Chapter 2

Context and challenges facing the Swedish food and agriculture sector

This chapter outlines the overall economic, social and environmental context in which the food and agriculture sector in Sweden operates, and the natural resource base upon which it relies. It discusses the challenges and opportunities for the sector; describes the natural and economic context; shows the importance of the agricultural sector in the economy; outlines the main structural characteristics of the sector; and analyses the main trends and performance in agricultural productivity and environmental sustainability

Key points

- The main socio-economic challenge facing the Swedish food and agriculture sector is achieving sustainable growth and employment, and maintaining high environmental and animal welfare standards, given the relatively weak competitiveness in several parts of the sector.
- Agriculture accounts for less than 10% of total land area, predominantly located in the south of the country, but about half of all farmland is located in areas with natural constraints, and its direct contribution to the economy and employment is less than 2%.
- The number of agricultural holdings has sharply declined over the last three decades, leading to larger farms, with average farm holdings of 43 ha compared to 16 ha in the EU28; most farms are pluriactive family businesses, with approximately one third of farm household income originating from off-farm sources. Livestock production in most sectors has declined since 1995, while production in some sectors such as grains, vegetables and poultry has increased.
- Sweden will need to raise investments in agriculture not only to increase food supplies, but also to raise the amenity value of agriculture for the urban population.
- Growth in agricultural Total Factor Productivity (TFP) has been in line with the EU28 and its main competitors, driven primarily by high labour productivity resulting from a sharp decline in agricultural labour.
- The food supply chain seems to function efficiently as the Swedish retail food industry is concentrated to a relatively small number of players, together with specialist niche food markets. The majority of Swedish agro-food trade is with other Nordic countries (Norway, Finland and Denmark).
- Sweden has made good progress in decoupling environmental pressures from agricultural production as the adjustment of farmers to changed business conditions and Common Agriculture Policy (CAP) reforms are contributing to enhancing the positive environmental impacts of farming (such as protecting cultural landscapes and biodiversity) and reducing environmental pressures (such as reduced use of inorganic fertilisers, ammonia emissions, eutrophication and GHGs).
- Sweden is considered a global leader in public policy and farm practices to improve animal welfare.

2.1. Key challenges and opportunities

Sweden has a robust innovation-oriented economy with relatively high taxes resulting in a well-developed welfare state system. Making growth more sustainable, inclusive and green is a key overall policy objective. The country has an impressive track record in sustaining a high level of wellbeing of its citizens. The country performs above the OECD average in all dimensions of the OECD's Better Life Index, and these outcomes are typically shared widely across the population. Being well integrated into international markets has enabled the country to overcome the constraints of a small domestic market and a peripheral geographical location (Chapter 3).

In 2017, the government launched a National Food Strategy. The overall objective is to develop a competitive food supply chain that increases overall food production of both conventional and organic food, corresponding to consumer demands, while achieving environmental and animal welfare objectives, generating growth and employment, and contributing to sustainable development throughout the country.

All three dimensions of sustainability (economic, environmental and social) are covered in the National Food Strategy. This constitutes a change as the public sector, which has, since the 1990s, focused on environmental sustainability and on collective public goods produced by the sector, while the economic dimension has largely been left to the market. But given it is a sector largely dominated by small and medium enterprises (SMEs), this has been a challenge for the food sector to meet food security objectives. Swedish producers have taken the opportunity to produce environmentally sustainable food to a large degree, but the key in the future to increasing national production in Sweden to contribute to a more sustainable food chain in a global context is to focus more on the economic dimension.

Sweden is one of the largest countries in Europe in terms of land area, but is sparsely populated. Even though part of its area lies north of the Arctic Circle, much of its area enjoys a temperate climate. Agriculture thus faces very different conditions in the north compared to the south: the crop growing season is almost 100 days longer in the southern province of Skåne compared to Norrland in the north, with the latter region focused on livestock.

Agriculture accounts for a small part of the Swedish economy in terms of GDP, jobs, land and water use, although is an important source of greenhouse gas emissions (GHG), while also protecting biodiversity. Agricultural land use is strongly dominated by cereals (mainly wheat) and pasture. Livestock production is dominated by milk. In most livestock sectors, particularly for pigmeat, milk and cattle, production has declined since 1995, while for some sectors such as vegetables, grains and poultry, production has increased. Overall, agricultural production has remained relatively stable over time.

Most farmland is in the south and middle of the country which have comparatively large arable farms with relatively high yields; in the four northern-most counties livestock and small farms dominate. Structural changes in agriculture have resulted in a sharp decline in the number of farms, while these have grown larger. Farmers have made large investments in machinery and have become increasingly specialised. Organic farming is expanding rapidly and is generally more profitable than conventional farming, but this is largely due to high government support.

Regional differences in farm performance are a common feature of Swedish farms. Grain and dairy farms are generally found to perform better in southern Sweden. Farms in less favoured areas are on average less efficient than the corresponding farms in other parts of the country. Even support to such areas does not generally compensate for the competitive disadvantages arising from natural handicaps.

If Sweden does not have an overall comparative advantage in agri-food production, as revealed by international trade flows, there is a high degree of heterogeneity and some sectors and regions, such as horticulture in the south, are competitive. Although exports are growing, Sweden's trade deficit of

agro-food products has increased over time, mainly due to high imports of processed foods. European Union (EU) and especially Nordic countries are the biggest markets for Swedish agricultural products. With the exception of grains, Sweden is a net importer of agricultural products.

Since EU-membership in 1995, input use has been decreasing, while total agricultural output has remained relatively stable, which explains the positive TFP growing at a slightly higher rate than the EU28 average over 1995-2016. Labour productivity growth is the main source of TFP gains, at the expense of capital productivity as labour has been substituted by capital.

The country is a leader in many fields of environmental policy. Sweden was one of the earliest OECD countries in raising awareness of environmental issues and developing environmental policies. Protecting biodiversity and cultural landscapes while reducing pollution have risen progressively up the policy agenda. Sweden has also been a leader in improving animal welfare (Chapter 4).

Achieving sustainable TFP growth for the agricultural sector requires continuation of structural adjustments, whereby farmers expand their business, adopt new or improved technology that can compensate for high labour costs or a less favourable climate, target investment, and take into account regional natural factor endowments. Nevertheless, relatively low profitability, productivity and competitiveness are the main socio-economic challenges facing the Swedish agricultural sector as a whole. The beef sector is among the lowest performing sector in terms of productivity and profitability, even with support payments coupled to production. The beef sector is to a large extent driven by the environmental goal of retaining semi-natural pastures.

Low productivity growth in some sectors is due to a high share of input costs in production. Sweden's disadvantages in agricultural productivity relative to competitor countries are linked mainly to its high agricultural production costs (feed and labour) originating from the constraints related to climate, large capital investment costs in infrastructure such as housing and stables for animal husbandry, land prices and taxes. The difference in cost of production between Sweden and other EU Member states is also due to the specific state rules with respect to environmental and animal welfare standards that require corresponding infrastructure, auditing and certification of farms. The high production costs impact on financial viability and the ability to invest in innovative techniques.

The continued rise in land prices could be an incentive to increase capital investment in agriculture. The fact that there has been strong growth in the value of agricultural properties despite the low profitability of agricultural production indicates that factors other than profitability are driving the upward trend in prices. The capitalisation of agricultural support in agricultural land has probably contributed to the growth in value of agricultural land in recent years, as the income from farming would have been even lower without these subsidies. The on-going urbanisation process has also influenced land prices. As land prices increase, this has led to the development of farming activities at farms located further away from urban centres, where there is less competition for land, fewer opportunities for alternative employment and less concern about issues such as farm odours and noise. A key question is whether the profitability of agricultural production will be increased by an improvement of the supply of capital to agriculture.

Other possibilities for input cost decreases and improvements in productivity may be expected from changes (economies of scale) in farm structures, consideration of regional factor endowments and diversification. Feed costs represent the highest share of total costs in livestock production. Given that feed prices are largely determined in international markets, large savings could be made with a better combination and application of feeding practices in livestock production. While further improvements in labour efficiency are possible, the availability of a large area of semi-natural pasture might be preconditions for improved profitability of Swedish beef production. Pasture-based feeding could save costs and is beneficial to animal welfare, the environment, biodiversity and rural landscape values. Thus, for the beef sector policy measures are more likely to be successful if targeted towards the establishment of beef farms in pasture-based regions and improving feeding practices.

Encouraging on-farm diversification in terms of the mix of agricultural products produced might be crucial in improving profitability and making Swedish agricultural production more efficient. Increased diversification activities on farms specialising in a specific agricultural activity (crop, dairy, beef, pigs etc.) could help farms to buffer the price shocks of inputs (e.g. lower risk of feed shortages and high production costs), generate income from other activities and increase utilisation of under-used inputs.

An on-going challenge is to bring about generational renewal in agriculture because as many as a third of farmers are now over the age of 65. Young farmers have a key role to play in structural adjustment. Farms managed by younger farmers are often found to be more efficient. This is mainly associated with their higher level of education, implying knowledge of more advanced technology, interest in making structural adjustments and investments and their enthusiasm. Older farmers tend to have less up-to-date knowledge on advanced technologies and be more resistant to structural changes.

Further reducing the relative importance of government support in agricultural revenue is a major policy challenge. Government support is one of the primary instruments used to drive farm profitability and intended to compensate for variations resulting from differences in agri-environmental practices and regional agricultural potential (Chapter 5). Although farm decoupled payments are provided in all EU Member countries to achieve the same objectives, there is no single confirmed impact of this type of decoupled support on farm efficiency and productivity. Research has shown both positive and negative influences of farm support on farm efficiency (see Chapter 5). These findings are related to specific countries, production specialisation and methodological specification. However, it is a common finding that dependence on government support, or a large share of support in total revenue, has a negative impact on farm efficiency.

On natural resources the broad challenges such as reducing eutrophication, biodiversity loss and addressing climate change are still present, although environmental challenges are very context specific. For example, nutrient leakage, contamination of river waters by pesticides, and biodiversity loss due to monoculture are largely found in the south, while homogenous landscapes of forest and grasslands are typical in the north. However, Sweden has made progress in decoupling environmental pressures from agricultural production as measured by the reduced intensity of nutrient surpluses and of GHG emissions while agricultural production has remained relatively stable.

Concerning the impact of climate change, long-term projections suggest a number of potential benefits in that vegetation and cultivation periods will be considerably prolonged, yields will be increased and new crops could be introduced. However, in order to capitalise on these opportunities, adaptation strategies to the new conditions would be required, in particular because climate change could also risk an increase in plant and animal diseases.

