanged. During this period agriculture, however, took a leap forward both in terms of technological changes as well as the EU going from being a net importer of food to a net exporter. There were four clear reasons which increased reform pressures of the CAP in the late 1980s; the budget, external demands, consumer welfare loss and environmental aspects.

The implementation of milk quotas in 1984 was the first attempt to modify the CAP but it was only in 1992 that the first major reform encompassing the whole agricultural sector took place. The MacSharry reform aimed to tackle the issue of the ever growing budget expenditure on the CAP, the growth of so-called "butter mountains" due to overproduction and the pressure from the General Agreement on Tariffs and Trade (GATT) Uruguay Round to reduce agricultural aid. The three main parts of the reform were: reduced intervention prices, compensation through direct payments and the set-aside system. Through this reform farmers could apply for direct payments as long as they agreed to set aside some of their land. The problem that remained was that farmers' compensation was calculated on the basis of a reference yield. This meant that high productivity increased the compensation, thus benefiting large farms more than small ones. The positive effects were a fall in production levels, bringing the EU a step closer to the Uruguay round agreement on agriculture and a gain for consumers in terms of a fall in prices. The Uruguay round agreements introduced the term decoupled support, which means support that is production neutral.[2] Thus, the EU was able with the MacSharry reform to arrive at a partially decoupled support system but more was needed in order to comply with the rules of the agricultural agreements of the GATT.

The Agenda 2000 reform in 1999 was a strategy of the European Commission which covered topics such as growth and employment, the future financial framework as well as the enlargement of the EU. It aimed to modernize the CAP and introduced more measures of regional policy. The 10 countries that joined the EU in 2004 had large primary sectors and it was therefore important

[2]According to this principle, payments that are not linked to the amount produced can be excluded from the requirement to reduce domestic support (Ritson C.,1998 p.200)

to ensure that agricultural production could continue on equal terms in the whole union without inflating the budget excessively. However, the most important achievement of the Agenda 2000 was the emphasis placed on the multifunctional role of farming and the vision of a European model of agriculture. In fact the CAP was now composed of two pillars, the first addressing only support for agricultural products while the second dealt with rural development policies.

In June 2003 the Council of Agricultural Ministers concluded the Mid-Term Review (MTR) of the Agenda 2000 which further modified the CAP. It was a clear continuation of the Agenda 2000 and the MacSharry reforms and aimed to further decrease budgetary expenditure and make agriculture more dependent on market forces than before. The main result was the decoupling of direct payments to farmers (i.e. payments are not tied to the production of specific crops). In order to receive these so-called single farm payments, farmers must comply with food safety, animal welfare and environmental standards (the cross-compliance principle) (Kelch et al. 2004 p.3).

2.3 The dairy sector in the EU

The dairy sector is one of the most strongly regulated sectors in European agriculture. Since the creation of the support system for milk and dairy products in the late 1960s the CAP has been the principal element in determining prices. In 1968 a common market organization for milk and milk products was set up. It included the "classical" elements of the CAP of the time: relatively high support prices sustained by subsidized withdrawal and storage of surplus products, subsidized schemes to dispose of surpluses on the EU market and export subsidies for disposal on world markets. The latest reforms of the CAP have ensured that market forces are now the main determinant of milk prices. This is expected to result in a fall in milk prices, in line with cuts in intervention prices, and becoming more in line with world prices

The importance of the dairy industry can be seen from the fact that it represents roughly 15% of the turnover of the food and drinks industry in Europe (employing about 13% of the total workforce). Milk constitutes 14% of agricultural output in the whole EU thus making it the single most important agricultural product sector. In 2004 milk production was worth ca 43 billion

Euros at farm level. The importance of milk grows even further if one looks at the turnover of the dairy processing sector, which was 117 billion Euros in the same year. Milk is extremely important for the primary sector in Northern Europe where it is the single most important agricultural product from an economic perspective. In Sweden and Finland milk's share of agricultural production (by value) in 2004 was respectively 23.7% and 27.9% (which are among the highest values in the whole EU). (Milk and Milk products in the European Union 2006.)

2.3.1 The milk quota system

The milk quota system was first introduced in 1984 to curb the increasing overproduction of milk products in the EC. Up until then, guaranteed minimum prices were valid for unrestricted quantities. The minimum price level was so high that the whole quantity could not be sold and thus oversupply arose. In addition to this, prices were increased every year in order to compensate for increased production costs and this way the gap between supply and demand became even larger. As the EU-10 was an important player on the world market, the subsidized exports from the EU pushed down world market prices. The lower prices combined with increasing supplies and ever higher guaranteed minimum prices led to the price of getting rid of excess supplies to constitute an increased weight on the common budget. The milk quota system created an effective limit on the amount of milk EU dairy farmers produced each year. Under the quota system if a farmer delivers more milk than his quota in any one year, he can be penalized financially. In 2005 total milk quotas in EU-25 were 137 340 928 tons.[3] Even though the EU has in several instances tried to get rid of the milk quota system it has now been decided that it will continue until the year 2015. (Milk and Milk products in the European Union 2006.)

2.4 Public opinion and the CAP

Even though the CAP has been criticized widely especially by countries outside the EU, the general opinion in Europe towards agriculture and support to this sector is very positive. According to the latest Eurobarometer study on the public's opinion of agriculture, 89% of the respondents said that agriculture and rural areas are important for the future of the continent.

[3] Sweden's milk quota is 3352545 tons for the year 2009-2010. (SJV)

Interestingly the highest positive responses were found in the Nordic countries. In Finland and Sweden respectively 57% and 50% of the respondents found it to be very important. An interesting phenomenon was also that only 17% of the respondents thought that the agricultural budget was too high. The main priorities of the CAP according to EU citizens are very much the same as during the formation of the CAP; ensuring reasonable consumer prices, ensuring the health and safety of food products and providing a fair income for farmers. (Eurobarometer 2008.)

3. Agricultural production in Sweden

This chapter looks more in detail at the structure of the Swedish primary sector as well as at agricultural policies and their effects before and after EU membership.

3.1 Structure of the Swedish primary sector

Even though Sweden is a vast country (449 964 km^2) only ca. 6,5% of its surface is arable land. This is due to the fact that half of the land area is covered in forest and a third is mountainous or water area. Climate is an important factor in agricultural production, and even though Sweden has certain disadvantages due to its northern location the southern part of the country has a very favorable climate for agriculture. In fact 60% of the arable land is found in southern Sweden where the growing period is nearly 100 days longer than in the northern region of Norrland.

Crop production in Sweden is mainly dominated by wheat, barley and oats but 44% of the land is used for leys. Due to the differing climatic conditions in the country leys make up most of the arable land in the north of Sweden, while cereal production is carried out in the south. Potatoes as well as other root vegetables are grown throughout the country, whereas sugar beet is grown only in the very south.

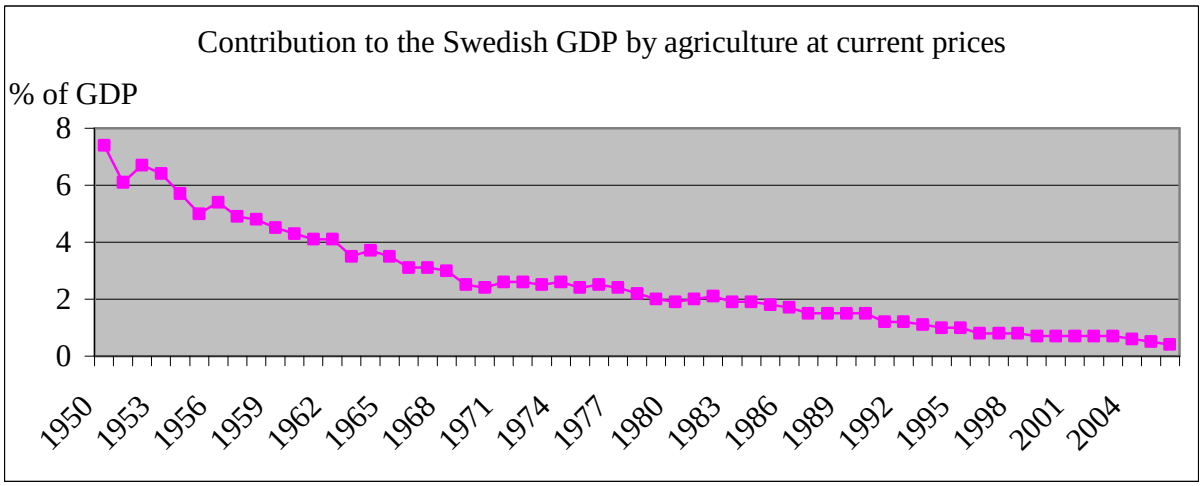
The dairy sector plays a very important role in Swedish agriculture even though the number of dairy cows has been decreasing over the past decades. However dairy yields per cow have grown and there has also been an increase in beef cattle rearing. In 2008 there were 22 844 agricultural holdings with cattle, 28% of which had dairy cows. Other important livestock are pigs (approximately 2400 pig farms existed in 2008) and poultry. (SJV 2009.)

In Sweden most farms tend to be family businesses and the majority of work is carried out by only the family members. However, structural change has led to the size of farms growing and small farms aggregating to form larger holdings. Thus the traditional form of family farming is diminishing in importance. Another specific feature of Swedish farming is that one third of all enterprises are so-called combination enterprises, which means that they combine income from

farming with income from related activities. These include for instance forestry, contracting and renewable energy production. It is also increasingly common for farming to be combined with tourism (SJV 2009).

Even though Sweden has a varied primary sector located in all parts of the country, it is important to keep in mind that the importance of agriculture in Sweden has been constantly declining. Graph 3.1 clearly shows the radical change in the importance of agriculture for the Swedish economy as a whole. Even though already in the early 1950s agriculture contributed only around 6% to the GDP the fall especially in the decade from 1953 onwards was significant. The trend is still downward sloping but the pace with which the contribution is declining is a lot slower.

Graph 3.1



Source: data from SJV

3.2 Agricultural policy in Sweden prior to 1995

The priority of Swedish policy makers especially after the II World War was to ensure a certain level of self sufficiency in food production and equitable income levels for farmers. When the industrial sector grew strongly in the 1960s, labor went out of agriculture into other sectors and the role of agriculture diminished. However, with fluctuations in world food prices and fear of food shortages agriculture regained ground in the 1970s and 1980s. Compared to the EU, which

had supply side objectives as the central idea, Swedish policy makers placed already in the 1980s consumer objectives and environmental issues in a central role (SOU 1997:151 p. 18).

The agricultural policy instruments that were in use in Sweden before entry into the EU had many similarities with the CAP at the time. The aim was to reach production, income and efficiency related goals in the primary sector. However, it was never specified how large the agricultural sector should be or how efficiency would be evaluated (Nalin 2000, p. 15). Obviously the income goal was relative, i.e. the income of farmers was to follow that of industrial workers. With the growth of wages and labor demand in the secondary and tertiary sector, the primary sector had to be supported financially in order to ensure that production would continue. The main policy used to achieve this was price support combined with export subsidies and import levies to protect producers from competition arising from international producers. In addition, similar policies as in the EU existed for specific product groups (e.g. milk and sugar quotas as well as set-aside schemes for grain production).

3.2.1 The agricultural reform of 1990

In the late 1980s it became clear that price policies were not the ideal tool to boost Swedish agricultural production as it mostly benefited large farms in the south of the country and thus increased regional imbalances. In addition "the policy was very costly and inefficient and farmers' incomes could not be politically set as long as people were free to enter and leave farming" (Niemi et al. 2005 p.6). Due to this in 1990 the Swedish parliament decided on a radical reform of agricultural policies. The main idea of the reform was complete internal deregulation of the agricultural market whilst maintaining a level of external protection. In practice price formation for agricultural products would work through market forces while so-called sales guarantees (i.e. a guarantee that all production would be sold at a certain price) were removed. The income goal was taken away as an explicit aim of the policies. External protection was maintained but it was expected that tariffs would fall as a result of the GATT negotiations.[4]

[4] For a more detailed description of the reform and its effects see Rabinowicz (2004).