2.2. General natural resources and economic context

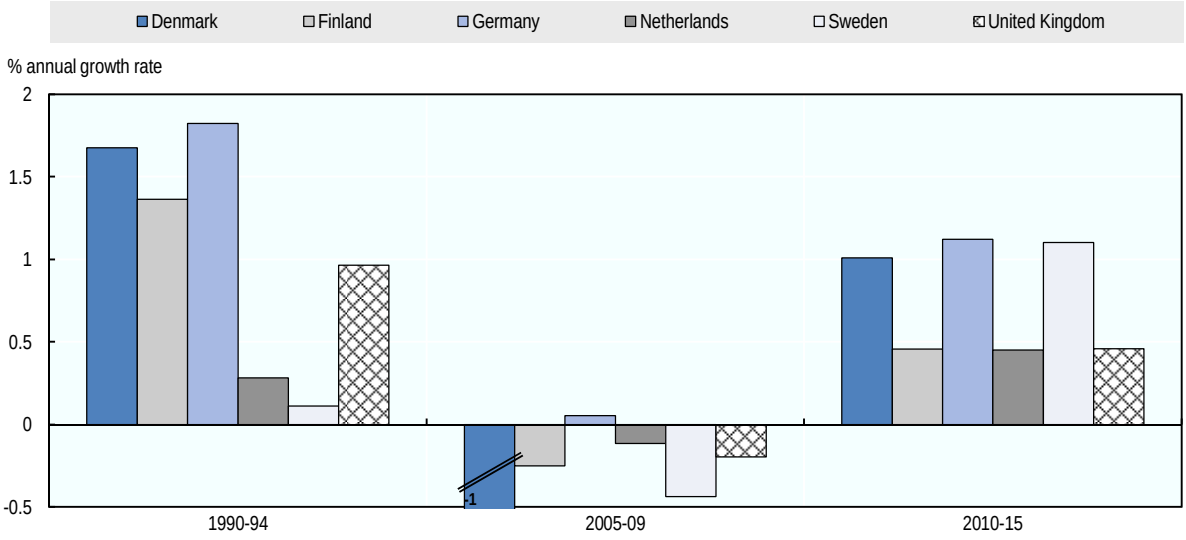
Sweden is the third largest country in the European Union in terms of land area, with only France and Spain covering a greater area, but it has a relatively small population.[1] Sweden is characterised by its large geographical and climatic contrasts due to its north-south orientation. With around 10 million inhabitants, Sweden has a low population density of 24.5 inhabitants per square kilometre, with the highest concentration in the southern half of the country, with a relatively high rate of urbanisation. In Norrland, the nine most northern counties in Sweden, which cover approximately 60% of Swedish area, population density is below five inhabitants per square kilometre.

Two-thirds of the land area is covered by forests making Sweden one of Europe's most heavily forested countries, whereas built-up land comprises less than 3% of the land area, mainly used for transport infrastructure, such as railways, airports and harbours. Regionally, while agricultural land dominates in the south, in the north forests are the most important use of land.

Sweden has achieved a high standard of living under a mixed system of a high-tech economy and extensive welfare benefits, to which the 20th century experience of peace and neutrality has contributed. Sweden has an efficient domestic distribution system, excellent internal and external communications, and a highly skilled labour force. Timber, hydropower and iron ore constitute the resource base of an economy heavily oriented toward foreign trade. Privately owned firms account for the vast majority of industrial output, of which the engineering sector accounts for about 50% of output and exports.

The Swedish economy is among the best performers among OECD countries with per capita GDP 23% higher than the average for the EU28, and 16% higher than the OECD average. Sweden's economy has experienced the highest growth rates in the OECD and the EU28 between 2014-16 (Chapter 3). Moreover, Sweden is one of the countries that have recovered well from the 2007 financial crisis, and since then it has tended to extend the gap in terms of economic growth and productivity compared with other countries of the EU28 and the OECD area (Figure 2.1), due to the diversification of the economy, adoption of high tech, skilled workforce, and an increase in the labour force linked to immigration.

Figure 2.1. Multifactor productivity of the economy, selected countries, 1990-2015



Source: OECD database on Multifactor Productivity, OECD.stat.

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2.3. The role of agriculture in the economy

Agriculture's contribution to the economy and employment is small (Table 2.1). Moreover, these shares have been declining steadily. While agriculture accounts for a relatively small share of GDP on average, rural areas have a substantial weight in the economy: indeed, predominantly rural areas account for 44% of total land area, 16% of the population, 14% of gross value added, and 15.4% of employment (Eurostat, 2016). In terms of international trade, agriculture accounts for 4% of exports and 8.3% of imports.

Swedish agriculture is not a large user of natural resources, in particular land and water, as compared to other EU Member states (Table 2.1). It occupies less than one tenth of total land area, predominantly located in the southern parts of the country principally because of climatic conditions that are more favourable to agricultural activities.[2] The vast majority of agricultural land is arable (85%) and the rest consists of pastures. Most agricultural land is classified as nitrate sensitive according to the EU Nitrate Directive. The predominant crops in Sweden are cereals, particularly

wheat, oats and other grains, together with leys or grass. Agriculture, mainly livestock and fertiliser use, is responsible for generating 12% of total GHG emissions in Sweden.

Table 2.1. Importance of agriculture in Sweden and selected economies (%)

	Gross value added	Employment	Exports	Imports	Total land area	Total water withdrawals
Sweden	**1.3**	**2.0**	**4.0**	**8.3**	**7.5**	**3.6**
Denmark	0.9	2.5	18.5	12.8	61.8	25.2
Finland	2.7	4.3	4.4	8.5	7.5	0.8
Norway	2.4	2.3	0.6	8.6	2.7	28.8
France	1.6	2.5	13.7	8.7	52.7	9.5
Germany	0.6	1.7	6	8	47.8	0.6
Italy	2.1	3.7	8.5	10.3	46.7	44.1
Netherlands	1.8	2.1	17.8	13	54.6	1.1
Spain	2.8	4.3	14.7	9.7	53.9	63.5
United Kingdom	0.6	1.3	5.5	9.9	71	9.2
EU28	1.4	5.8	6.7	6	43.0	19.2
OECD	**1.9**	**5.2**	**8.6**	**7.6**	**39.5**	**30.6**

Note. Data refer to 2016 or more recent year.
Source: OECD System of National Accounts, OECD Annual Labour Force Statistics, UN COMTRADE, FAO FAOSTAT, FAO AQUASTAT, 2017.

2.4. Characteristics of agriculture and agro-food sectors

Swedish agriculture is marked by significant diversification

The fertile soils in the South and comparatively poor soils in North as a result of the climatic conditions affects the growing seasons and patterns of production. However, production in value terms is evenly distributed between livestock and crops, together with agricultural services.

Agricultural production

The heterogeneous natural conditions favour diverse agricultural activities: grassland based and intensive livestock farming, arable farming, open field horticulture and greenhouse horticulture (Table 2.A.1). In addition to agricultural and horticultural products, farms produce energy, fibre and pharmaceuticals. Other business activities have also become more important, especially services such as tourism and contract work. About one third of all enterprises combine agriculture with other gainful activities related to agriculture. The agricultural sector also generates public goods, such as biodiversity and landscape amenities, and provides valuable ecosystem services (SOU, 2015).

Swedish crop production is dominated by cereals, mostly barley, oats and wheat, as well as by grassland. In the north, crop production mostly comprises forage and coarse grains. Bread grain is mostly grown in the plain districts of south and central Sweden. Oilseed production, mostly rapeseed, is also located in the southern and central areas. Potatoes are grown throughout Sweden.

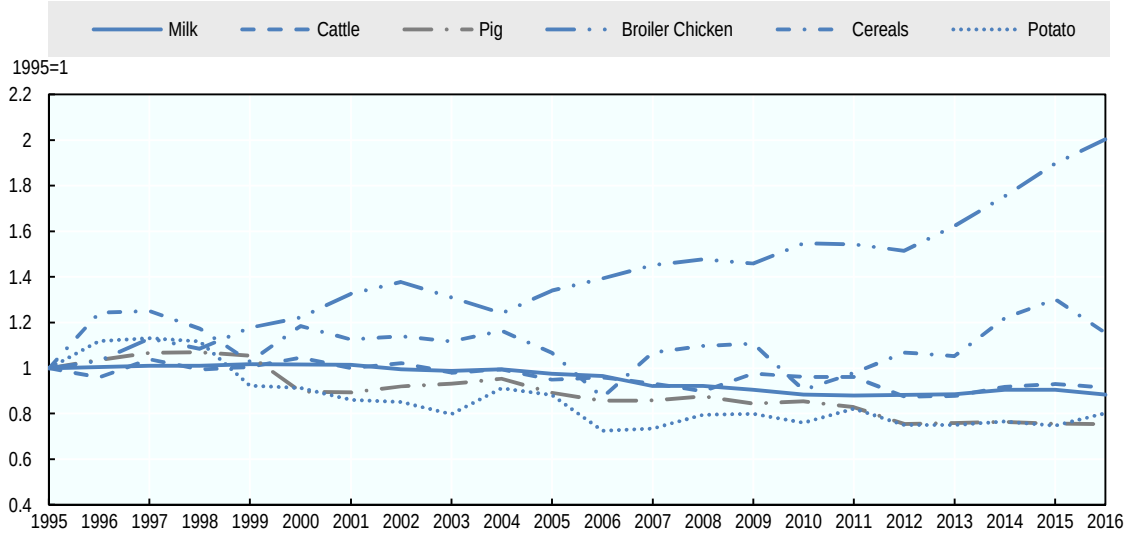
The highest crop yields are found in southern Sweden, while the yield for some crops in northern Sweden can be around half those levels. On the other hand, the long days with the midnight sun in the

north during the summer months makes the growing period intensive and allows for the production of high-quality potatoes, berries and vegetables (SOU, 2015).

Milk production is an important sector in Sweden and about one-third of milk production is for drinking. While the volume of cereal production has been stable during the last few decades, milk, cattle and especially pig production (currently the dominant meat in volume terms) have declined (Figure 2.2). Broiler (chicken) production has increased rapidly during the period 1995-2016, and has more than doubled in volume during the period.

Figure 2.2. Evolution of agricultural production by sector

1995-2016 (1995=1)



Source: SBA, Statistical Database.

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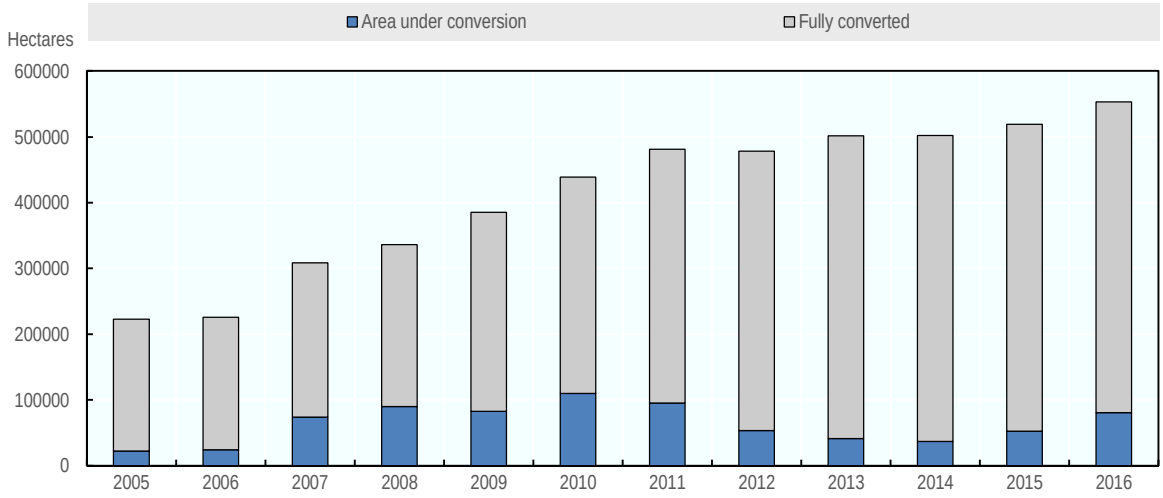
Organic farming is well established in Sweden, driven by increased demand and government support. Organic-certified areas account for more than 17% of the area of agricultural land in Sweden, which is much higher than the EU average (6%). Among the countries of the European Union, only Austria has a larger share (20%). The growth rate of organic farming areas increased very strongly between 2005 and 2016 (Figure 2.3) with the area converted to organic farming more than doubling.