The reform had many points in common with the MacSharry reform, as it included for example compensation for farmers who took land out of grain production in order to decrease the amount of farmed land. Differing from the CAP reforms of the time, the Swedish reform included concrete goals for environmental protection and maintenance of biodiversity. The leading thought in the reform was that the primary sector should be treated just like all other sectors and that particular subsidies and aid would only be given if agricultural production produced collective benefits (Nalin 2000). However, as Sweden applied for EU membership in 1991 and became a member in 1995, the agricultural reform was never fully completed. Compared, though, to the EU as a whole, Sweden managed due to this reform to move to a more market oriented approach in agriculture policies.

3.3 The effects of the CAP on Sweden

The main effects of market integration on agricultural production are seen as changes in agricultural output and input prices. These consequently affect the volume of agricultural production and the level of foreign trade in these products. As pointed out by Niemi et al. (2005 p. 7) it indirectly affects the structure of the primary sector, the size of the farm population, farm income, production costs, the input manufacturing and output processing industries as well as the overall national economy with its income and resource allocation effects. Considering the structure and productivity of the Swedish primary sector one would expect that after EU membership producers would suffer as a consequence of lower producer prices while consumers would benefit from more trade leading to a larger choice of products and lower prices due to competition. Depending on the competitiveness of Swedish agricultural products, exports could increase or decrease leading to benefits also for the producers.

Due to the reform of 1990 Sweden was relatively well prepared for the change that was to occur in the agricultural sector as a result of EU membership. In 1995 when Sweden, Finland and Austria joined the EU, Sweden had in many ways the most favorable position of the three when it came to adjusting to change. The reform of 1990 had brought prices of agricultural goods closer to the EU level and producer subsidy levels were not a lot higher than those of the EU-12. The situation was completely different for example in Finland, where no deregulation process had

occurred and thus the fall in producer prices and subsidy levels was a lot harsher. In many ways Swedish farmers benefitted from the CAP especially in the first years of membership. The 1990 reform would have been a true survival test for many farms but as the reform was never fully implemented the farmers did not have to bear the consequences. Instead the CAP meant for Swedish farmers a reestablishment of e.g. direct payments and milk quotas and did not reduce producer prices significantly, thus leaving them relatively well off. According to Nalin (2000) the CAP has given the agricultural sector more subsidies than what it had received if Sweden had not joined the EU. He also states that membership has most likely led to a larger increase in arable land than what would have occurred if the reform of 1990 had been implemented.

3.3.1 The Nordic Aid scheme

In article 142 of Sweden and Finland's act concerning accession to the EU, a special national aid scheme was laid out, the so-called Nordic Aid scheme. In this article the EU Commission authorized the two countries to grant long-term national aid with a view to ensuring that agricultural activity be maintained in the northern regions of the countries (MTT and SLI, 2007). The reason for this singular scheme was that the areas concerned have special conditions related to the climate, topology and population which may hamper agricultural production. The regions eligible for the scheme are situated above the 62^{nd} parallel in both countries (see map 3 in appendix A), where the growing season is less than 180 days per year, population density is often less than 10 persons per km^2 and topological conditions render the formation of large fields impossible. In 2008 the total level of Nordic Aid in Sweden was 250 million kronor out of which 90% went to milk production and the remaining part to swine and poultry production (SJV 2009). In part 5.5 the effects of the Nordic Aid scheme on structural change will be analyzed.

4. Existing literature on structural change in agriculture

This chapter deals with the existing literature on structural change in agriculture. The aim is to present some of the main results of the studies on the subject both on a general level as well as specifically for the dairy sector.

4.1 Structural change in agriculture

In developed countries during the latter part of the 20th century there has been a constant decline in the number of farms and in the relative importance of farm employment, as well as significant changes in average farm size and productivity. The scale of this structural change has been so large that it has led policy makers and academics to look into the reasons that have led to this and analyze what could be done to reverse the phenomenon.

Structural change in this context implies not only the question of entry into and exit from farming but also changes in the scale and type of farming as well as localization questions and concentration patterns. Economists have tried to analyze for example the reasons that induce a person to enter into the primary sector or to leave it, why certain farms grow and some do not, what leads to concentration of farm business in certain areas and what leads to specialization or diversification of production.

When reviewing the causes that have led to structural change in the primary sector on a general level, Tweeten (1984 p.44) concludes that "the major determinants of farm size and numbers have been technology, national economic growth, and off-farm income." In particular, we know that improvements in farming technology lead to more efficiency in production and thus to a fall in the amount of labor needed. Economic growth tends to move resources from less productive sectors into more productive ones, which in the case of developed countries can be seen especially as a contraction of the primary sector and growth of the tertiary sector. Thus, farm workers who were made redundant through technological change were able to find work in other sectors. Off-farm income, as will be seen below, is the most debated one of the three as it has two opposing effects. On one hand the opportunity cost of farming rises if off-farm earning

possibilities grow, thus leading to exits from farming. On the other hand, high off-farm incomes can induce farmers to engage in other activities but allow them financially to remain in the farming business, leading to a situation known as part-time farming.

4.2 Reasons for entry and exit

There are several studies that in particular look at the entry-exit dynamics in farming and policy measures which affect this process. Several empirical studies analyze the question as a farm-level decision making process. Different characteristics of farms and farm operators in a particular region are used as explanatory variables on which net exit (or entry) rates are regressed upon.[5] The advantage of these types of cross-sectional studies is that data is readily available and they are able to capture well the decision making process of individuals and show contemporaneously the influence of several different factors. The problem with these models is that it is difficult to see the impact of general economic conditions and policy measures. Therefore, some studies model farm level changes on an aggregate (sector and/or regional) level, which gives the opportunity to see changes over longer time periods and across regions. However, these models often lack the detailed explanatory power of the farm-household models. Independent on the type of model framework used, some general conclusions can be drawn from the existing literature.

Breustedt and Glauben (2007) study the exit process from farming of Western European farmers during the 1990s, combining both farm characteristics and macroeconomic variables. They find that net farm exit rates decrease with larger farm size, higher output prices and higher subsidies. These results seem straight forward as larger farm size increases the opportunity cost of quitting farming while higher output prices and subsidies increase profitability. When looking at individual specific factors, they find that older farmers are less likely to exit farming voluntarily than young farmers. This indicates that younger farmers might have an easier time finding work outside the primary sector and are also more willing to do so than older farmers. The authors also find that having family members work on the farm decreases exit rates, which points to the possibility in this case to find a successor for the business inside the family. A high level of off-

[5] Considering individual characteristics of farmers and the farm family is especially important as most farms tend to be family businesses.

farm income is seen to reduce exit rates slightly, but the theory on this remains controversial. In addition they find that if farmers own their farmed land they are less likely to exit, which could be due to both economic as well as emotional reasons (i.e. attachment to own land).

Looking more specifically on the impact of age on entry-exit dynamics, Gale (2003) finds that in the USA there is a significant trend towards the ageing of the farm population and a steady decline in the number of entries by young farmers. He studies age-specific patterns of entry and exit between 1978 and 1997 and shows that the exit rate by operators over 65 years of age fell during this period whereas that by operators under age 65 fluctuated cyclically. He also points out that when the decline in farm numbers slows down it is due to a fall in exits rather than a rebound in entries. Gale concludes that the decline in entries among young farmers can be attributed to two factors: financial entry barriers and higher earnings prospects in nonfarm occupations.

An extension to basic entry-exit models is to look at the expansion and survival of farms that continue business. Weiss (1999) studies the survival and growth of farm households in Upper Austria and finds that initial farm size, off-farm employment status, age, schooling and sex of the farm operator strongly influence farm survival. Weiss shows that the probability of survival is positive for young farmers and negative for farmers over the age of 51 years. Linked to this is the effect of agriculture-specific schooling which has a positive effect both on the growth and survival of farms. Thus younger operators may have additional skills and knowledge of both farming and managing of finances, which older operators lack as they have not had access to similar schooling. In line with similar studies, Weiss shows that a farm with a married operator who has family working on the farm is more likely to survive, due to succession possibilities. Also, the farm is more likely to grow as labor resources are more readily available. The most interesting finding by Weiss is that he claims that there exists a “disappearing middle” in the Austrian farm sector. Often a starting point for this type of studies on the growth rates of farms is Gibrat’s Law of Proportionate Effects, which states that the growth rate of firms is independent of their initial size. Weiss, however, rejects Gibrat’s law and shows that even though initial farm size in Austria has a positive effect on survival and growth, small farms grow faster than larger ones. He states that there does not seem to be an “identical size-growth relationship over the entire spectrum of farm sizes” but rather a “polarization of growth rates towards two centers of

attraction" (p.112). In other words, farms tend to either be full-time farms which are growing or part-time farms which are decreasing in size as off-farm work increases. Thus, Weiss sees multiple job holding as a key factor affecting structural change in agriculture.

As mentioned earlier there is however still controversy on the effect of off-farm income and part-time farming. Kimhi (2000) studies work choices of farmers in Israel (i.e. whether they work full time on the farm, part-time on the farm or full-time off the farm). He finds, contrary to Weiss, that "farmers view off-farm work, especially in a full-time job, as a stable long-run combination with farming rather than a step in the way out of agriculture" (p.46). Similar results are obtained for the US by Goetz et al. (2001), who conclude that off-farm income stabilizes total farm household income and thus decreases the probability of exiting from farming. However, they also show that if a region is already suffering from a net loss in farms, off-farm income is likely to accelerate the loss of farms in these regions. Thus, there is no clear cut answer to the effects of off-farm income.

4.3 Structural change studies on dairy farming

Studying changes in dairy farming is interesting due to the dairy sectors importance in overall agricultural production as well as due to the fact that changes in dairy farming have significant effects on land use (i.e. the amount of grazing land available), production of beef and most importantly on the domestic food sector.[6] As the reasons for entry-exit dynamics seen above are applicable to most agricultural production sectors, studies on dairy farming tend to concentrate on other issues. Among these several studies have been done on the concentration patterns in the sector, the effect of specific dairy policy measures as well as the reasons that lead dairy farmers to switch or diversify production into e.g. beef or fodder production. In the case of entry exit dynamics an important question in the dairy sector are productivity measures such as the average milk yield per cow, as well as the importance of sunk costs. Dairy farms are in fact characterized by a high level of sunk costs as investments into milk parlors and other equipment needed for

[6] For example in Sweden the food sector is an important employer and a significant component of the economy and most agricultural inputs come from domestic producers. In the case of dairy products 98% of all butter, milk, cream and yoghurt produced are domestically consumed and thus there exists a clear interdependence between dairy farming and the food sector. (Gullstrand 2005).

milk production cannot easily be recovered if the farmer decides to exit the sector or switch production.

Foltz (2004) studies precisely the question of entry and exit into and farm growth in dairy farming in the US. His model hypothesizes that farm exits depend negatively on price levels, current capital and level of technology whilst they are positively influenced by price variances and the value of the returns to non-farm capital. He shows that higher levels of productivity of the cows on a farm lower exit probability, whilst the size of the farm (measured as the number of cows) is insignificant. Thus, farm size is per se not a significant determinant to exit but low milk yields which indicate inefficiency in production do have an effect. This is an especially interesting point for the case of Nordic countries where the size of dairy farms tends to be relatively small. Foltz also states that "farmers facing sunk investment costs are less likely to either enter or exit the industry or respond to increases in output price levels with more capital investment" (p.597). Due to this reason, it can be argued that dairy farmers would benefit from extra price support in order to continue farming or to initially enter the sector. Foltz shows that in the case of Connecticut dairy farms, the establishment of a price floor for dairy products did help to maintain dairy production in the region but it did not significantly affect farm size. Policy measures of this type also often end up being very costly and therefore their usefulness can be questioned.

In geographically vast countries such as Sweden an interesting question is localization, i.e. why some types of farms cluster to certain areas and why some are more spread out. Obviously this is often due to climatic reasons but in the case of dairy farming this is not the case, as it can well be practiced in most types of climates. Gullstrand (2005) shows that in Sweden the economic environment in close proximity to farms is an important factor in determining growth and survival of farms and helps to explain regional farming patterns. He finds that dairy farms in the close proximity to an economic center grew more slowly or had lower survival rates than those in the periphery. He also shows that regions which are highly specialized in milk production lower the propensity of farms to survive. Thus, there seem to be no positive externalities for survival and growth from the clustering of milk farms. However, the farms in a cluster that did survive grew more quickly than farms in less specialized regions. Foltz (2004) finds similar results for

the US, as he shows that a higher number of dairy farms in a town increase growth probabilities of farms.

An interesting study from the point of view of Sweden is done by Flaten (2002) who studies structural change in dairy farming in Norway. By using a simulation model on alternative rates of structural change (i.e. showing scenarios for different growth levels of farm size) he studies in particular the social costs of structural change and its impacts on rural employment. He shows that compared to the present structure of Norwegian dairy farms, an increase in farm size and a reduction in farm numbers would reduce employment to 85% of the present level. This would be especially detrimental for rural areas located far from urban centers as many of the smallest farms are located there and represent a large share of total milk production. The survival of small dairy farms is thus very important for maintaining rural populations, economic activity and social wellbeing in sparsely populated regions. Therefore even though increasing dairy farm sizes would in the long-run lead to cost savings, the social impacts of this process would be so large both on the rural population as well as for the environment, that it is questionable whether it is a situation that should be striven for. The difficulty lies in finding policy measures which would both lead to more efficient production and cost saving whilst maintaining the possibility also for smaller farms to survive. Clearly in the case of dairy farming in the Norway (as well as in Sweden and Finland), irrespectively of size the farms will not be internationally competitive. Therefore, Flaten states that "farming can only be maintained as long as its contribution to society is perceived as positive and paid for" (p.439).

4.4 Structural change and concentration of production

Two branches of literature are used to study concentration; traditional trade theory and new economic geography. The traditional Ricardian theory states that a region will specialize in the production of a product in which it has a comparative advantage and will trade this product with other regions which are specialized in the production of other goods. This implies that differences in factor endowments and technology affect concentration patterns. In today's world where economies tend to be diversified the Ricardian theory does not hold as such but in the agricultural sector it is still applicable. Even though labor and capital are mobile, land is not, and this

combined with climatic conditions will initially determine where farming is practiced. However, what is more interesting to analyze is whether these so-called agricultural regions are growing or not and why this might occur.

Recent studies by Brülhart et al. (2005) and Gullstrand (2004) show for Europe and Sweden respectively, that agriculture is the most concentrated economic sector. These studies show that agriculture is geographically very concentrated but not in relative measures (i.e. concentration relative to aggregate employment). This is in line with Krugman's (1991) study that industrialized countries tend to become differentiated into a manufacturing core and an agricultural periphery due to the existence of demand and supply linkages which cause monetary externalities. From a policy maker's perspective the question that thus arises is not whether this phenomenon can be reversed but how it can be slowed down. This is also the idea behind EU's regional policy measures (and special aid measures such as the Nordic Aid scheme), which aim to give support through various programs to less densely populated areas where the economy is not growing.

5. Structural change in the Swedish agricultural sector

This chapter will analyze the structural change that has occurred in the Swedish agricultural sector after Sweden's EU accession and the specific traits of agricultural production in Sweden that might have led to this. Geometric estimates that analyze the future of farming in Sweden will be made both on a general level as well as more specifically for the dairy sector. The end of the chapter is devoted to the study of concentration patterns and their implications in Sweden.

5.1 Background

A significant structural change has been going on in the Swedish primary sector for a long time. In fact for the past 40 years the number of agricultural holdings has been decreasing continuously. In 1961 the number of holdings was 232 920 (Jordbruksstatistisk årsbok 1980) whilst in 1991 it was only 93 554. After EU accession this trend has continued. In 1995 there were 87 305 holdings and in 2007 72 609, which means that during this period nearly 17% of farms ended production. It is difficult if not impossible to say how large the decrease would have been if Sweden had not been an EU member and subject to the CAP. However, many studies have shown that Sweden is better off as a member of the EU and that structural change might have been more dramatic if Sweden was outside the scope of the policies of the CAP (MTT and SLI 2007, Nalin 2000).

Chapter 4 showed that there are several reasons which affect entry and exit into farming. More in general we can say that it is the interrelationship between so called push and pull forces that affect the rate of structural change. Factors which operate within the agricultural sector (e.g. production costs, demand for agricultural products) push farmers into the sector or out of it, whilst alternative employment opportunities and the external economic environment pull resources out from the primary sector.[7] We will begin by looking at the changes to the operational environment of farmers during the period 1995-2005 that have influenced structural

[7] For a more detailed discussion on the effect of push and pull forces in agriculture see Bolin et al., 1977.

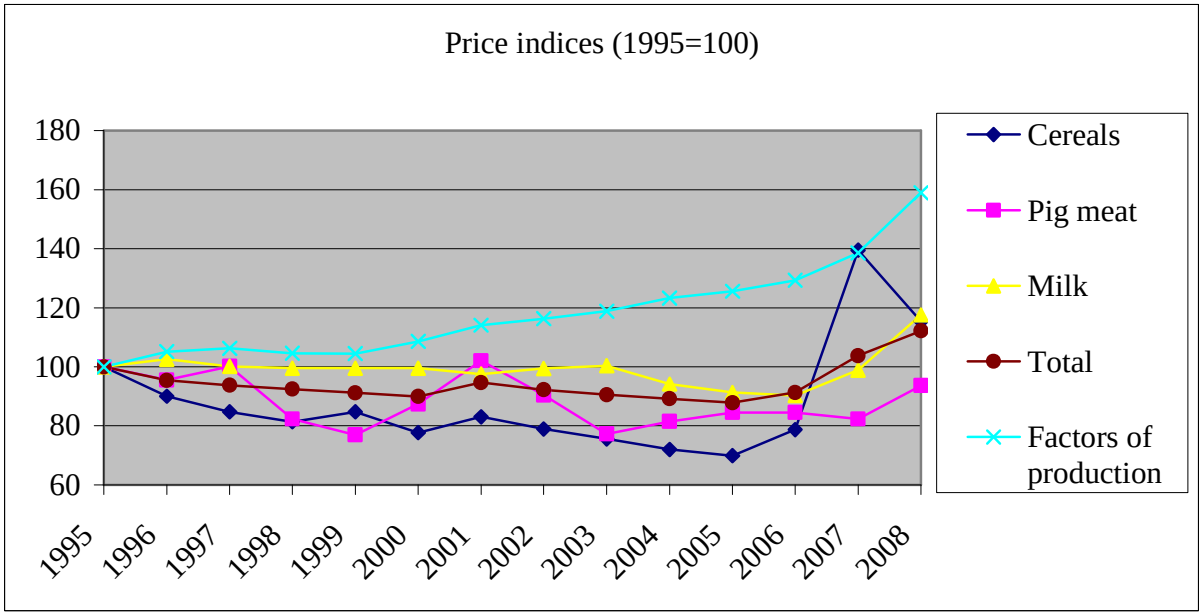
change and then continue by looking more in detail on structural change through changes in farm numbers and estimates for the future.

5.2 The operational environment

5.2.1 Output and input prices

The prices in Sweden for factors of production in agriculture in 2004 were on average 28% higher than in 1994, whilst producer prices for agricultural products decreased on average 12% (Statistikrapport 2005:5). Graph 5.1 depicts the producer price index (i.e. farm output prices excluding direct support) for specific products as well as the input price index for factors of production used in agriculture in Sweden from 1995 to 2008. This gives a much more dismal picture than the above. The prices of factors of production appear to be nearly 60% higher today than in 1995 due largely to a significant rise during the past four years. The rise in the input price index is mainly due to increases in construction costs as well as energy costs. Both of these affect investments in agriculture and therefore a continuous rise in these will hinder especially smaller farms from expanding production. During the same period there has been a downward trend in the producer prices for all product categories. However, during the last few years there has been a significant rise especially in the price of cereals. Cereal prices fell following the Agenda 2000 reform (which cut the intervention price of cereals) but picked up again after due to structural factors such as the global rise in food demand, a fall in cereal stocks of the EU as well as adverse climatic conditions.

Graph 5.1



Source: Own calculations based on data from SJV

The sharp rise in input prices combined with a significant fall in output prices was most likely a major reason for the large number of exits from farming during the period 1995-2005. Now nearly 15 years after EU accession, farmers have adapted to the large difference between output and input prices and know that subsidies are in place to curb the difference between the prices. However, as more and more production is decoupled, farmers base production decisions increasingly on prices. Therefore, if these price trends continue, production in Sweden is likely to shift increasingly away from animal husbandry to crop production.

5.2.2 Price of agricultural land

The price of agricultural land in Sweden has risen steadily after EU accession. The price of agricultural land will in general grow faster in prospering agricultural areas than in areas where agricultural production is in decline. Therefore, we can also expect that in areas where the price of land has risen quicker than the average, there has been growth in the number of holdings or in their size. Graph B.1 in the appendix depicts the agricultural land prices in Sweden's agricultural production areas. It shows that there has been a constant increase in the prices in all agricultural

production areas. However the sharpest rise has been in the Gss area in the very south of Sweden and the trend is that the higher northwards one moves, the cheaper land prices become.
However, interestingly when looking at the percentage change in agricultural land prices (table B.1 in appendix) it becomes clear that the largest increase during the period 1995-2005 has been in the north of the country in Norrland followed by the central parts of the country. In addition, in all areas the price change has been larger during the period from 2000-2005, in the case of Norrland it was 15 fold compared to 1995-2000. This price rise is most likely due to the rise in cereal prices and due to the decoupling of subsidies, which came into force in January 2005. Decoupling meant that land which earlier was not entitled to subsidies (e.g. grazing land) could now receive subsidies. These trends have consequently induced farmers to increase crop production and land use. It is also important to note that the amount of rented fields has risen constantly since 1995. In 2007 of the 3 135 516 ha of total agricultural land in Sweden 1 229 701 ha (39%) was rented out. On average since EU accession, rents on agricultural land have risen by 61% and just as in the case of agricultural land prices, the rents in the south of Sweden are on average 10 times higher than those in the north.

5.2.3 Labor and income structure in the primary sector

The importance of considering effects of age and the use of family labor as well as the implications of off-farm income on structural change were shown in chapter 4. The age distribution of Swedish farmers has remained constant during the past 20 years and is homogenous throughout the country. Approximately 20% of farmers are over 65 years of age whilst the second largest group is farmers between the ages 35-44. However, the problem for the future lies in the fact that in addition to a general fall in the number of new farmers entering the sector, in particular the number of young farmers (between the ages 25-34) has been declining during the past 15 years.

As farms in Sweden have traditionally been small in size, they have mostly been run by families and outside help has only been used during the third quarter of the year when harvesting occurs. From the data in table 5.1 we can show that the use of non-family workers has fallen by 50% during 1995-2005 whilst the use of family members has risen by 20%. This could be a result of

holders wanting to cut down on costs and thus using less outside labor. For the future this is a positive phenomenon, as successors for farms are more likely to be found within the family and they will already have the needed skills to continue the business. An interesting observation is that the amount of women working on farms has remained very much the same during the period in question and thus it is mainly men that have left farming.