Organic production has increased in most types of agricultural production by over 20% since 2005. Production of organic eggs and winter wheat has doubled during this period. Organic livestock farms are, on average, larger than other farms with the same type of livestock. The two exceptions are laying hens and broiler chickens, where organic farms are on average smaller. The share of organic food and non-alcoholic beverages also increased over time – from 2% in 2004 to 4.3% in 2013 (SBA, 2015c). Large food retailers, such as ICA and Coop have increased their sales of organic products from 40% to 60% during the same period.

The comparison of environmental performance between organic farming and "conventional" farming remains complex (OECD, 2016). The reduced use or even the prohibition of certain inputs can reduce polluting emissions (including GHGs), but the result may be a reduction in the efficiency of input use and productivity. Moreover, where organic farming requires more land to produce a given output, there is an opportunity cost in terms of land use.

Figure 2.3. Organic agricultural land, fully converted area, area under conversion (2005-16)



Source: SBA, Statistical Database.

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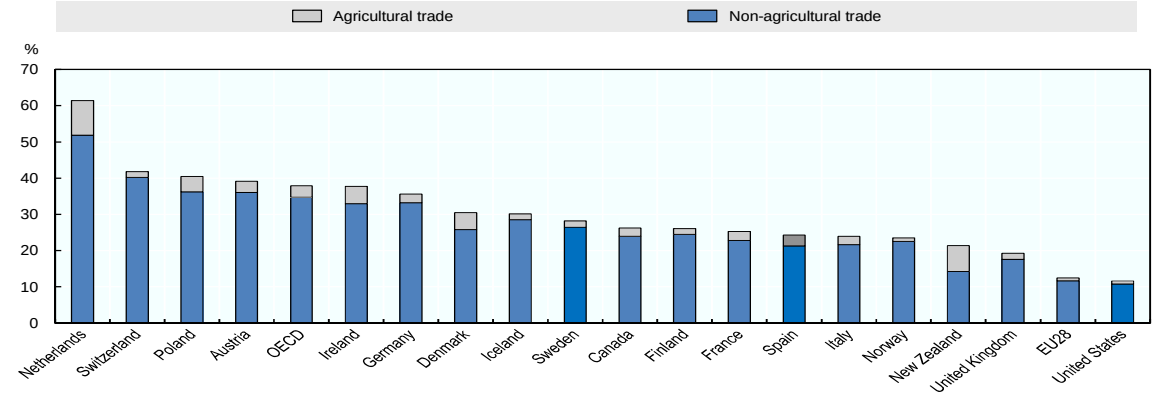
The Swedish agriculture and food sectors have a limited exposure to global trade

Sweden is an open economy that is thus highly dependent on international trade. As measured by the percentage of overall trade in Swedish GDP (i.e. exports plus imports divided by GDP), "openness to trade" in Sweden is significantly higher than the EU28 average, but comparable to other EU15 member states, such as Germany, Denmark, France, Finland or Norway (Figure 2.4). However, the Swedish agricultural sector has a limited exposure to global trade (1.7% of the 28% overall economy-wide exposure), which is in line with the limited share of agriculture in GDP of the Swedish economy, and typical of almost all OECD countries.

Sweden is a net importer of food and agricultural products. The trade deficit is increasing, but has stabilised somewhat in recent years (Figure 2.5). Trade in agricultural and agri-food products is mainly within the European Union (and Norway), which accounts for 89% of Swedish agricultural exports and 93% of Swedish agricultural imports (Eurostat, 2016; Table 2A.2).

Figure 2.4. Exposure to trade, selected economies, 2015 or latest available year

Average of exports and imports as a percentage of GDP



Note: GDP = Gross domestic product, national currency, current prices.
Source: UN COMTRADE 2016, OECD National Accounts, 2016.

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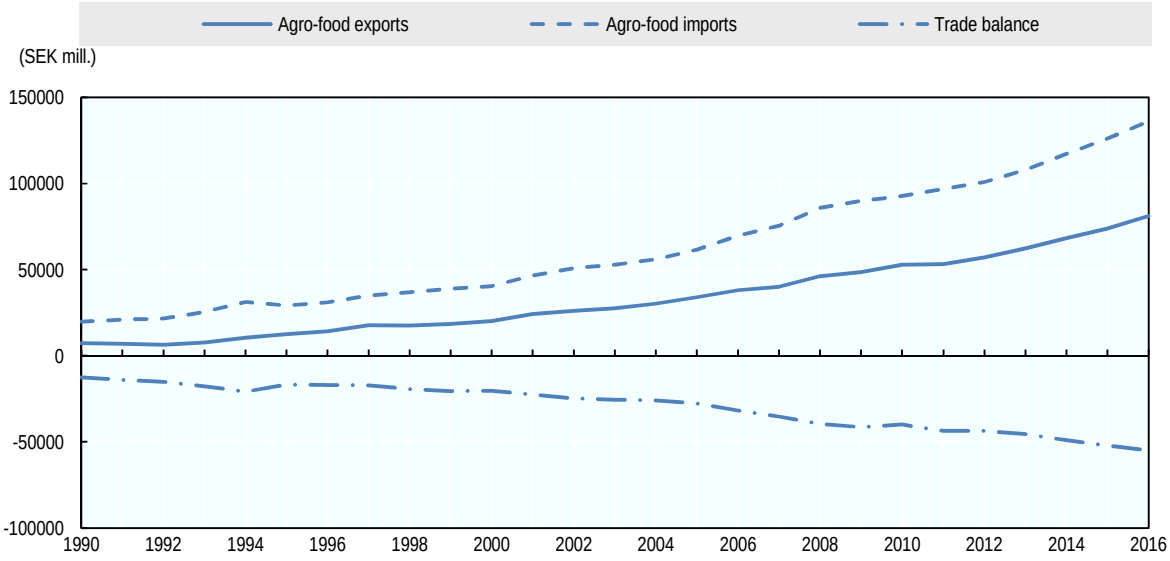
Figure 2.5 Agri-food trade, 1995-2016

SEK million



Source: Statistics Sweden. Unadjusted values for imports and exports by SITC product groups.

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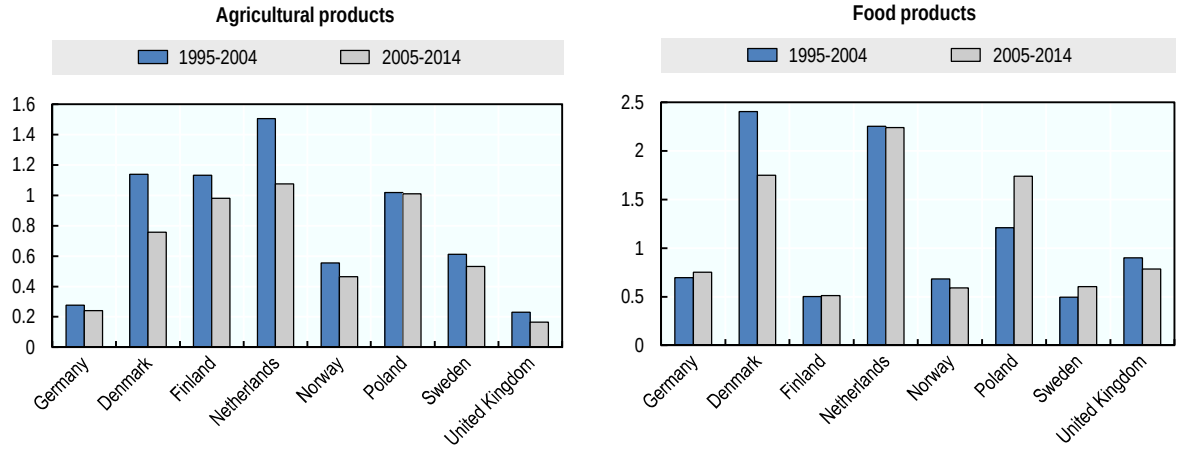
International trade does not reveal Sweden's comparative advantage in agri-food production. The Revealed Comparative Advantage (RCA) indicator compares the country's share in world agro-food exports with its share in world exports of all goods – ratio above unity indicates a comparative advantage of a country and vice versa.[3] Sweden's RCA is estimated at 0.5 for agricultural goods and 0.6 for food products (2005-14) suggesting that Sweden does not have a competitive stance overall. Moreover, since 1995 the value of Swedish RCA has remained rather constant (average RCA index of 0.5) indicating a stable position in the EU agricultural and food market (Figure 2.6). However, the RCAs estimated for individual commodities show that Sweden has an advantage in some sectors (Figure 2.16).

Of Sweden's total exports of food and agricultural products, exports of processed agricultural products make up one third. Net trade in processed agricultural products is negative but less so than for food and agricultural products in general. Spirits, processed fish products and processed cereals, various preparations and chocolate account for 70% of total exports of processed agricultural products. Sweden's largest export market for processed agricultural products is Norway. Imports are more evenly distributed among product groups, but processed meat, game, poultry, fish and beverages predominate (SBA, 2016d).

The role of trade in enhancing a country's competitiveness and innovation can also be revealed by the degree of its participation in global value chains, and thus its exposure to globally competitive productions and processes. Participation in Global Value Chains (GVC) can be analysed through the import content of exports (backward participation) and the extent to which domestic value added from an industry in a given country form part of the value of another country's exports (forward participation) (Greenville, Kawasaki and Beaujeu, 2017.

Figure 2.6. Revealed comparative advantage of agricultural and food products



Note: Revealed comparative advantage (RCA) is first calculated in value-added terms. The value-added RCA is defined as the share of value-added originating from a given service sector in a country's exports divided by the share of value-added originating from this service sector in world exports. As with the traditional RCA, a country has a comparative advantage in a service industry when this share is above one (i.e. when the value-added coming from this service sector represents a higher share for this country as compared to the world average).
Source: OECD WTO Trade in Value-Added Database, 2017.

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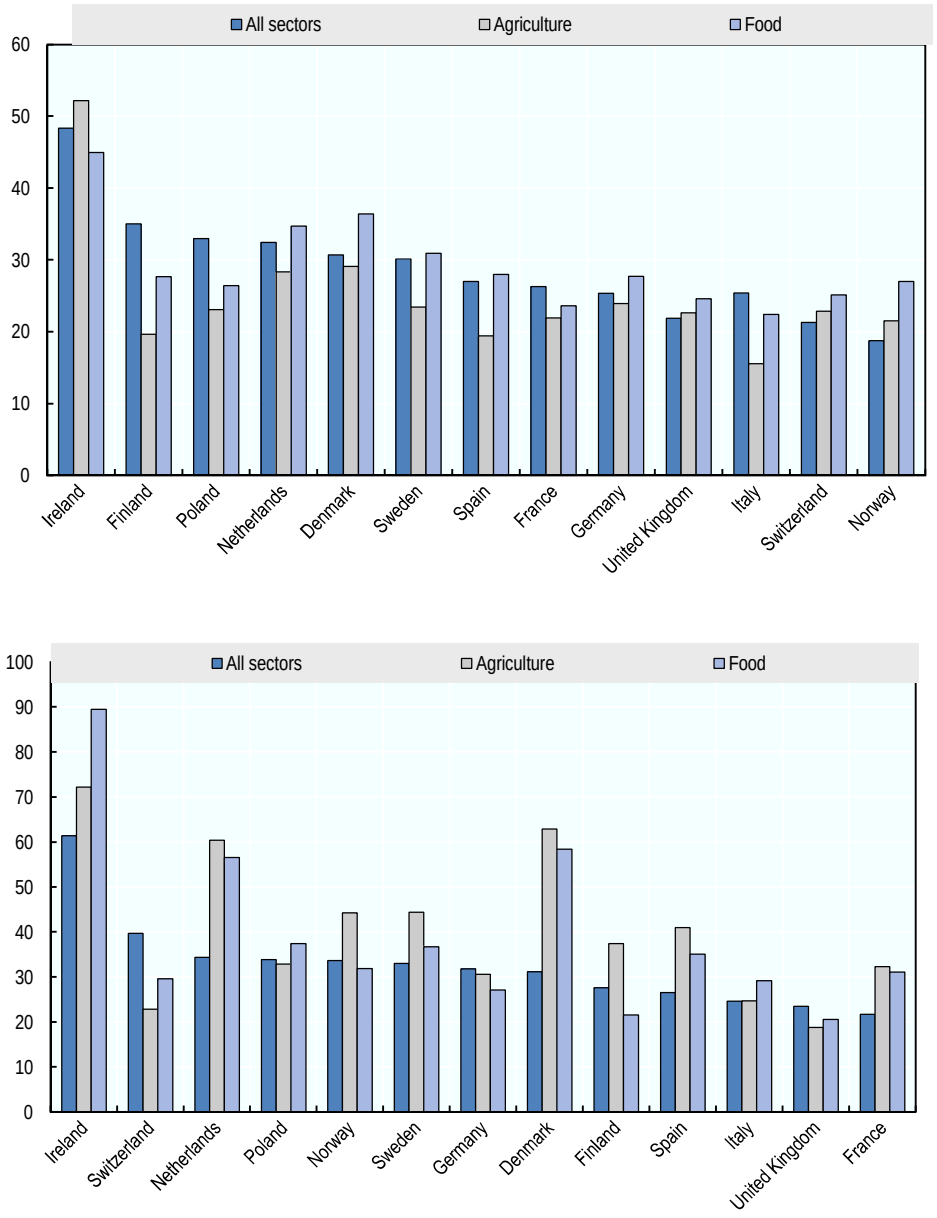
Figure 2.7 suggests that participation rates are lower for Sweden than some other European countries, both for all national exports and the agro-food group. This may suggest that some opportunities across the economy to increase competitiveness by increasing its engagement in global production remain unexploited.[4] For Sweden and some other countries, agriculture has high level of forward participation compared with relatively low levels of backward participation, suggesting that the sector is linked to GVCs more as an upstream provider of materials used in other production processes (Figure 2.7). On the other hand, the food sector is more a downstream user of materials with many food-manufacturing industries sourcing inputs internationally but selling their products domestically or directly to foreign consumers.

The distributions of GVC participation reveal significant differences across agri-food sub-sectors. Differences exist across sectors, the GVC measures explored (forward and backward) and between Sweden and the EU28 (Figure 2.8**)**. Overall, the results point to significant structural differences between sectors driven largely by the nature of the product produced. The backward participation seems to be relatively similar across the food and agriculture sectors than the forward participation. In general, food and agriculture sectors with higher forward participation have lower backward participation, suggesting a high degree of export orientation of some sectors and high import sourcing for others. Backward participation is lower in Sweden than in the European Union for all food and agriculture sectors, except for vegetables and wheat, while forward participation is higher in Sweden than in the EU28 for most food and agriculture sectors, particularly for livestock sectors.

Figure 2.7. Sweden's agro-food sector integration into global value chains



1. Backward and forward participation correspond, respectively, to the shares in a country's gross exports of foreign value added and domestic value added embedded in in foreign final demand.
2. Agriculture refers to TIVA sector C01T05 (includes hunting, forestry and fishing). Food includes food products, beverages and tobacco.
3. Data are for 2014.
Source: OECD-WTO Trade in Value Added (TiVA) database, Nowcast estimates 2017.

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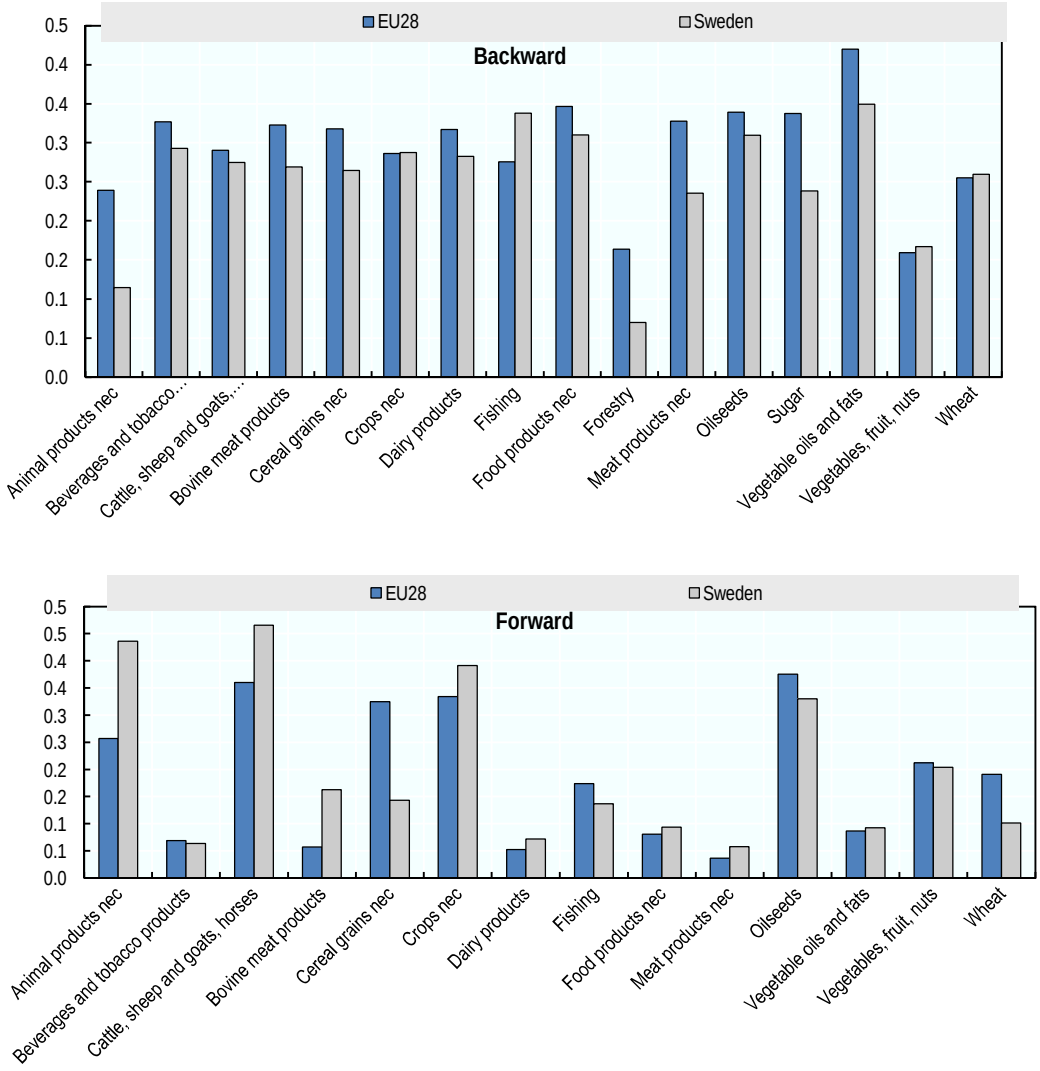
Figure 2.8. Sweden's forward and backward participation varies across agro-food sectors, 2014



1. Backward and forward participation correspond, respectively, to the shares in a country's gross exports of foreign value added and domestic value added embedded in in foreign final demand.
2. Data are for 2014.
Source: OECD-WTO Trade in Value Added(TiVA) database, Nowcast estimates 2017.

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Swedish diets are gradually changing over time

Swedish diets have changed considerably in recent decades, as is the case in many other developed economies. Increasingly, in addition to prices the food market is also influenced by consumer awareness of health, environmental and social issues. Consequently, consumption of foods with organic and "fair trade" labels has increased. There is also an increased consumption of locally produced foods, as well as "ethnic" foods from other countries, partly reflecting the diverse ethnicity of the population.[5] In 2016, about 9% of total consumer food expenditure was on organic foods. Another recent trend is online sales of food. In 2016, one in four households bought food online, and sales correspond to about 4% of total retail sales (Swedish Trade Federation, 2016).

During the period 1980-2015, meat (mainly poultry and beef) consumption per capita increased by 40%, fresh vegetables by 116%, and fruits, berries and nuts by 28%. The consumption per capita of milk decreased by 39%, of edible fats by 25% and sugar and syrups by 67%. Consumption of frozen ready-cooked food increased by over 42% during the period, but after 2011 there has been a trend of decreasing consumption per capita.

Structural changes in agriculture mean fewer, larger and more specialised farms

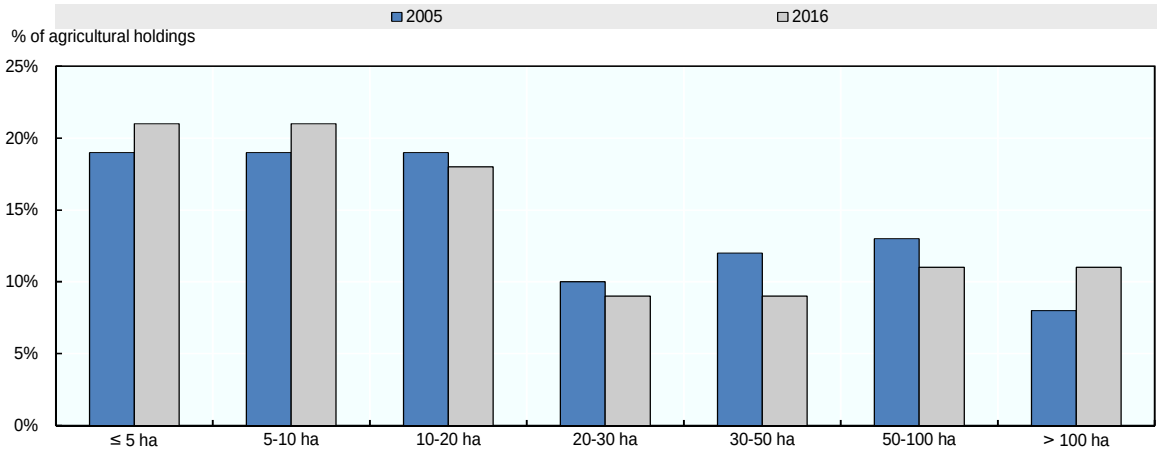
Farm structures

There are about 67 000 farms in Sweden, of which 75% can be considered commercial farms. They are predominantly pluriactive, with approximately 30% of farm household income originating from off-farm sources, resulting in different size farms earning approximately equivalent incomes.

Structural changes in agriculture have resulted in a sharp decline in the number of farms in recent decades, so that farms have grown larger, accounting for a larger share of production. Farmers have made substantial investments in machinery and become more intensive and specialised in cereals, dairy or the rearing of pigs and bovine animals. While farms are generally moving towards more specialised production, the majority still produce a range of commodities. However, about half the number of farms are less than 20 hectares. The biggest changes in size and number of farms can be observed for large and mid-size farms. While small farms have recorded a slower decline in numbers the median farm size has grown marginally during the period (Figure 2.9; SBA, 2017).

The trend towards fewer and larger agricultural holdings has been in continual progress for many decades. The number of agricultural holdings decreased by 1.9% per annum over the 2000-16 period. In general, the rate of decline has been somewhat higher in the central and northern part of Sweden. In horticulture – a sector that is relatively capital, labour, and knowledge intensive – the number of holdings has halved since 1990 while the utilised area has remained more or less constant. Likewise, major structural changes in size are evident for all livestock sectors, and all sectors except pigs have experienced a concentration of production into relatively large farms. While the number of dairy cows has decreased sharply, due to increased productivity, the decrease in milk production has been less.