Table 5.1

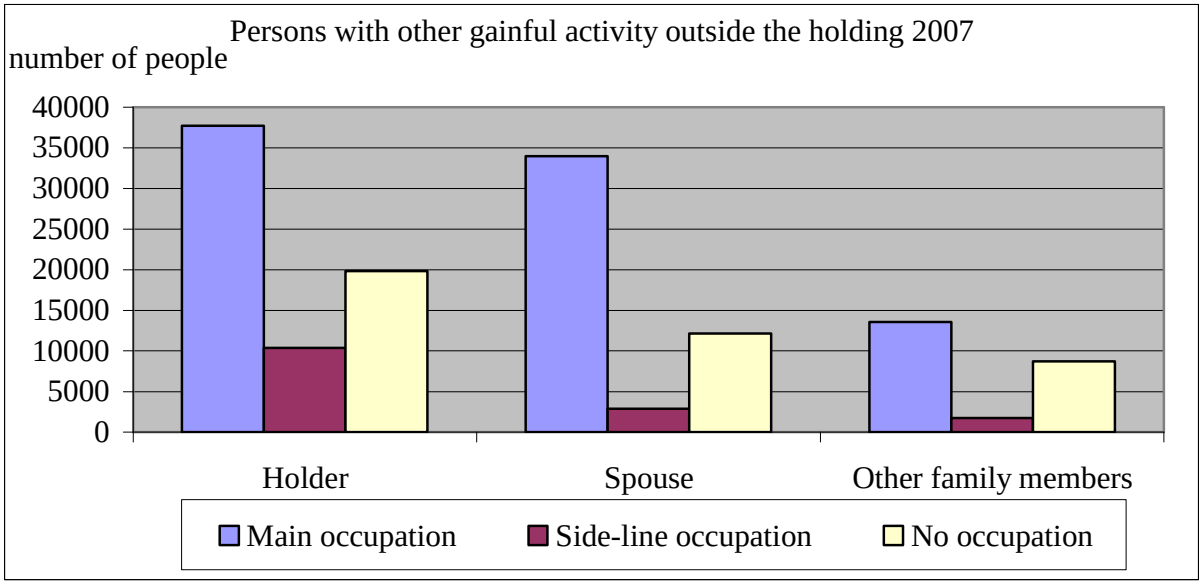
Number of people employed in holdings owned by natural persons						
	1995			2005		
	Men	**Women**	**Total**	**Men**	**Women**	**Total**
Holders	76192	7236	83428	61977	8744	70721
Spouse or other family member	13417	38135	51552	23277	38703	61980
Permanent non family worker	10380	3912	14292	5326	1785	7111
Total	**99989**	**49283**	**149272**	**90580**	**49232**	**139812**

Source: Data from SJV

The effect of off-farm income has ambiguous effects on structural change. On the one hand it is likely to stabilize household income and thus be an important aspect for the survival of farm families but it can also be an easier way out from farming. When looking at graph 5.2 it becomes clear that farming in Sweden is the main occupation of only a handful of people and that it is necessary for income reasons to have other sources of income outside of farming. In 2007 of all the holders and their family members that worked in holdings that were run by private persons, 60% had an occupation outside of farming as their main occupation. This statistic gives indirectly some evidence of Weiss' (1999) theory of a disappearing middle, as there seems in Sweden to exist two types of farms; a large number of part-time farms and a smaller number of full-time farms. The part-time farms tend to be smaller in size and run fully by the family whereas the growing number of large farms (with over 100ha of land) are owned by legal persons and run largely by non-family workers. In 2007 approximately 34% of holdings were classified as small sized holdings, which mean that they require less than 400 hours of work annually and could thus be run on the side of a full-time job outside the sector.[8]

[8] 1800 hrs/a are used as a measure of full time work in Sweden.

Graph 5.2



Source: Data from JO 30 SM 0801 (2008)

5.3 Number and size of agricultural holdings

After having seen some of the changes that farmers face in the operational environment it is natural to look more closely at what has actually happened to the number of farms in Sweden and what the future holds. As in most industrialized countries, also in Sweden the number of farms has decreased but the average size of farms has increased. This trend has led to a change in what is produced and to concentration of production.

In order to study the on-going and future development of structural change a geometric estimate of how the number of farms is expected to change in the coming years is constructed. This type of an estimate assumes a continuation of past trends (i.e. a similar rate of decrease) in the future. As the data used covers the period 1995 to 2005 we are able to estimate the number of farms in 2015. It is clear that the rate of change of the number of farms can vary a lot between years. However, over longer time periods geometric series manage to estimate well the level of structural change (Lehtonen et al 2005). It is important to note, though, that geometric estimates are very sensitive to the baseline data i.e. adding or subtracting one year to the initial dataset can radically affect the projection. Therefore, a projection based on a geometric estimate will not give

an exact account of what the number of farms will be in the future but rather an idea of the direction of change that can be expected if the economic environment remains more or less the same.

Table 5.2 shows the change in farm numbers in the main agricultural production groups. There has been a radical decrease in the number of livestock farms whilst the number of crop farms has risen substantially. Often livestock farms do not close down completely but rather switch to more profitable production forms such as crop production, thus contributing to an increase in the number of crop husbandry farms. Looking more closely at the yearly changes in the number of holdings it was found that the average yearly change during the period 1995-2005 was + 4,9% for crop husbandry, - 4% for animal husbandry, - 1,7% for mixed farming, - 2,3% for small sized holdings and - 1,5% for agricultural production in general. Using both the overall percentage change and the average yearly percentage change an estimate for 2015 was constructed. According to this the total number of agricultural holdings would be approximately 65000 and half of the farms would be specialized in crop production. This is a significant change from 2005 when the shares of crop production, animal husbandry and small sized holdings were more or less equally important.

Table 5.2[9]

Number of holdings by type of farming

				% change	**Estimate for 2015**	
	1995	**2000**	**2005**	**1995-2005**	**Using the overall % change**	**Using the average yearly % change**
Crop husbandry	12887	21377	20843	61,7	33711	33629
Animal husbandry	36607	29710	24322	-33,6	16160	16170
Mixed farming	6819	7085	5715	-16,2	4790	4815
Small sized holdings[10]	31369	18938	24928	-20,5	19810	19753
Total	87682	77110	75808	-13,5	65542	65174

Source: Own calculations based on data from SJV

[9] This statistic includes farms with more than 2,1ha of arable land or holdings with large animal stocks.
[10] These include all farms which require less than 400 standard man-hours of labor.

For the purpose of this study it is interesting to look more closely at the changes in the number of agricultural holdings on a regional level. From table 5.3 it becomes clear that structural change has not been a homogenous process in the whole country, and in the county of Stockholm the number of agricultural holdings has actually increased during the period in question. In all the counties structural change was significantly faster during 1995-2000 than in 2000-2005 and in 6 of the 21 counties there was an increase in the number of agricultural holdings during the period 2000-2005. This difference in the rates of change could be due to farmers reacting more strongly initially after EU accession, while the situation stabilized once the effects of the CAP became clearer. Regionally the fastest change in the number of holdings has occurred in the county of Norrbotten, which would indicate that the Nordic Aid scheme has not managed to significantly curb exits from farming. However, it is interesting to note that structural change has also been significant in the southern counties of Skåne and Halland, which traditionally are considered the best agricultural areas in Sweden.

Table 5.3[11]

Number of agricultural holdings by county

County	1995	2000	2005	% change 1995-2005	% change 1995-2000	% change 2000-2005	Average yearly % change 1995-2005	Projection for 2015 [12]
Stockholm	1873	1825	1942	3,7	-2,6	6,4	0,3	2001
Uppsala	2993	2775	2659	-11,2	-7,3	-4,2	-1,1	2380
Södermanland	2261	2162	2149	-5,0	-4,4	-0,6	-0,5	2044
Östergötland	4002	3725	3539	-11,6	-6,9	-5,0	-1,2	3136
Jönköping	4465	4079	3844	-13,9	-8,6	-5,8	-1,5	3304
Kronoberg	3142	2745	2593	-17,5	-12,6	-5,5	-1,9	2140
Kalmar	3869	3549	3359	-13,2	-8,3	-5,4	-1,4	2917

[11] This statistic includes only farms with more than 2,1 ha of arable land.
[12] Using the average yearly %-change during the period 1995-2005.

Gotland	2068	1794	1667	-19,4	-13,2	-7,1	-2,2	1335
Blekinge	1622	1453	1381	-14,9	-10,4	-5,0	-2,1	1117
Skåne	11700	9876	9513	-18,7	-15,6	-3,7	-2,1	7694
Halland	4484	3854	3646	-18,7	-14,0	-5,4	-2,0	2971
Västra Götaland	17661	15713	15013	-15,0	-11,0	-4,5	-1,6	12777
Värmland	4504	4026	4160	-7,6	-10,6	3,3	-0,8	3839
Örebro	2806	2649	2598	-7,4	-5,6	-1,9	-0,8	2397
Västmanland	2455	2339	2262	-7,9	-4,7	-3,3	-0,8	2087
Dalarna	2677	2352	2396	-10,5	-12,1	1,9	-1,1	2145
Gävleborg	3284	2871	2845	-13,4	-12,6	-0,9	-1,4	2471
Västernorrland	3151	2574	2619	-16,9	-18,3	1,7	-1,9	2162
Jämtland	2525	1950	2082	-17,5	-22,8	6,8	-1,9	1719
Västerbotten	3615	2834	2974	-17,7	-21,6	4,9	-1,9	2455
Norrbotten	2148	1653	1622	-24,5	-23,0	-1,9	-2,5	1259
Whole country	87305	76798	74863	-14,3	-12,0	-2,5	-1,5	64362

Source: Own calculations based on data from SJV

It is not only interesting to look at the change in the number of holdings but also at the change in the size of holdings. Between 1995 and 2005 there has been a significant increase in the amount of large holdings (i.e. with over 100 ha of arable land) (table 5.4). However, contemporaneously the number of holdings with less than 5,1 ha of arable land has risen, while the number of holdings in all other size groups has fallen. This once again highlights the fact that there is a significant amount of small farms run on a part-time basis and likewise a fair amount of large sized holdings which are run on a full time basis, but that mid-sized farms are disappearing.

Table 5.4

Number of agricultural holdings by size of arable land

	1995	2000	2005	% change 1995 -2000	% change 2000-2005	% change 1995-2005
2,1-5,0 ha	12828	11784	14486	-8	23	13
5,1-10,0 ha	16710	14110	14117	-16	0	-16
10,1-20,0 ha	18458	15453	14147	-16	-8	-23
20,1-30,0 ha	10633	8717	7583	-18	-13	-29
30,1-50,0 ha	12834	10624	8862	-17	-17	-31
50,1-100,0 ha	11339	10652	9569	-6	-10	-16
100,1+ ha	4503	5458	6099	21	12	35
Total	87305	76798	74863	-12	-3	-14

Source: Own calculations based on data from SJV

5.4 Changes in dairy farming

Studying changes in dairy farming is of particular interest due to dairy farming's importance in overall agricultural production but also from a regional perspective as milk is produced throughout the country. The dairy sector is also one of the most regulated sectors and thus production is very dependent on specific policy measures such as subsidies. In fact milk production receives more than 90% of all the Nordic Aid in Sweden and thus it is an interesting field of study in order to verify the effects of subsidies on structural change and regional concentration patterns.

In a similar manner to what was done above, the changes that have occurred to the number of dairy farms during the period 1996-2005 are calculated. Based on these a projection for 2014 is created (table 5.5). In the whole country the number of farms with cows for milk production nearly halved during 1996-2005 and the rate of decrease in most counties was stronger during the latter half of this period. If this trend would continue the number of farms with cows for milk production would only be 4438 in 2014. The rate of change has been surprisingly homogenous throughout the country. It also shows that the extra aid granted via the Nordic Aid scheme has not significantly been able to help farmers in the north remain in business, nor encouraged new

farmers to enter the sector. Once again, though, it is difficult to know how large the decrease could have been if no extra aid was available.

Table 5.5

Number of holdings with dairy cows							
County	**1996**	**2000**	**2005**	**% change 1996-2000**	**% change 2000-2005**	**% change 1996-2005**	**Projection for 2014[13]**
Stockholm	234	179	115	-23,5	-35,8	-50,9	57
Uppsala	546	383	271	-29,9	-29,2	-50,4	135
Södermanland	432	326	234	-24,5	-28,2	-45,8	127
Östergötland	793	699	496	-11,9	-29,0	-37,5	310
Jönköping	1250	1000	750	-20,0	-25,0	-40,0	450
Kronoberg	650	501	362	-22,9	-27,7	-44,3	202
Kalmar	1243	1007	716	-19,0	-28,9	-42,4	412
Gotland	634	518	364	-18,3	-29,7	-42,6	209
Blekinge	278	283	151	1,8	-46,6	-45,7	82
Skåne	1640	1198	799	-27,0	-33,3	-51,3	389
Halland	924	700	490	-24,2	-30,0	-47,0	260
Västra Götaland	3024	2372	1531	-21,6	-35,5	-49,4	775
Värmland	525	371	238	-29,3	-35,8	-54,7	108
Örebro	403	360	190	-10,7	-47,2	-52,9	90
Västmanland	303	133	126	-56,1	-5,3	-58,4	52
Dalarna	553	444	240	-19,7	-45,9	-56,6	104
Gävleborg	620	477	305	-23,1	-36,1	-50,8	150
Västernorrland	584	441	261	-24,5	-40,8	-55,3	117
Jämtland	566	392	267	-30,7	-31,9	-52,8	126
Västerbotten	831	623	427	-25,0	-31,5	-48,6	219

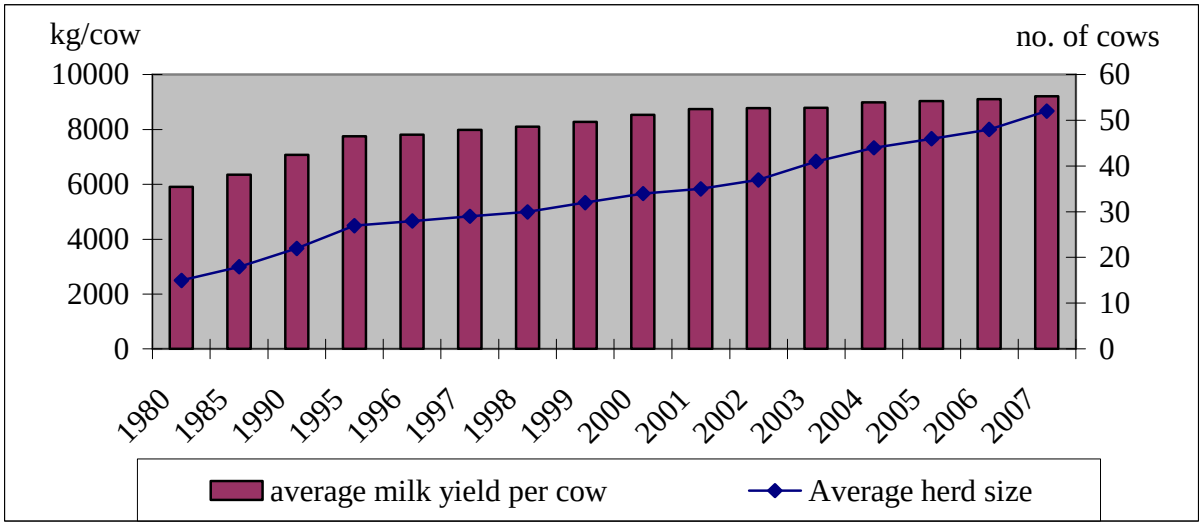
[13] Using the overall % change between 1996 and 2005.