Figure 2.9. Structure of agricultural holdings



Source: Eurostat, Farm Structure Survey 2005 and 2016.

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Box 2.1. Major changes in livestock farm size structure

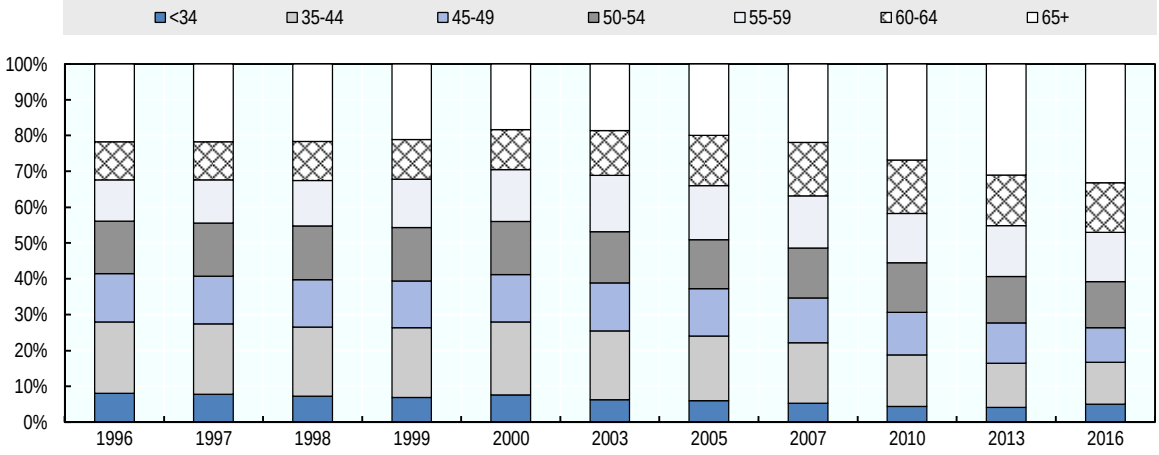
In 1990, half of all milk cows were on farms with no more than 24 cows. Twenty-five years later, that midpoint was at 73 cows. The change in the pig sector was even more dramatic as it underwent a wide-ranging and comprehensive set of structural changes. In 1990, half of all pigs were on farms with no more than 119 pigs. The midpoint for pig farms had increased to 657 by 2015. The mid-point size for egg farms grew from 18 000 in 1990 to 32 600 in 2015. It is not possible to calculate the mid-point size for broiler farms before 2000, due to changes in how the statistics are collected, but in 2000, half of all chickens were reared in farms with at least 92 000 chickens. By 2015, the midpoint for broiler farms had grown to 110 000.

Farm labour is getting older and is increasingly reliant on younger, temporary workers

Most farms are family businesses in which the family itself does most of the work and combines farming with employment in other activities. Less than 8% of farms are operated by limited companies, and at least 70% of those employed in agricultural holdings are family members of the owner(s). Thus the number of employed people in agricultural holdings has declined, predominantly of permanent employees, while those temporarily employed has been increasing.[6] Growing perennial crops is the sector with the highest proportion of immigrant labour (25% in 2013), while the lowest proportions are observed for animal production, mixed farming and the supporting activities to agriculture. The number of women in agricultural enterprises is also growing and in 2015, 29% of all those employed in agriculture were female. Almost 50% of employment is in holdings with more than 50 ha of arable land.

The age structure in Swedish agriculture is quite uneven and differs from the average of EU28 as only 4% of agricultural farm holders were under 35 years old (7.5% in EU28) in 2013. Moreover, the average age of employees as well as farm holders has been increasing. In 2013, the average age of employees in the industry was more than 55 years, compared to 50 years in 2007. Mixed farming and growing of non-perennial crops are the industries with the highest average ages, 64.6 and 51.8 respectively. One-third of managers in 2016 were 65 years or older, which is more than ten percentage points higher than in 2000 (Figure 2.10). Another 28% of Swedish farmers will reach retirement age within coming decade, according to data from 2013. An ageing workforce is a challenge to the future development and innovation capacity of the agricultural sector.

Figure 2.10. Age distribution of farm holders (1996-2016)



Source: SBA, Statistical Database. All farm holders occupied in the agriculture sector.

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Better educated and trained farm managers are more likely to make successful changes to farm-management practices and be more innovative (OECD, 2014). The agricultural work force is far less educated than the total working population of Sweden. In 2016, while 41% of the overall working population have graduated from tertiary education, and thus had a high level of education attainment, only 17% of those in agriculture have reached this level (Eurostat, 2017). Learning by doing is the main form of training for the majority of Swedish farmers as the majority of the farm managers have acquired agricultural experience through practical work on an agricultural holding (69% in 2013) and only 19% of farm managers have completed full agricultural training.

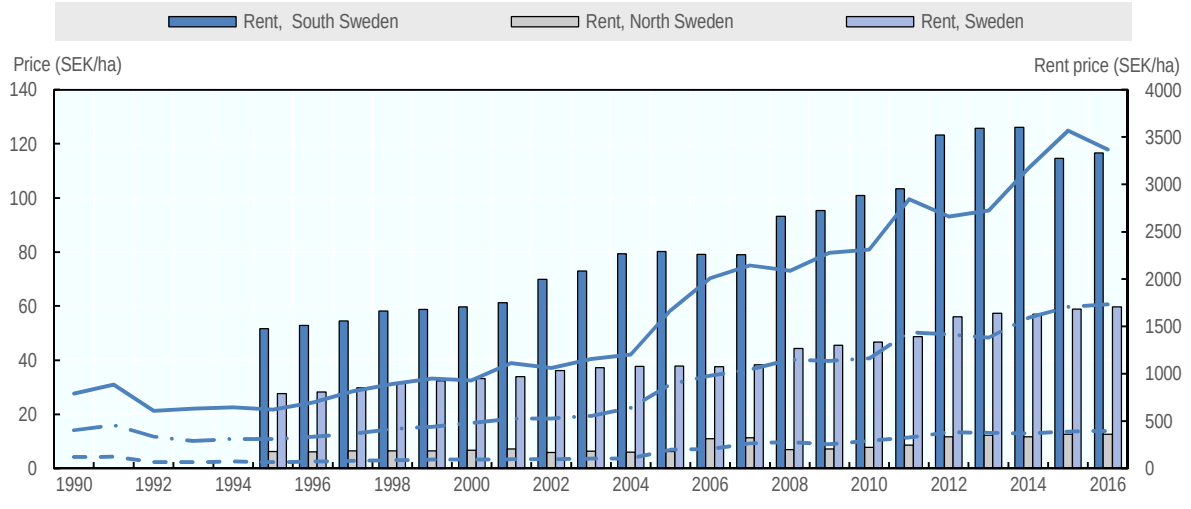
Land use

A large proportion of agricultural land is rented (39% in 2013), but the proportion differs between different forms of agricultural production. The largest share of rented land is found in dairy production and the lowest share among small farms. Farmers younger than 25 years old rent about 68% of their land, but as they age, farmers are able to buy more of their total agricultural land.

The price of agricultural land has increased since Sweden's accession to the European Union throughout the country (Figure 2.11). The increase in land prices is due to increased demand for land, land productivity and capitalisation of subsidies at least in central and southern Sweden (where the most productive agriculture land is located). In areas with less productive agriculture land the increased demand is mainly related to rural amenities (recreation, tourism and seasonal homes) and accessibility (housing, industry and transportation) (Karlsson and Nilsson, 2014; SBA, 2015b; Nilsson and Johansson, 2013).

Historically, large agricultural estates leased land to small farmers. The landowner was the dominant party in the contractual relationship, and current legislation reflects this. Today, it is not unusual for a property owner to be a small farmer who leases agricultural land to a large-scale farmer who also leases additional land from other small farmers. Therefore, the landowner might no longer be the dominant party in the contractual relationship. A government inquiry on leasing proposed several changes to the present legislation (SOU, 2014). The inquiry into the competiveness of the agricultural sector further proposed that full liberalisation of contracts should apply when establishing rents (SOU, 2015).

Figure 2.11. Average price and rent price for agricultural land, 1990-2016



Note: Based on NUTS2 classification.
Source: SBA, Statistical Database.

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Concentration in the food supply chain is compatible with competition to address consumer preferences

Farms are part of the food chain of processors, retailers and input providers. Most of the non-farm businesses in the food chain are large corporations, and few directly operate farms – there is little vertical integration between agriculture and other parts of the food system and intra-industry trade is weak in Sweden. However, farms are often closely linked with other firms in the food system through various types of contractual relationships and co-operatives. Food manufacturers and retailers tend to be large undertakings operating in highly concentrated markets. It should be noted that there is also a strong emerging trend in small-scale production and innovations (Food and Bioscience, 2016). The increasing health consciousness is altering consumer behaviour while "food tech" is creating conditions for new foods for consumers, with implications for value chains. This is leading to possibilities for different business structures. However, in some parts of Sweden, especially in the north, the long distances between farms and input providers with higher transport costs reduces the competitiveness of those farms (SOU, 2014).

The most extensive system of contractual arrangements is in broiler chicken production, where almost all broilers are raised under production contracts. The pig sector is less tightly controlled, but is still dominated by contract production. In other commodities, farmers can enter into contracts with buyers that tie prices to commodity attributes, and they may have longstanding but less formal ties to specific buyers.

An examination of competition in the food supply chain by the Swedish Competition Authority in 2011 found that market concentration is high in some parts of the food supply chain (Swedish Competition Authority, 2011). Both the food industry and the retail food trade are sectors where a small number of undertakings account for a significant proportion of sales. However, consumers benefit from lower prices due to economies of scale, despite high market concentration.

The overall assessment of the Swedish Competition Authority was that competition in the food supply chain is essentially functioning efficiently. Swedes pay no more for their food than consumers in comparable EU Member states, regardless of whether prices are compared directly or whether prices are compared to income. Swedes, however, pay less than consumers in other Nordic countries. Nor have prices in Sweden increased more rapidly over the past decade than they have in comparable countries. The margins in the Swedish food supply chain are no higher than in other EU Member states, nor have they increased over the past decade.

Co-operatives

Co-operatives between producers are not normally permitted under competition rules, but within agriculture and forestry they are exempt, as they are not expected to harm competition. On the contrary, there is good reason to believe that both farmers and consumers benefit from the economies of scale in agricultural co-operatives that function according to traditional co-operative principles (Swedish Competition Authority, 2011).

Co-operatives play a significant role in the Swedish food chain, particularly in the dairy sector, where they account for almost all market share (Box 2.2). However, some of the most important Nordic co-operatives are based in either Denmark or Finland, reflecting a Nordic-wide consolidation process. The largest ones especially look for economies of scale in international markets, whereas the smaller ones concentrate on regional markets (Cogeca, 2015). Forestry co-operatives play a major role in the Swedish forestry industry as about half of the Swedish forest area is privately owned, most often by farmers (Nilsson et al., 2012).[7]

Box 2.2. Co-operatives play an important role in the Swedish agro-food system

Co-operatives dominate the dairy sector in Sweden. Arla Foods is a clear market leader, with a 64% proportion of milk purchases in Sweden. Arla merged in 2000 with Danish MD Foods. Arla Foods is an international co-operative with its headquarters in Denmark and with members in seven countries. Arla Foods, as well as other co-operative dairies, is active in the entire chain from purchasing to processing and marketing its products to retailers and for export (Nilsson et al., 2012).

Producer co-operatives account for a small market share in that Sweden imports 48% of the beef, 30% of the pork and 34% of the poultry consumed in Sweden (2015). Processing is also decentralised compared to Sweden's neighbours, where the market shares of the two biggest processors are high (more than 80% both in Denmark and in Finland) (Nilsson et al., 2012).

In Sweden, the meat market leader is HK Scan, although Swedish farmers are not co-operative members. The majority owner of HK Scan is the Finnish co-operative LSO. Competitors in the market are the Finnish Atria and Danish Crown. All of these co-operatives have made acquisitions in Sweden during recent years. In addition to those large co-operatives, there are many processors in Sweden and it is estimated that more than half of players in the meat processing industry are small (turnover less than EUR 50 million) private companies (Nilsson et al., 2012). In the sheep meat sector, there are – in addition to the big slaughterhouses – several small, newly created co-operatives specialising in organic or local meat, with their customers being very close to the farms.

The cereal trade is generally a part of the business of input suppliers. There are several operators in the Swedish market. The largest one is Lantmännen a farmers' co-operative, which also has a few local co-operatives as organisational members. Lantmännen accounts for about 40% of total cereal trade (Nilsson et al., 2012). The second largest player is Svenska Foder owned by Danish DLG. The other co-operative group consists of regional co-operatives, mainly in Southern Sweden, which are members of the Danish DLA Agro.

In the egg sector, the role of co-operatives has traditionally been quite strong. However, there is now only one Swedish co-operative, namely Norrlandsägg. The other co-operative, Kronägg, has merged with the Danish Danæg into a transnational co-operative. Kronägg's market share is less than 20%, and Norrlandsägg is much smaller. Their aggregated market share is less than 25% (Nilsson et al., 2012).

The food industry sector

Profitability is at a relatively constant level in the food industry as a whole when compared with other major manufacturing sectors. However, the sub-sectors closest to agricultural production (meat processing and dairy, slaughtering, milling and baking) are the least profitable (SBA, 2012). Industries that have shown a high growth rate include manufacture of tobacco, fruit and vegetable juice, flour, macaroni, noodles, couscous and similar farinaceous products.

A relatively small part of production in the industry is exported and large enterprises and companies that are part of multinational corporations mainly undertake exporting. Moreover, these firms are the best performers in the sector, in terms of employment and productivity growth. The growth in the industry has mainly been located in rural areas, since it is less dependent on being close to domestic markets and it is more economical to be close to the agriculture sector (SBA, 2016b).

Firms (often multinational) with production in Sweden are leading players in dairy and beverage processing, coffee roasting, fish and meat processing, and milling and baking. The food industry is Sweden's fourth largest manufacturing sector (SBA, 2012). Based on turnover, the largest food industry is meat and meat products (including slaughterhouses), while the bread and flour industry has the largest number of enterprises and employees. Most food industry companies are small, with fewer than ten employees, although the larger companies account for most production. In total, the number of companies in the food industry is increasing while the number of employees is continuing to decline, especially in larger companies. The food industry creates jobs throughout the country, unlike the other three major manufacturing industry sectors (i.e. motor vehicles, chemicals and machinery equipment).

Retail sector

The retail sector currently accounts for 68% of consumer food expenditures, most of which consists of supermarkets, and specialised food and convenience stores (Delfi, 2013). A state monopoly has the sole right for over-the-counter retail sales of alcoholic beverages stronger than 3.5% by volume. There are retail co-operatives and one of the three large groups (COOP) is a consumer co-operative.

Market concentration is high in the Swedish retail market, with few large players. In general, the Swedish food-retailing sector is characterised by a relatively high degree of vertical integration between the wholesale and retail trades. Three large groups and one smaller group are responsible for about 90% of retail sales of food and other everyday commodities. Since 2013, the ICA Group – which is the largest group accounting for 51% of retail sales – and the Federation of Swedish Farmers have been co-operating to increase awareness of Swedish food to consumers.

2.5. Farm sector and farm household financial performance is under stress from low profitability

Profitability trends within different activities in the agricultural sector are an important indicator of how the conditions for entrepreneurship and investment are changing within the agricultural industry. Profitability trends are, in turn, dependent on the development of a number of factors, including price trends for products and the means of production, and productivity and efficiency trends within agriculture.

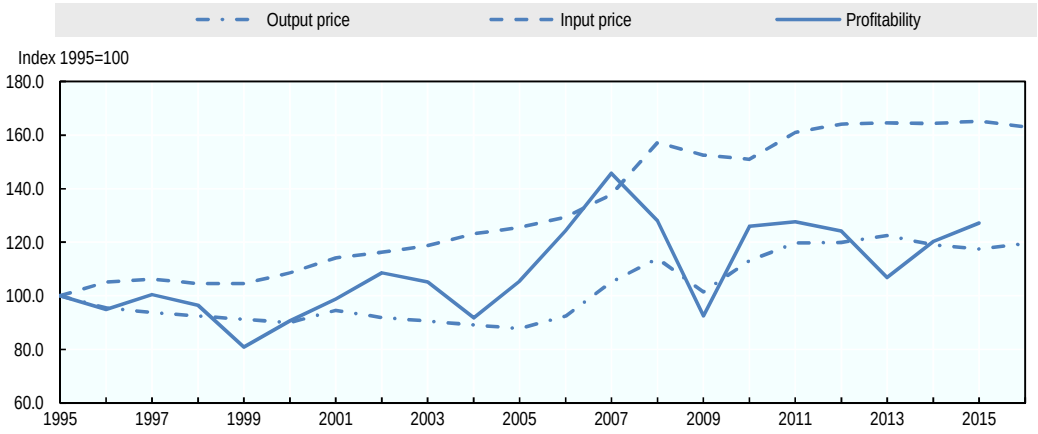
Profitability, measured at current prices, rose by around 27% between 1995 and 2015 (Figure 2.12). During the same period, input prices increased much faster than output prices (output prices rose by around 19% and input prices by around 63%). Thus the profitability trend has been possible due to improved production efficiency and enhanced productivity. Such a relatively weak profitability trend, which also assumes strong growth in efficiency and productivity, in turn places significant overall demands on those entrepreneurs who intend to set up agricultural operations.

Profitability in the agriculture sector is low, especially without support payments (on which farmers depend heavily). During the years 2005-13 only 60% of farms had an average production value larger than the production cost. Only 17% of farms had a production value that could also provide a return on own labour and land, at the same level as the cost of employed labour and cost of renting land. Larger farms with high capitalisation and intensive production are generally more profitable and productive, and are relatively less dependent on support payments. However, these farms are, generally, more indebted, more dependent on employed labour, and rent a higher share of their land (SBA, 2016c).

Profitability has varied considerably between farms, over time and according to location and specialisation, but about half of the profitability variability is farm dependent (i.e. size and management). The variable profitability due to location and specialisation is largely smoothed out by support payments (SBA, 2016c). Profitability also varies by sector. For example, profitability in the beef sector is among the lowest in the European Union, both with and without considering the production-linked support payments (EC, 2013).

Farm-level decomposition of profitability change in four farm specialisations (dairy, beef, pigs, specialised cereals, oilseeds and protein crops) during the period 2005-13 indicates that profitability change is mainly dependent on input and output prices and productivity, and to a lesser degree on output growth (Table 2.A.2). Changes in productivity are the main cause of differences of farm profitability between farms: farms experiencing positive profitability changes are likely to have positive productivity changes (SBA, 2016c).

Figure 2.12. Agricultural profits are low



Note: Profitability is measured "operating surplus" at current prices in accordance with Economic Accounts for Agriculture.
Source: SBA, Statistical Database.

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2.6. Agricultural productivity

Productivity is growing

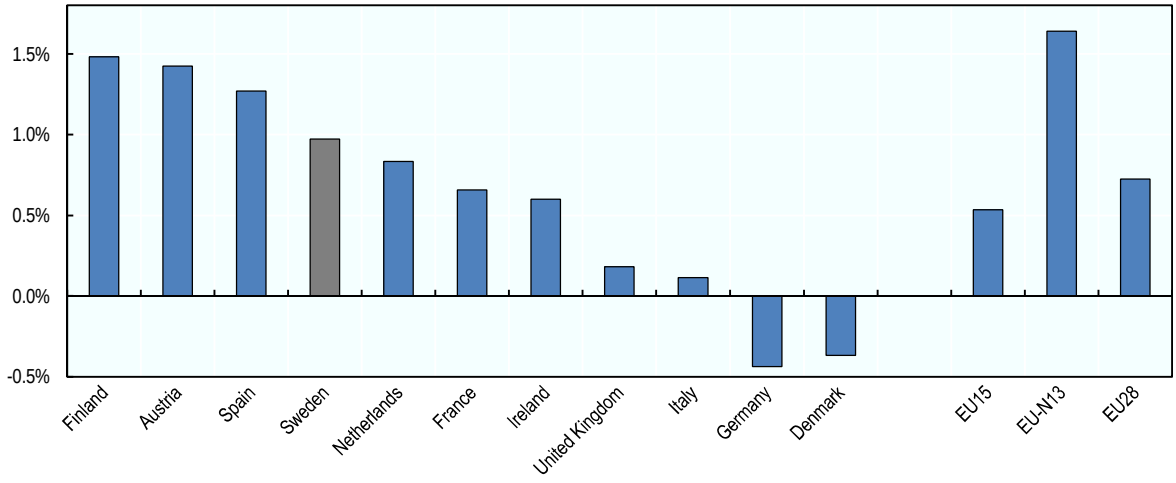
Farm productivity is a performance measure showing the ability of the farm to produce more outputs with the same or fewer inputs. TFP measures the change in output that is not directly originating from a change in input use, but from changes in technology, managerial skills, efficiency and organisation of production.

In terms of TFP growth (the differences between the growth in aggregate outputs and aggregate inputs), TFP in Swedish agriculture grew by 1% per year between 2005 and 2016, which is higher than the EU28 (0.7% annually) (Figure 2.13). From the time of Sweden's accession to the European Union until around 2006, annual productivity growth in agriculture was higher than the EU15 average of 1.3% (EC, 2016).

Figure 2.14 compares Sweden's agricultural productivity trends with its main competitors in agricultural markets since 1995.[8] Over the whole period, Sweden has been performing well, with TFP steadily growing, at a rate comparable to the Netherlands.[9] The growth in TFP in Sweden is mainly due to a strong decline in labour input. Labour productivity growth is the main source of productivity gains, at the expense of capital productivity, which evolved negatively (Figure 2.15). From the early 1990s to 2005, the total workforce in agriculture (in AWU) declined by 38% and by 21% between 2005 and 2016, in line with the restructuring of the sector towards fewer and larger farms.

As labour has been substituted by capital, productivity per unit of capital has decreased. Capital productivity shows an overall decreasing trend prior to the financial crisis, indicating that investments in machinery and buildings have played a major role in output growth and the substitution of labour. After the financial crisis, capital productivity growth recovered, mainly linked to this slowdown in investment growth (Figure 2.15). The growth in intermediate inputs use has remained largely in line with overall TFP growth, while land productivity growth improved, particularly after the financial crisis, as outputs grew while the Utilised Agricultural Area (UAA) declined by 1.7%.[10]

Figure 2.13. Average annual total factor productivity growth in Sweden and selected EU countries between 2005 and 2016



Note: Average growth calculated as compound annual growth rate. To smoothen out the effect of weather variability, the three-year moving average TFP is used: TFP 2005 = average (203, 2004, 2005); TFP 2016 = average (2014, 2015, 2016).
Source: European Commission, DG AGRI based on Economic Accounts for Agriculture, January 2018, https://ec.europa.eu/agriculture/cap-indicators/context/2017/c27_en.pdf.