Norrbotten	432	269	215	-37,7	-20,1	-50,2	107
Whole country	16465	12676	8548	-23,0	-32,6	-48,1	4438

Source: Own calculations based on data from SJV

The number of dairy cows in Sweden decreased by nearly 16%[14] between 1996 and 2005 whilst the amount of milk produced only fell by 2%. This indicates that the milk yield per cow has risen and thus fewer cows are needed for production.[15] However, the fall in the number of dairy farms has been far larger than that of milk cows, therefore indicating that the average herd size of the remaining farms has risen (see graph 5.3). Statistics show that it is in fact farms with herd sizes up to 49 cows that have decreased (in absolute terms) whilst farms with herd sizes above 75 cows have increased (Statistikrapport 2005:5) .

Graph 5.3



Source: Data from Svensk Mjölk and SJV

Today the most common herd size in Sweden is 25 to 49 cows, whilst in 1996 it was 10 to 24 cows. More importantly the amount of holdings with large herd sizes, over 99 cows, has

[14] The largest decreases in dairy cow numbers have been in the counties of Västmanland (-38%), Stockholm (-34%), Dalarna (-31%) and Örebro (-30%).
[15] Sweden had the highest milk yield per cow in the whole of EU in 2006 (EU-25 average: 6836kg/cow, Sweden: 8383kg/cow).

increased by 164%.[16] From an economic point of view this is positive as due to economies of scale the total inputs needed per ton of milk decrease when herd size increases, thus reducing costs. However, as today approximately 24% of holdings have herd sizes below 25 cows these will have a harder time competing with larger more cost efficient farms and thus risk having to close down unless they find resources to significantly expand production. Here arises the problem of the considerable sunk costs related to dairy production which often hinder farmers from investing into restructuring and expansion.

5.4.1 Profitability of dairy farms

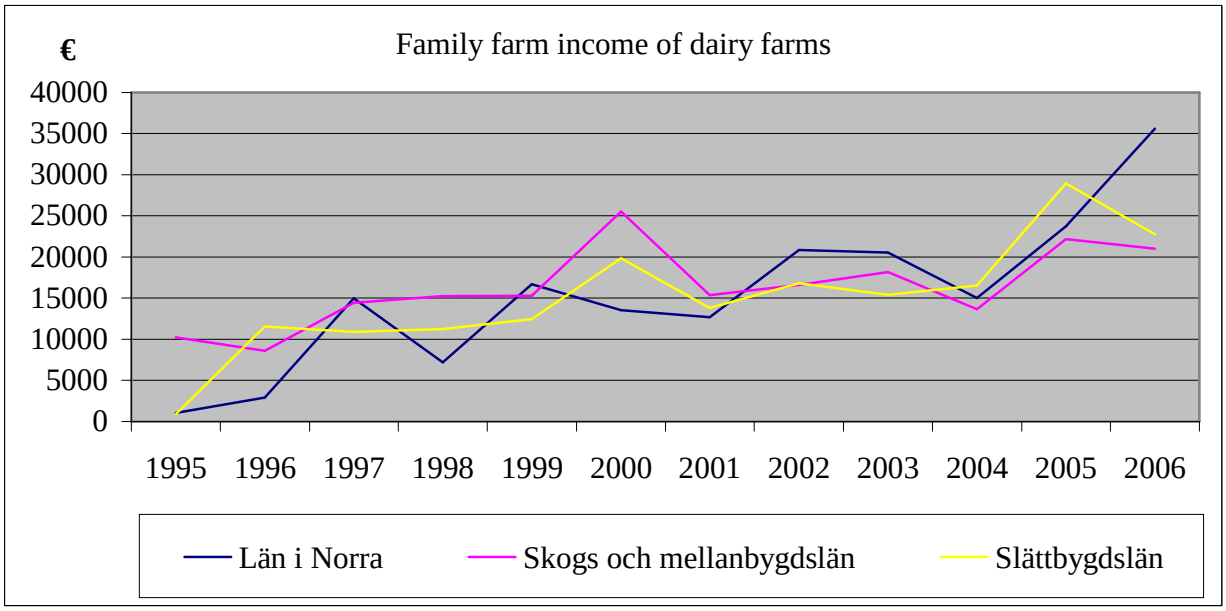
In part 5.2 the costs faced by Swedish farms in general were shown. Tables B.2 and B.3 in appendix B show the costs faced by dairy farms in Sweden for 1995 and 2005 based on data from the FADN. Costs faced by farms have risen significantly during the 10 year period, but once again the biggest increase has been in the cost items energy and construction and machinery. There has also been a large increase in the cost item wages, which highlights the fact that as farms grow in size they employ more outside workers. An interesting fact to note is the amount of feed for dairy cows which is produced by the farms themselves. This is a common trait for dairy farms, which often have high degrees of vertical integration (i.e. raising inputs, such as feed crops and replacement heifers, for use in their own production thus creating value-added within the farm and cutting costs) (Sumner et al. 2002). Some of rise in costs can be compensated for by the steady increase in the productivity of labor (see graph B.2 in appendix B). It is important to note, though, that high milk yield and the extensive use of machines on large farms increase this figure. Small farms in Sweden still tend to be largely manually operated and thus cannot reach the benefits of high productivity without increasing herd sizes and making large investments into machinery.

In order to get a clearer picture of the influence of costs and returns on structural change some basic financial ratios of Swedish dairy farms will be presented. The result of a farm business is often measured by family farm income (FFI), which shows what is left to the farm family as

[16] On a global level these are still relatively small herd sizes (e.g. in Australia the average herd size is 280 and in the UK over 100 cows) (Eurostat).

compensation for the fixed factors of production (i.e. labor, land and capital) and as remuneration to the entrepreneur's risks. Graph 5.4 shows that FFI has fluctuated a lot between 1995 and 2006, but after having been under 5000€ in the north and center of Sweden in 1995 it has had a clear increasing trend. Extensive use of outside labor and capital will decrease this ratio, whilst high levels of subsidies will increase it. This could partly explain the reason for the higher FFI in the north of Sweden, where subsidies to dairy production are higher than in other areas. Also farm size tends to be smaller and thus wages and interests paid to outsiders make up a less significant share.

Graph 5.4



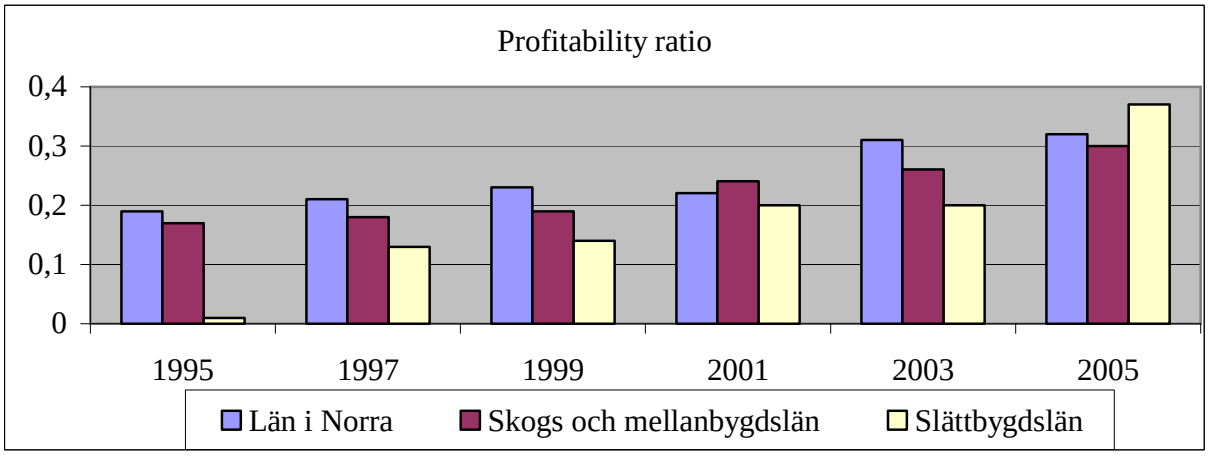
Source: Data from FADN

In order to analyze profitability three different measures are used: return on total assets, entrepreneurial profit and the profitability ratio. Return on total assets shows the annual return that a farmer receives for the capital invested into the business, which means that it tends to be bigger on larger farms.[17] Entrepreneurial profit indicates the profitability of agricultural production by showing what is left as profit to the farm business after the opportunity costs of the

[17] In the case of dairy farms capital also includes arable land and milk quotas.

family labor and interest for own capital is subtracted from FFI.[18] Graphs depicting these two measures are found in appendix B (graphs B.3 and B.4). What is alarming is that both of them are clearly negative and no significant changes have occurred during the 10 year period. This will most likely initially lead to farmers working part-time off farm in order to compensate for the low income received from farming. However, in the long run this will probably result in farmers quitting dairy production, and lead remaining farmers to decrease investments into production expansion and discourage new entrants from entering the sector. The most common measure of profitability is the profitability ratio which is calculated by dividing the FFI by the sum of the farm family's wage and interest claims. It is a good measure as inflation and the size of the farm do not affect it.[19] Graph 5.5 shows that this ratio has increased between 1995 and 2005, especially in the southern parts of the country but it is still significantly below 1 and thus dairy farming cannot be considered profitable.

Graph 5.5



Source: Data from FADN

5.5 Concentration patterns

Structural change in the Swedish agricultural sector has led to a fall in the number of agricultural holdings, in the amount of labor employed in the sector as well as changes in production patterns.

[18] If the entrepreneurial profit is 0 the required compensation for a farm family's own work and own capital has been reached, if the figure is negative the necessary compensation has not been achieved.
[19] If the profitability ratio is equal to 1 a necessary compensation for the wage and interest claims of the family have been reached.

However, a phenomenon that has occurred together with structural change is concentration in production, i.e. regions specialize in the production of certain products and production units cluster together.

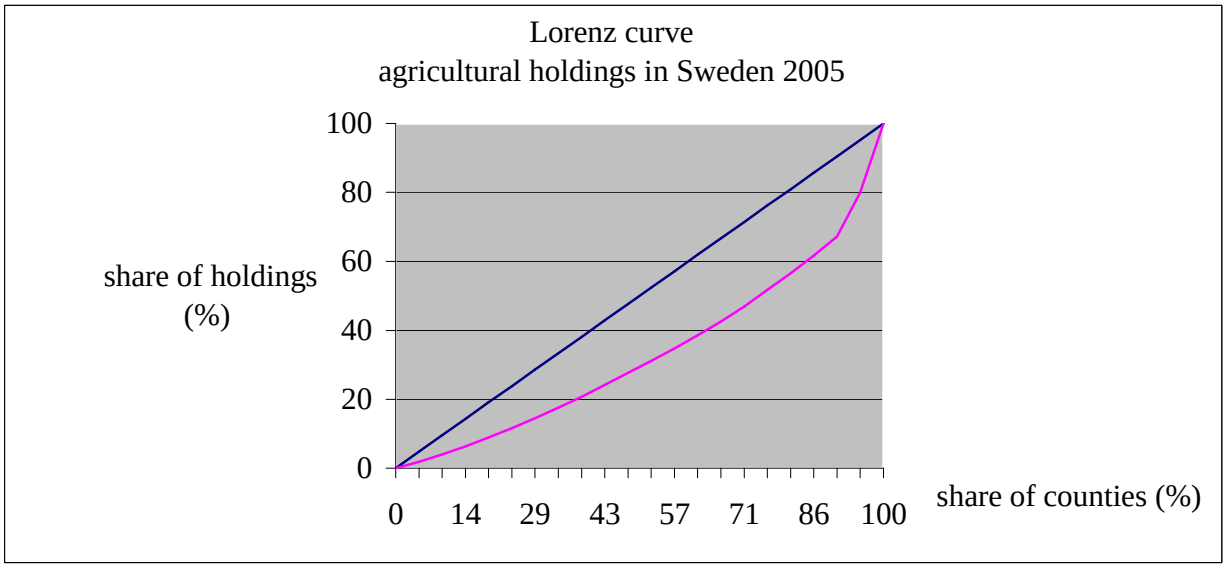
In Sweden's case most emphasis has been put on maintaining a viable economy in the north of the country. Chapter 5 has shown that structural change has not led to significantly larger changes in the number of holdings in the northern counties, but considering that agricultural activity in the region was smaller already to begin with, the consequences of a continuation in past trends could be very harmful. In order to see concentration patterns in Sweden in a more analytical manner we use Lorenz curves and Gini coefficients. Lorenz curves are used to show the distribution of an economic variable in a population by plotting the cumulative distribution function of a probability function over a population. If a variable is perfectly divided between the population the Lorenz curve would be equal to a 45^{o} line. The more concentrated the distribution of a variable is the further the Lorenz curve falls from the 45^{o} line. The area between the 45^{o} line and the Lorenz curve is measured by the Gini coefficient which shows the inequality of a distribution.[20] If the Gini coefficient is equal to 0 (i.e. the Lorenz curve is equal to the 45^{o} line) there is no concentration of the variable and if the coefficient is equal to 1 concentration is maximized.

Graph 5.6 depicts the Lorenz curve for the number of holdings per county in Sweden in 2005. The Gini coefficient for 2005 is 0,335, which indicates that a certain degree of concentration exists in the distribution of agricultural holdings. Interestingly, though, the Gini coefficient for 1995 is 0,344 and hence concentration has not increased during the analysis period. Looking more in detail at the number of holdings per county, it can be shown that the top 5 counties in terms of number of holdings had 48,3% of all the holdings in Sweden in 2005. This figure was 49% in 1995 and 55,6% in 2000. Thus, concentration has actually fallen during the period after an initial rise. The same conclusion can be reached when looking at the distribution of holdings by size of arable land. What is particularly interesting is to see if large farms have concentrated in particular regions. The Gini coefficient showing the concentration of holdings with over 100,1 ha

[20] If the area between the Lorenz curve and the 45^{o} line is A, and the area under the Lorenz curve is B the Gini coefficient is equal to A/(A+B).

of arable land per county was 0,534 in 1995 but fell to 0,471 in 2005, indicating that the large sized holdings were more evenly spread throughout the country than before. Still the coefficient is relatively high and in fact the top 3 counties in terms of number of large holdings had 44% of all the holdings with over 100,1 ha of arable land.

Graph 5.6



Source: Own calculation based on data from SJV

In order to look more in detail at dairy production the above procedure was applied to agricultural holdings with cows for milk production and to the number of cows per county. When measuring the concentration of dairy farms the Gini coefficient for 1996 was 0,348 and 0,368 for 2005. Even though the difference may seem small it clearly indicates that geographic concentration has occurred. By looking at the number of dairy cows, the Gini coefficient shows an increase from 0,379 in 1995 to 0,412 in 2005. Considering the significant overall decrease in dairy farming and the number of cows, concentration seems to be both geographical and also moving production towards bigger farms. The top 5 counties with most dairy farms have retained a constant share of 50% of all dairy holdings during the analysis period. Another indirect indicator of increased concentration is the size of trade in milk quotas. As milk quotas are freely traded in Sweden since

the year 2000 and trade is very active[21] looking at where most quotas have been bought should give and indication of where production is growing and where it is likely to concentrate. Data on milk quota trade shows big increases in quotas for the counties of Kalmar, Halland and Östergötland and equal size decreases for the counties of Södermanland and Örebro. This confirms what has been seen already in the above analysis; dairy production is concentrated more to the south-east of the country where production already previously has been larger in scale.

Directly linked to the concentration of dairy farming is the number and proximity of dairies. Norman et al. (1995) show that there are costs to moving factors of production and final products and the higher these costs are the higher is the incentive to move production away from a particular region. In this case long distances to dairies will increase costs of dairy farmers and on the other hand a dairy will not remain in a sparsely populated area to cater the needs of only a few producers. In Sweden between 1995 and 2005 there was a general decline in the number of dairies and a clustering towards regions with large scale milk producers. Of 12 dairy facilities that were located in the Nordic Aid region in 1995, 3 closed down and no new ones were opened (MTT and SLI 2007 p.49). This is not a larger decrease than in the rest of the country, but the problem of long distances to dairies for milk producers in the north still remains.

5.6 Policy implications and the future of agricultural production in Sweden

The above data and calculations have shown that structural change in terms of a decrease in the number of holdings, size of holdings and concentration of holdings has occurred in Sweden between 1995 and 2005. It also seems that this trend is likely to continue in the coming years. Logically in a sector where costs are high, profits low and expectations of future growth poor, exits of operators will be higher than entries. The literature reviewed in chapter 4 indicated that older farmers are less likely to exit than young farmers, and that young farmers will not enter unless there are significant financial gains to be made. In Sweden, where the farm population is ageing rapidly and entries by young operators are low, this will mean that in the coming 10 years there will be a significant decrease in farm numbers unless earnings possibilities in the sector

[21] Between 2000 and 2004 in total 683 kg worth of milk quotas have changed owners. This is equal to 20,7% of the whole Swedish quota. (Mjölkekonomi 2004)

increase. Thus, even though many farms are run by families, many young family members will prefer to find other employment options and might continue farming only on a part-time basis. In addition, earnings in the agricultural sector continue to grow slower than those in other sectors of the economy thus creating no stimulus for new operators.

A shift towards part-time farms has been a dominant trend in Sweden and in many ways seems to be the form of farming that has enabled farming to continue in many parts of the country. However, even though some studies indicated that this might be a stable and beneficial situation for the sector, it is certain that the agricultural sector cannot survive if most farms are run on a part-time basis. These farms will not have the same incentives or resources to expand production and thus they will most often run inefficiently and will not grow to become full-time farms in the future. It also seems that Weiss's theory of a disappearing middle is a reality in the Swedish agricultural sector and the farms which are growing in size are the farms which were already initially large. Therefore there is no sign of positive structural change occurring, i.e. smaller farms becoming larger and more productive. With increasing prices on factors of production and low output prices the means for farms to sustain profits in the long run is to exploit economies of scale. However in order to reach these, significant investments into production technologies will have to be made.

In the case of dairy farms structural change seems to have been more severe than in the agricultural sector as a whole. Looking at the problems faced by dairy farmers gives a clear picture of the complex issues that policy makers are faced with. Historically dairy farming has been a cornerstone of the Swedish agricultural sector and today, even though the number of dairy farms is decreasing, it is still extremely important as it is directly linked to land use and the domestic food industry. Therefore, on the one hand it would be more cost efficient and productive to increase dairy farm size and concentrate production into large scale holdings in close proximity to dairies. On the other hand, it is important to realize that for geographical (and economic) reasons it can be impossible in some parts of the country (e.g. Norrland) to have large dairy farms, but that it is equally important that dairy farming be maintained there. Survival of farms in these regions enables dairies to survive and thus has a twofold effect on employment. It also decreases the possibility of land abandonment and thus helps to maintain open landscapes.

Therefore, subsidies need to be available not only for large efficient farms but also for smaller farms which do not have high growth prospects.

The CAP policies currently in force as well as those planned for the future are likely to decrease dairy farming in Sweden even further. Decoupling will most likely lead to some existing dairy farms switching to crop production or other forms of animal husbandry while the ending of the milk quota system in 2015 will make output prices fluctuate more. Thus small scale dairy farms will find it increasingly difficult to compete with larger farms and foreign milk producers. It is important here to note, that even though the demand for agricultural products tends to be price inelastic and demand for especially dairy products has been relatively stable, this could change not in terms of quantity but in terms of origin. What needs to be questioned is consumers' willingness to pay for domestic dairy products, i.e. how much more are they willing to pay for domestic produce instead of foreign one. This directly affects the dairy processing industry and thus reflects back on dairy farmers.

The EU agricultural income forecast for 2013 predicts that in Sweden agricultural output will fall by 2% while subsidies rise by +15% thus leading to a small rise in farm incomes (European Commission 2006 p. 15). However, this will not be enough to attract new entrepreneurs into the agricultural sector in Sweden nor will it curb the current decrease in farm numbers. It seems that both the public and policy makers agree that it is vital that agricultural production is maintained in Sweden and that this production should be diversified and spread equally around the country. The big problem is that there may be no one to do the job. Therefore, policies should first and foremost be oriented towards encouraging new farmers to enter the sector and to enhance the possibility of existing small farms to expand production and benefit from economies of scale. This means that subsidies should not only be in place to curb the difference between output and input prices but rather in the form of investment grants, start-up loans as well as special aid for young farmers to receive education on the subject. To ensure that concentration does not increase and that some regions do not die out, it is vital to guarantee a functioning social environment in all regions. Structural handicaps such as a lack of services and slow regional development will not make a region attractive for new settlers nor will it encourage inhabitants to engage in entrepreneurial activities. Therefore, the EU's way of looking at agricultural production in a

bigger framework of regional development and environmental policy is most certainly the right one. However, as regional problems are very different between member states this would indicate that more national decision making power in these questions could be useful.

6. Conclusions

This study has highlighted some of the factors which have affected and will affect structural change in the Swedish primary sector. The research question of this study was how structural change has affected agricultural production in Sweden between 1995 and 2005 and how agricultural production is likely to evolve in the future. The study finds that structural change has led to a decrease in the number of farms (with the decrease being larger in the dairy sector than in other sectors), an increase in the size of farms and to some degree of regional concentration. The number of agricultural holdings is expected to fall to ca. 64 000 in 2015 out of which only ca. 4 400 would be dairy farms and approximately 50% of all Swedish farms would specialize in crop production. The decline in farm numbers is a result of the ageing of the farm population, a fall in the entry of new farmers and agricultural policy measures which affect production patterns. Prices of agricultural inputs have risen by nearly 60% since 1995 while output prices for most product categories have fallen. If prices continue to evolve in this manner the trends in the decline in farm numbers may strengthen further. Approximately 60% of Swedish farmers have an occupation outside of farming as their main occupation. This allows small-scale farming to continue in Sweden but at the same time can make exiting from farming easier and thus lead to a fall in farm numbers in the future. Regional concentration in agriculture has meant that areas which to begin with had less and smaller farms have lost production mostly to the south of Sweden. The study also showed that the special national aid available to the North of Sweden has not managed to significantly slow down structural change in the region.

There are also several other unknown factors outside the domestic economic environment, which were not considered in the analysis and which are likely to affect the rates of change. World market prices of agricultural commodities as well as changes to international agricultural trade policies could have a significant effect on a country such as Sweden which has a comparative disadvantage in agricultural production on a global scale. Climate change can also notably affect production possibilities and therefore improve or hamper agricultural production in Sweden.

Production has to be continuously developed if it is to grow in the long run and be profitable. This means that also agricultural policies (in particular subsidies) have to be flexible and not only address a certain type or structure of production. However, in the case of Sweden there is a trade-

off between emphasizing economic goals in agriculture and rural development goals. From an economic perspective farms should be as productive and as efficient as possible. However, this will inherently lead to a fall in the demand for labor and a fall in the number of farms thus hindering rural development in certain areas. If on the other hand rural development and environmental goals are considered more important, Sweden has to accept that agricultural production will remain inefficient and that a high level of government support is needed. To address these problems Sweden and other EU Member States will have to work closely together and acknowledge the price that has to be paid for agricultural production and rural livelihood to be preserved in the future in all parts of the Union.