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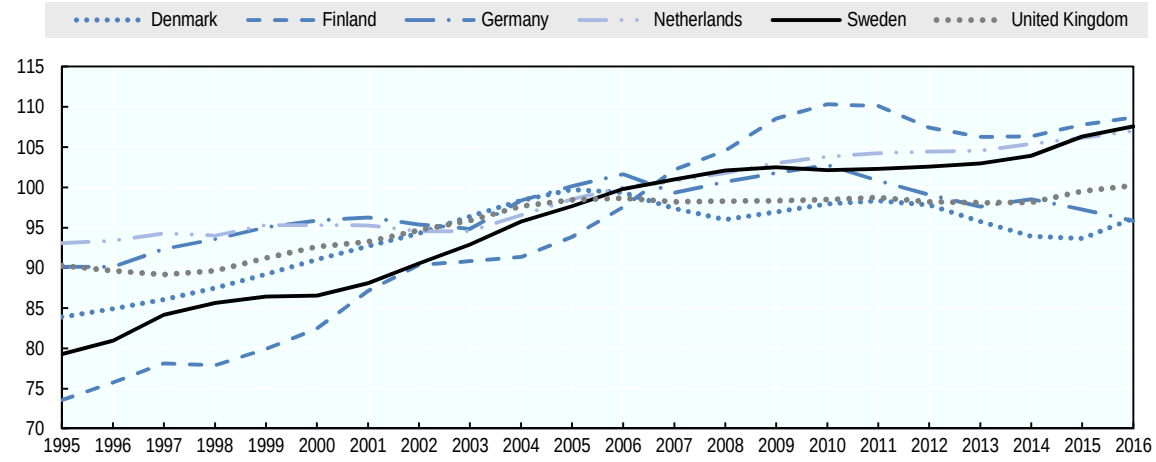
Figure 2.14. Trends in total factor productivity growth in Sweden and selected EU countries, 1995-2016



Source: European Commission, DG AGRI based on Economic Accounts for Agriculture, January 2018, https://ec.europa.eu/agriculture/cap-indicators/context/2017/c27_en.pdf.

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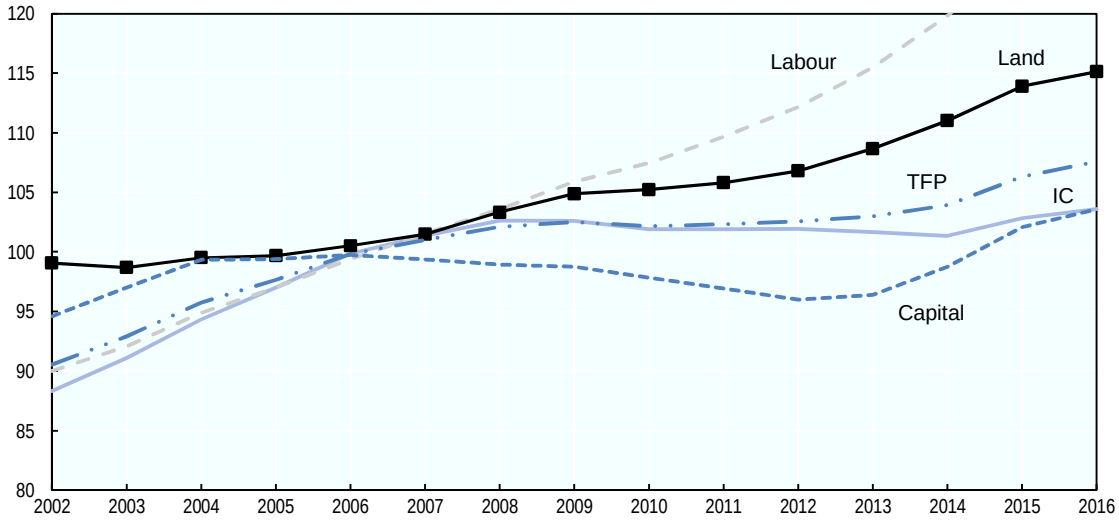
Figure 2.15. TFP and partial productivity growth in Sweden



Notes: IC = intermediate consumption; to smoothen out the effect of weather variability, three-year moving average is used.
Source: European Commission, DG AGRI based on Economic Accounts for Agriculture, January 2018, https://ec.europa.eu/agriculture/cap-indicators/context/2017/c27_en.pdf.

StatLink http://dx.doi.org/10.1787/888933709470

In addition to high TFP growth, Sweden benefits from the relatively good technical efficiency of its farms. Farm-level decomposition analysis of productivity growth for the period 2005-13 indicates that productivity growth is mainly related to change in technical efficiency and in the allocation of inputs (SBA, 2016c). Technical change had a positive impact on productivity growth in several subsectors, including the pig and beef sectors.

Although the technical efficiency of Swedish farms is relatively high, it is estimated that it could be further increased by about 10% (Agrifood, 2013). The highest potential for improvements is on beef farms (17%), which are less efficient and less profitable at both national and international level than other commodity sectors. Table 2.2 summarises the annual average change in outputs, inputs and productivity at the sub-sector level. Estimates for the average productivity and profitability change at farm level in the four subsectors can be seen in Annex 2A (Table 2.A3).

While both output and input use decreased in two subsectors (pigs and milk), input use has declined faster (Table 2.2). The crop, oilseeds and protein crops (COP) subsector is the only one of the with a negative average annual productivity change, due to an increased use of inputs on more land. Concerning the development of land productivity, COP farms (mainly located in south and central Sweden), cattle and milk farms have increased land productivity during the period 2002-14.

In the pig subsector, the productivity change is mainly due to more efficient use of materials and services. The milk subsector has increased the use of capital while enhancing both capital and labour productivity. The cattle subsector has become more extensive, with less use of capital and materials and increased use of labour, land and services.

Compound feed and seeds, which are produced in Sweden, account for a large share of the costs of inputs (Table 2.3). The production of compound feed and seeds are largely dependent on imported commodities as are other inputs, such as mineral fertilisers, pesticides and fuels. The market for inputs is highly concentrated, especially at local level, due to transport costs and economies of scale.

Input costs have followed similar trends as in the rest of the European Union. Fertiliser and energy costs have increased less than other countries in the European Union, partly due to the removal of the

tax on nitrogen content in mineral fertilisers in 2010. Costs of seeds and pesticides have developed less favourably, probably due to Sweden's relatively small market size (SOU, 2014). Costs for some inputs such as fuel are higher than in some countries in northern Europe (SOU, 2015).

Table 2.2. Annual average change in output, input and productivity (%)

	Pigs	Cattle	Milk	Cereals, oilseeds and protein crops
	2002-13	2002-14	2002-14	2002-14
Productivity	2.1	1.3	1.7	-0.9
Output	-3.6	1.4	-1.3	6.7
Input	-5.7	0.1	-3.0	7.6
Partial productivity				
Labour	0.8	1.1	4.0	-1.4
Land	-1.5	1.0	2.0	1.5
Capital	0.6	2.3	0.5	-1.3
Material	2.2	1.6	1.0	-1.9
Service	5.1	0.0	1.1	0.1
Input use				
Labour	-4.4	0.3	-5.3	8.1
Land	-2.1	0.4	-3.3	5.1
Capital	-4.2	-0.9	-1.8	7.9
Materials	-5.9	-0.2	-2.2	8.5
Services	-8.7	1.4	-2.4	6.6
Capital/labour	0.2	-1.2	3.5	-0.1

Source: SBA (2017).

Table 2.3. Agriculture: Share of input costs, 2014

	SEK millions	%
Seeds	2 465	6
Electricity	1 170	3
Fuels and propellants	3 023	7
Fertilisers & soil improvers	2 876	6
Plant protection & pesticides	1 047	2
Animal feed	12 932	29
Maintenance of equipment	2 881	6
Maintenance of buildings	910	2
Veterinary costs	319	1
Financial services	709	2
Agricultural services	3 229	7
Other inputs	9 769	22
Compensation of employees	3 180	7
Total	44 510	100

Source: SBA, Statistical Database.

Box 2.3. Technical efficiency and structural change are the key drivers of productivity growth

Technological improvements are generally essential for increasing farm productivity and reducing production costs, but capital investments might not necessarily be beneficial for farm performance. A study of COP, cattle, milk and pig farms indicate that productivity change is related to structural change in Sweden (SBA, 2017). The milk and pig sub-sectors, which have experienced the largest change in the number of farms and farm size, have had the highest average annual change in productivity.[1]

Farm-level analysis of Swedish agricultural production (1998-2008) indicated that Swedish crop farms would need to grow in size, whereas beef and pig farms need technological improvements, in order to improve productivity (Manevska-Tasevska et al., 2013; Manevska-Tasevska et al., 2014). However, dairy farms were operating at optimal scale. Furthermore, a certain level of diversification activities on farms specialising in a specific enterprise helps them to buffer price shocks in production inputs, generate income from other activities, increase utilisation of under-used inputs, etc. Farms managed by younger farmers are more technical efficient. Technological improvements are generally essential for increasing farm productivity and reducing production costs, but capital investments might not necessarily be beneficial for farm performance. The beef sector appears to be overcapitalised and higher capital use on Swedish beef farms might not improve farm technical efficiency (Manevska-Tasevska et al., 2013; Manevska-Tasevska et al., 2014). Organic farms are, in general, less technical efficient without environmental payments.

Feed costs represent the highest share of the total costs of the livestock production (EC, 2013; Manevska-Tasevska et al., 2013), and feed is thus the main area where larger savings (in absolute terms) can be made. Swedish beef farms with large grazing area per animal and farms located in regions with a longer grazing period (implying low-cost feeding for the animals) are on average more efficient (ManevskaTasevska et al., 2014).

Regional differences in farm performance are common on Swedish farms. Cereal and milk farms in southern Sweden are generally better performing (LRF, 2012). Swedish farms in less favoured areas are on average less efficient than corresponding farms in other regions. Even with the support received, such areas are generally not compensated for the competitive disadvantages arising from the natural handicaps (Manevska-Tasevska et al., 2013; Manevska-Tasevska et al., 2014).

1. Similar results have also been found by Agrifood (2014).

Competitiveness of the food manufacturing industry varies across sectors

The food manufacturing industry achieved robust growth in production and labour productivity over the period 2005-15, which exceeded most EU Member states (Table 2.4). Export growth, while lower than most EU Member states, was higher than most Scandinavian countries However, the absolute size of the food industry is small and exports are limited. The share of the food industry in manufacturing is 9% by turnover and 10% by employment, which is lower than most OECD countries.

Sweden scores slightly above average on the overall competitiveness of its food industry (Figure 2.16), mainly due to the highest score for its labour productivity growth.[11] Although Sweden's share of food manufacturing on the world market increased, its comparative advantage declined. The growth rate of real turnover is also below the benchmark countries and its performance relative to overall manufacturing is weak as other manufacturing sectors grew faster.

The assessment of the competitiveness of nine sub-sectors in Sweden's food manufacturing industry shows the diversity of performance (Figure 2.17). The fruits and vegetables, bakery, meat, other food, and animal feed industries are found to be the most competitive food industries in Sweden, although these sectors do not necessarily account for large shares in the food industry. Labour productivity growth is higher than in the benchmarking countries. On the other hand, seafood, dairy, and beverages are found to be losing comparative advantage, have weak growth rate of real turnover and are losing shares relative to the whole manufacturing industry. While the dairy industry has experienced higher labour productivity growth than the benchmarking countries, both seafood and beverage experienced lower growth. Grain milling is slightly above average on overall competitiveness.