This study has looked at some of the factors affecting structural change in Sweden based on the existing literature and on available data. However, a lot more research needs to be done in the field and in particular empirical studies on a country as well as on a regional level would be needed in order to be able to construct appropriate policies for different geographical areas. It would be important and interesting to continue studying the effects of other domestic and international factors (e.g. international trade policies, different forms of subsidies, climate change) and where data is available construct an empirical model and see the effects of single variables as well as the combined effects of different factors. Seeing how the agricultural policies of one region or country affect production in other areas is particularly important in today's economically integrated world.

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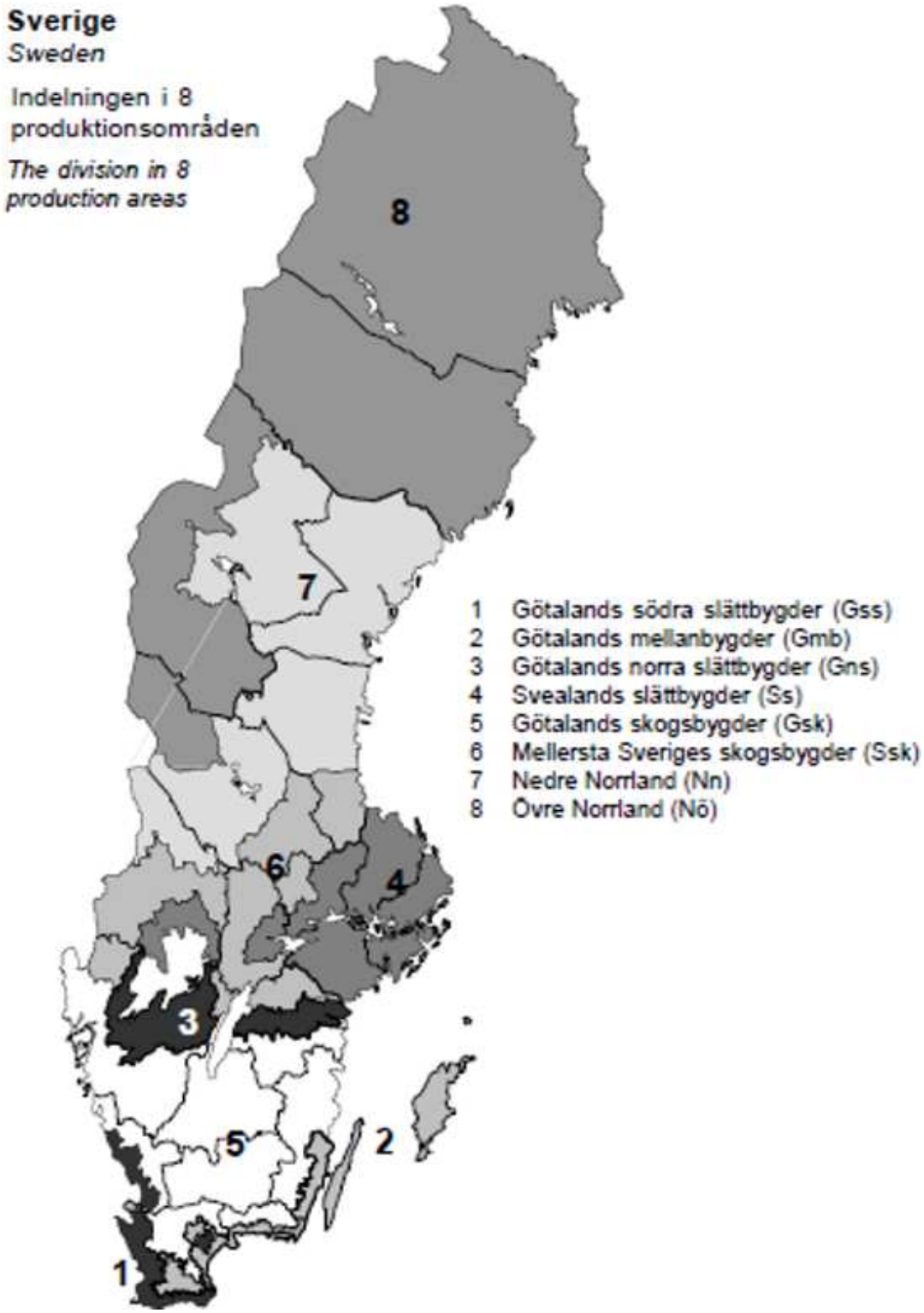
SJV statistics database, available from:
<http://statistik.sjv.se/Database/Jordbruksverket/databasetree.asp> (accessed 1st-31st July 2009)

Appendix A

Map 1 The counties of Sweden[22]

[22] Source: http://www.lst.se/vastragotaland/Lattlast/vad_ar_lansstyrelsen.htm

Map 2 Agricultural production areas[23]

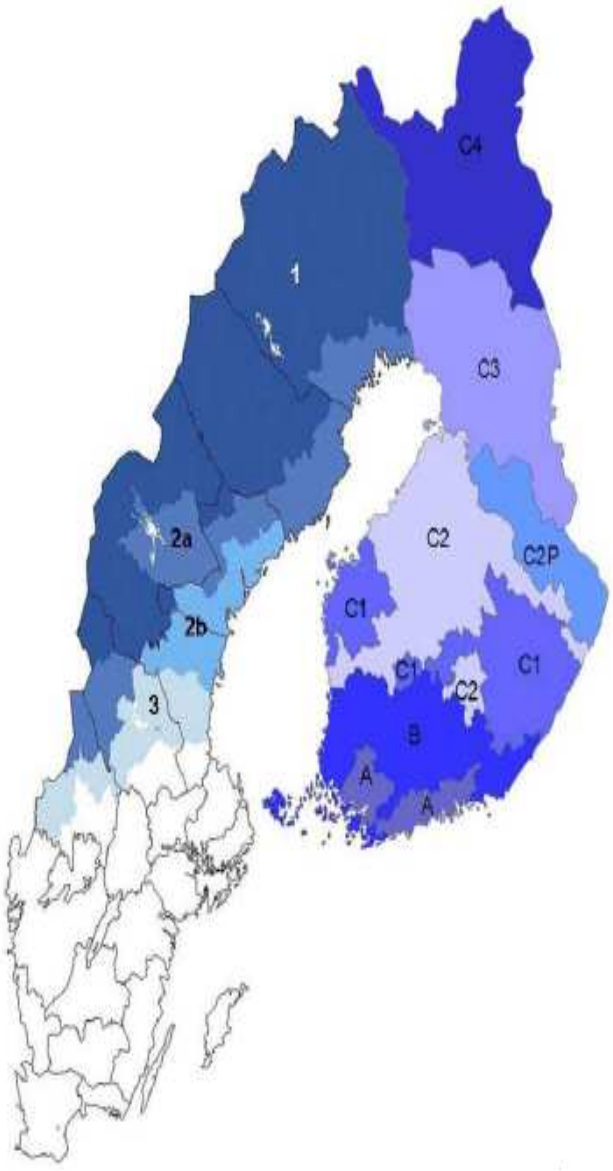


[23] Source : http://www.h.scb.se/scb/bor/scbboju/bj_htm/bj_goodmaps.asp

Approximation of FADN's division of areas

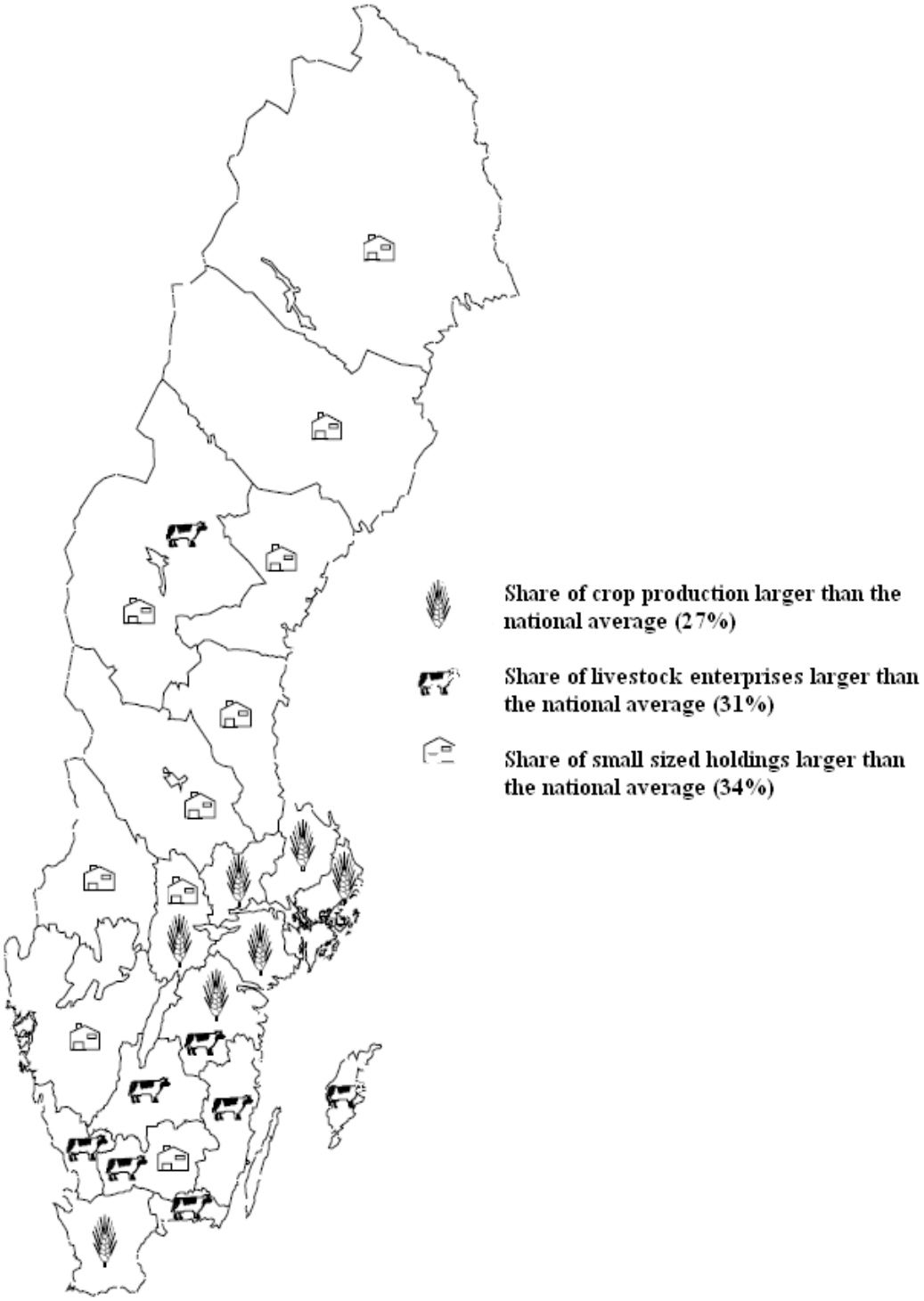
Slättbygdslän contains : GNS, SS, GSS
Skogs och mellanbygdslän contains: GMB,GSK, SSK
Län i Norra contains: Nö, NN (some parts of this are contained in Skogs och mellanbygdslän)

Map 3 Nordic Aid areas Sweden and Finland[24]



[24] Source: MTT & SLI p. 19

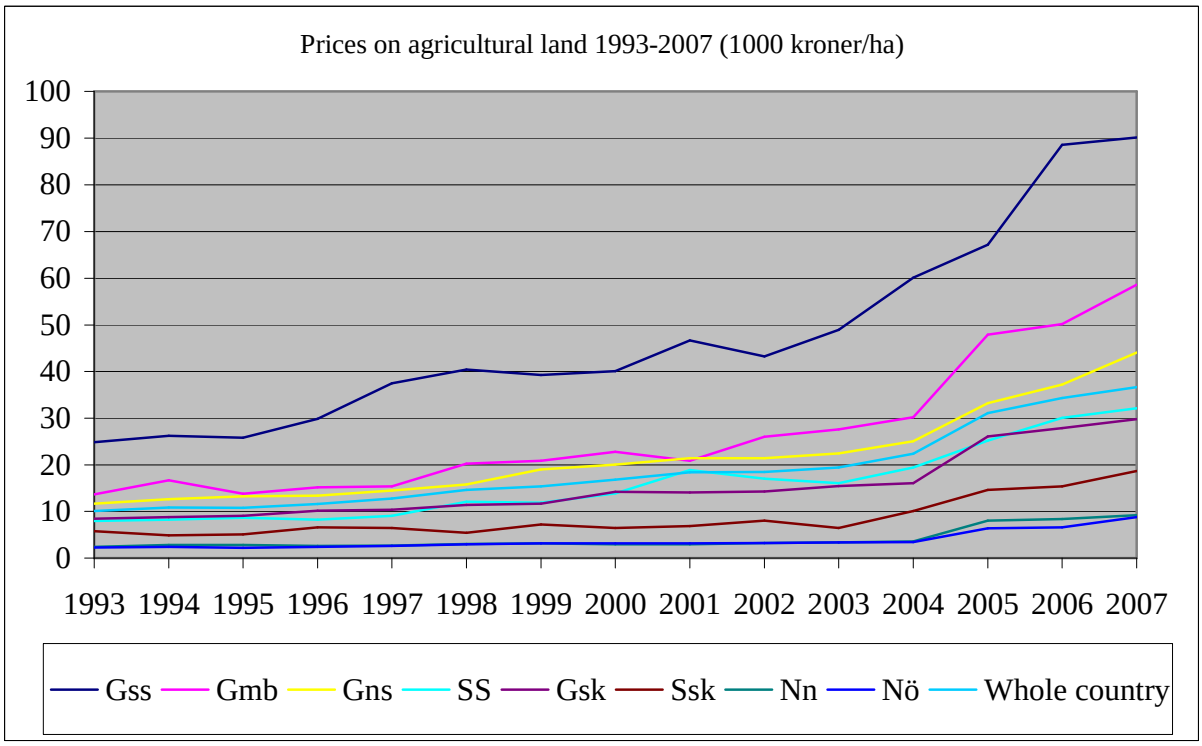
Map 4 Characteristic type of farming by county[25]



[25] Source: SJV, Jordbruksstatistisk årsbok 2009 p.44

Appendix B

Graph B.1



Source: Data from SJV

Table B.1 Changes in prices of agricultural land

	Average price change (%)		
	1995-2005	**1995-2000**	**2000-2005**
Gss	9,4	7,8	9,9
Gmb	11,7	6,3	16,6
Gns	9,5	8,1	10,2
SS	11,7	9,7	14,6
Gsk	11,5	8,5	16,1
Ssk	12,9	6,3	15,7
Nn	13,9	1,5	22,9
Nö	11,2	5,2	15,3
Whole country	10,4	7,6	13,1

Source: Own calculations based on data from SJV

Table B.2 Dairy farm costs 1995

	1995			
Cost item	**Län i Norra**	**Skogs och mellanbygdslän**	**Slättbygdslän**	**Average all dairy farms**
Seeds and plants	886	1244	1410	1242
Fertilizers	1792	2879	3692	2999
Crop protection	0	0	0	0
Other crop specific costs	3642	2756	2690	2902
Feed for grazing livestock	13531	16704	19448	17207
Of which home grown	0	0	0	0
Feed for pigs and poultry	0	0	0	0
Other livestock specific costs	5898	6702	7948	7055
Total specific costs	**25749**	**30284**	**35188**	**31404**
Machinery and buildings current costs	8170	7903	8671	8269
Energy	3771	3781	4625	4124
Contract work	597	614	1654	1036
Other direct inputs	4378	3590	3906	3872
Total farming overheads	**16917**	**15888**	**18855**	**17300**
TOTAL INTERMEDIATE CONSUMPTION	**42666**	**46172**	**54043**	**48704**
Wages paid	2143	1239	2237	1823
Rent paid	482	1392	1999	1463
Interest paid	6107	8463	11834	9381
TOTAL EXTERNAL FACTORS	**8732**	**11094**	**16071**	**12667**
DEPRECIATION	**14802**	**15683**	**18859**	**16809**
TOTAL INPUTS	**66199**	**72950**	**88973**	**78180**

Source: Data from FADN

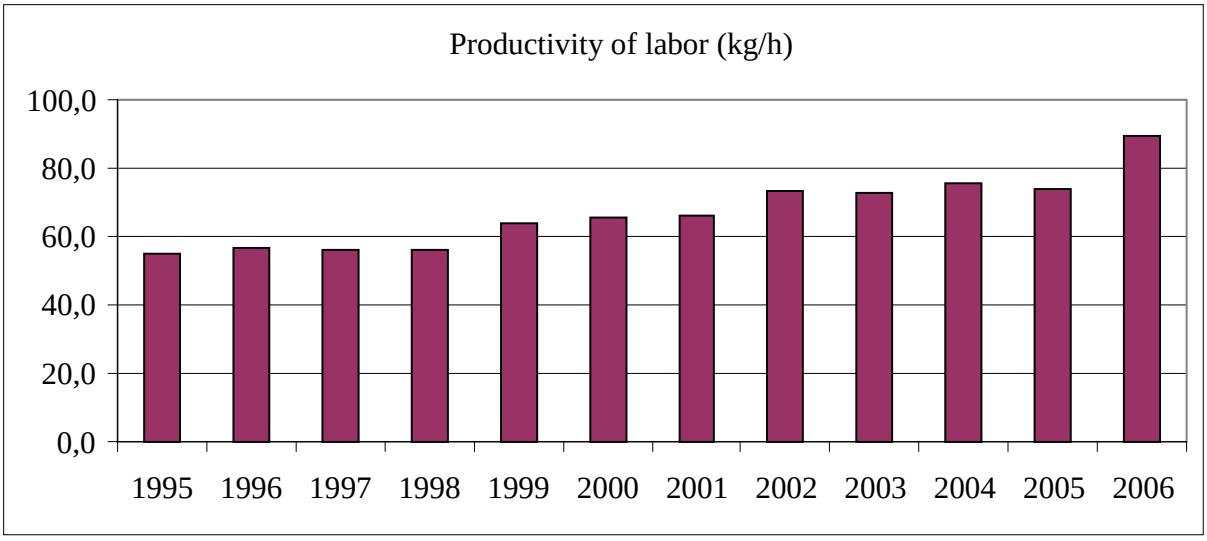
Table B.3 Dairy farm costs 2005

	2005			
Cost item	**Län i Norra**	**Skogs och mellanbygdslän**	**Slättbygdslän**	**Average all dairy farms**
Seeds and plants	1819	1982	2556	2248
Fertilizers	3417	4028	5268	4555
Crop protection	232	743	989	778
Other crop specific costs	3590	3201	3359	3351
Feed for grazing livestock	51432	58850	60140	58192

Of which home grown	24769	25118	26172	25597
Feed for pigs and poultry	7	815	1333	937
Other livestock specific costs	7430	8842	8410	8369
Total specific costs	**67928**	**78460**	**82054**	**78430**
Machinery and buildings current costs	9954	13681	14625	13502
Energy	13471	11523	14332	13312
Contract work	14052	13263	19460	16584
Other direct inputs	7446	8842	9507	8935
Total farming overheads	**44923**	**47309**	**57924**	**52333**
TOTAL INTERMEDIATE CONSUMPTION	**112851**	**125769**	**139979**	**130763**
Wages paid	8381	12729	13981	12598
Rent paid	2160	4687	6816	5330
Interest paid	5376	6811	9111	7736
TOTAL EXTERNAL FACTORS	**8381**	**24227**	**29908**	**25664**
DEPRECIATION	**31199**	**30337**	**34951**	**32859**
TOTAL INPUTS	**159 967**	**180333**	**204837**	**189286**

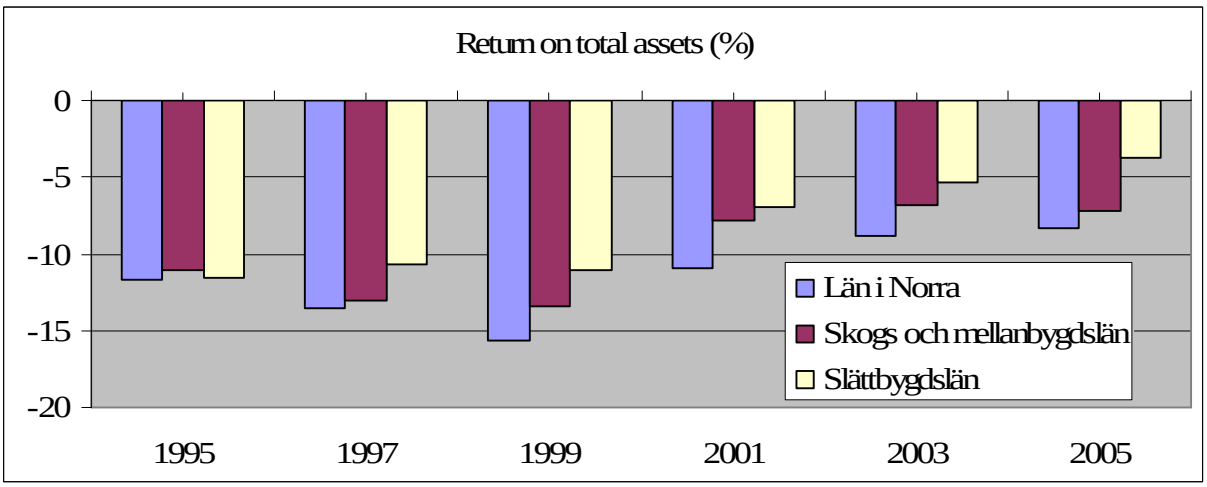
Source: Data from FADN

Graph B.2 Productivity of labor on dairy farms[26]



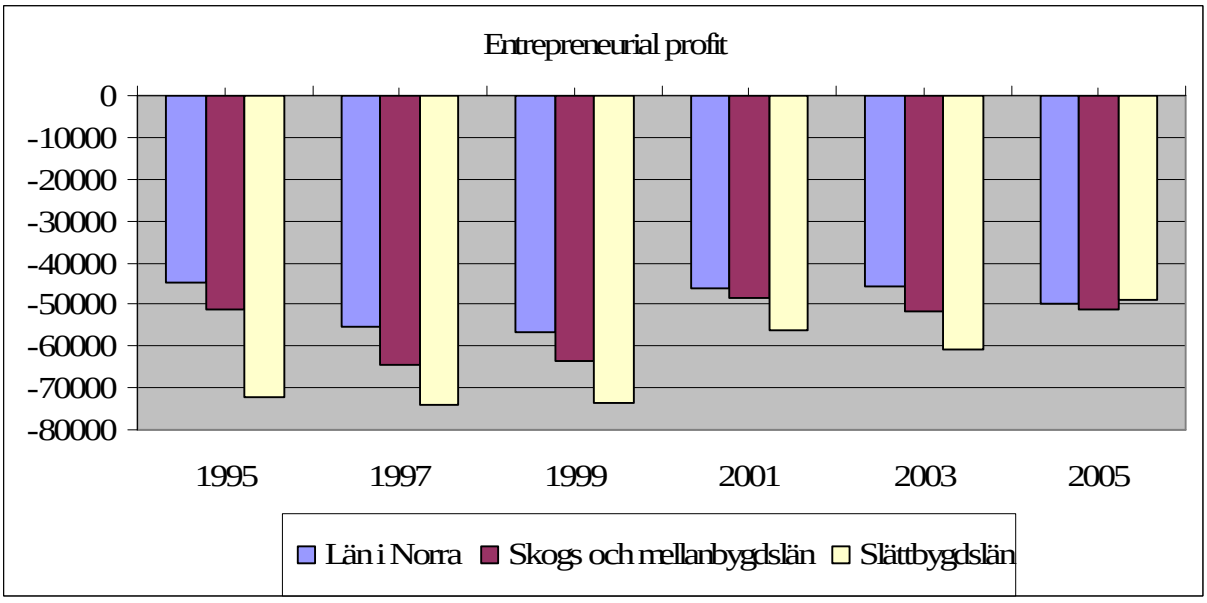
Source: own calculations based on data from FADN
Graph B.3

26 Productivity is calculated by dividing the quantity of milk produced by the amount of hours worked (hours contain both those by family members and outside workers).



Source: Data from FADN

Graph B.4



Source: Data from FADN