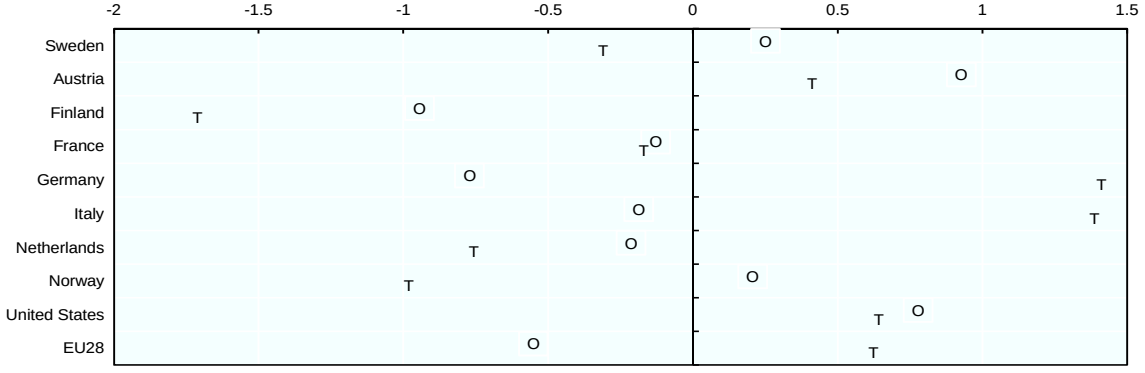
Table 2.4. Performance of food manufacturing industry in selected OECD countries, 2005-15

Country	Turnover			Exports		Employment			Labour productivity	
	Value (EUR billion)	Growth (%)	Share in manufacturing (%)	Value (EUR billion)	Growth (%)	Value (1000)	Growth (%)	Share in manufac-turing (%)	Value (EUR 1000 per employee)	Growth (%)
Sweden	18	2.4	9.1	5	4.0	54	-1.1	10.1	332	2.5
Austria	23	5.2	12.8	9	4.0	81	1.0	13.3	282	2.4
Finland	11	1.8	8.8	1	0.7	39	0.6	11.8	282	-0.4
France	184	2.4	21.3	42	2.9	545	-0.9	19.4	337	2.0
Germany	187	1.5	9.1	53	4.8	821	0.4	11.6	228	-0.1
Italy	132	2.3	14.9	29	4.6	346	-0.2	11.1	381	1.2
Netherlands	71	3.4	21.5	49	5.4	124	0.3	19.5	572	1.6
Norway	23	4.1	25.2	4	2.6	52	0.9	22.2	441	1.6
United States	775	3.4	16.0	67	7.6	1533	-0.2	13.7	506	1.8
EU28	1115	1.4	15.2	95	5.7	4210	-0.3	14.9	265	0.3

Note: Growth rate is average annual compound growth.
Source: Statistics Sweden, Eurostat, Census Bureau for United States and UNComtrade.

On the performance related indicators, the strongest growth in real turnover is observed for the fruit and vegetables industries, followed by bakery and meat in comparison with the other benchmark countries, while the relative performance of the dairy industry is the weakest of the subsectors. Fruit and vegetables and meat are the only industries where growth performance relative to the whole manufacturing industry is above the average of the benchmark countries. Other food and animal feed industries experienced weak relative growth performance even though they achieved higher overall growth, compared to the benchmarking countries.

Figure 2.16. Competitiveness of the food manufacturing industry in Sweden



Notes: The location of each indicator is based on the Z-score that compares the values for individual sub-industries to the overall average (Wijnands et al., 2015); O: Overall competitiveness; T: Difference in Relative Trade Advantage indicator between 2015 and 2005 (value in 2015 minus the value in 2005).
Source: Eurostat, Census Bureau for United States and UNComtrade.

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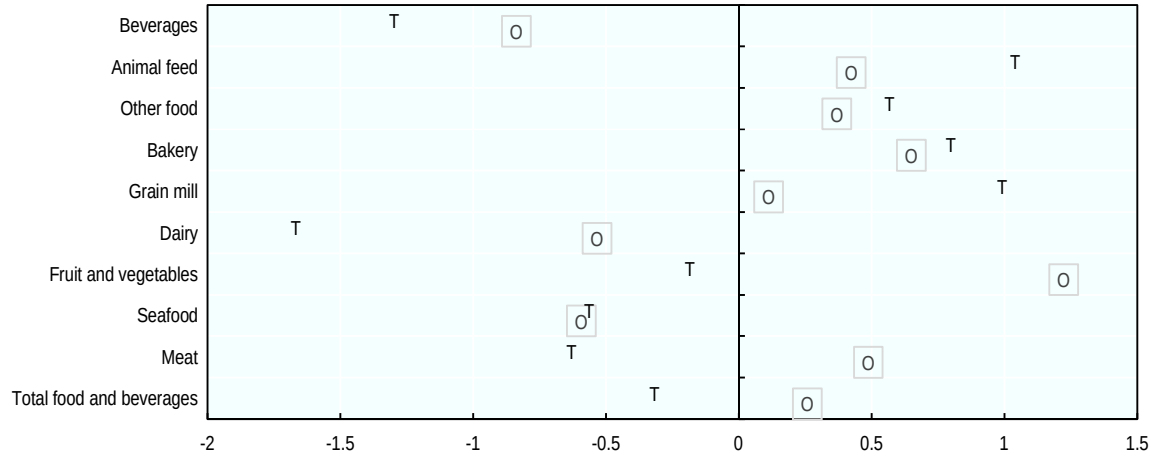
Figure 2.17. Competitiveness of the food and beverage sub-sectors in Sweden



Notes The location of each indicator is based on the Z-score that compares the values for individual sub-industries to the overall average (Wijnands et al., 2015); O: Overall competitiveness; T: Difference in the relative trade advantage indicator between 2015 and 2005 (value in 2015 minus the value in 2005).
Source: Statistics Sweden, Eurostat, Census Bureau for United States and UNComtrade.

StatLink http://dx.doi.org/10.1787/888933709508

The relative performance of labour productivity growth was above average for all industries, except for seafood and beverage. The strongest relative growth was estimated for the dairy industry and the weakest for seafood.

Based on the trade related indicators, the relative increase in world market share was above average in all industries except beverages. The relative performance growth was strongest in seafood and grain milling. The indicator of comparative advantage improved more than average for grain milling, bakery, other food, and animal feed. The loss of comparative advantage of the dairy industry was particularly large as imports of these products increased during the period.

Sweden has made progress in decoupling environmental pressures from agricultural production

Sweden has been one of the earliest OECD countries in raising awareness of environmental issues and developing environmental policies.[12] Sweden has set out 16 major environmental quality objectives covering a wide range of environmental issues. These comprise all economic sectors and range from combating climate change to landscape protection (Swedish Environmental Protection Agency, 2017). Agriculture is concerned with several of these environmental objectives, in particular for three of them: a Varied Agricultural Landscape; Zero Eutrophication; and a Non-Toxic Environment.

The main environmental issues related to agriculture in Sweden are eutrophication, landscape protection and biodiversity protection (Engström, Wadeskog and Finnveden, 2007; SBA, 2008; OECD, 2013). To this has been added more recently the role of agriculture in reducing GHG emissions. Water quality problems are related to the use of nutrients (nitrogen, phosphorus) through the use of mineral fertilisers and manure in livestock, which, when in surplus, can pollute soil, air, as well as surface and groundwater, and coastal areas. Excess nutrients can reduce the quality of drinking water (nitrates) and cause eutrophication, while also contributing to GHG emissions. Agricultural production, as in many OECD countries, is also a source of pressure on ecosystems and habitats and thus has an influence on the protection of biodiversity in Sweden.

Figure 2.18 compares trends in a selection of agri-environmental indicators for Sweden with those in the OECD, EU15 and EU28. The results for the decade 2004-14 clearly show that Sweden has experienced an important decline in environmental pressures exerted by agriculture: a small but

significant reduction in ammonia emissions; marked reductions in nitrogen and phosphorus surpluses related to livestock and mineral fertilisers; reduction in energy use by and share of agriculture; and a fall in agricultural water use. Moreover, these reductions in environmental pressures exerted by agriculture occurred at a much faster rate than the average for OECD, EU15 and EU28 countries.

A decrease in the volume of agricultural production, mainly pig, milk and cattle partly resulted in the decline in environmental pressures. Nevertheless, this decline in production volume is much lower in absolute value than the reduction in environmental pressures, which can indicate some decoupling of agricultural production and environmental outcomes in agriculture or, in other words, a measure of environmental productivity gains in the agriculture sector.

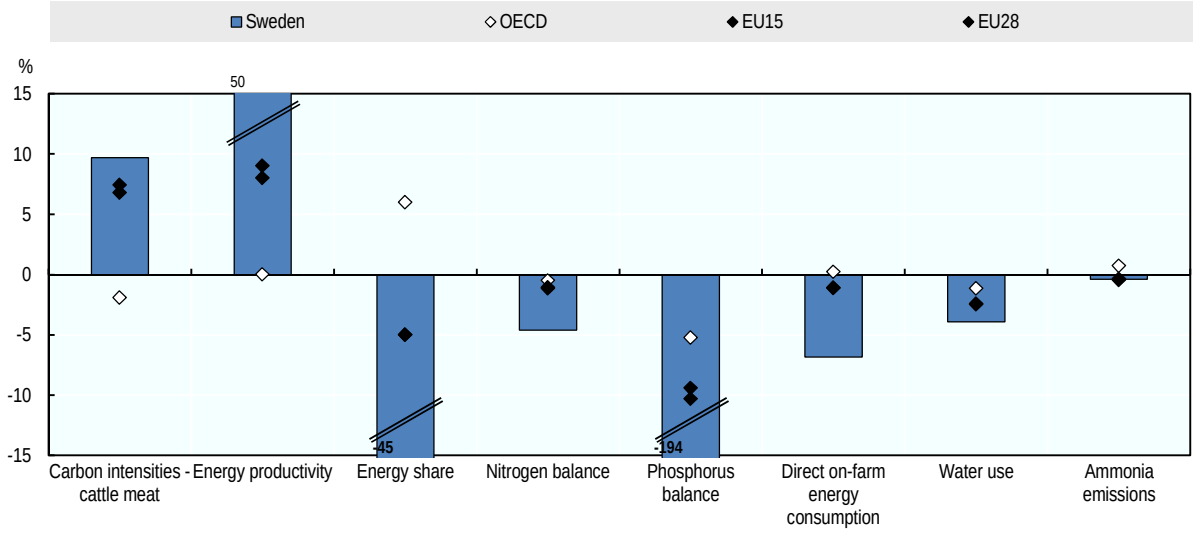
Nutrient surplus

Since 2000, nitrogen and phosphorus surpluses (as measured by the respective balances) have dropped significantly, at more than the OECD average, while agricultural production has remained relatively stable or even increased in recent years, indicating some decoupling of crop production from environmental pressures (Figure 2.19). This is partly due to declines in fertiliser use, although the amount of nitrogen fertiliser used per square kilometre of agricultural land is higher than the OECD average.

The rate of decline in agricultural nitrogen and phosphorus surpluses has been particularly remarkable since the early 1990s. Sales of commercial fertilisers to agriculture and horticulture have also fallen over time.[13] Reduction in nitrogen leaching is mainly due to reductions in cultivated field area, higher nitrogen efficiency in farming and environmental payments for reducing nitrogen leaching.

Figure 2.18. National agri-environmental performance compared to the OECD average

Average annual percentage change 2002-04 to 2012-14, or nearest available period



Note: For Sweden percentages changes for energy productivity, energy share and phosphorus balance are larger than the maximum and minimum limits shown in the graph.
Source: OECD Agri-environmental Indicators; Eurostat for nitrogen and phosphorus balance for EU Member states (2016), and OECD Environmental Database (2017) for water use. FAOSTAT for carbon intensities.

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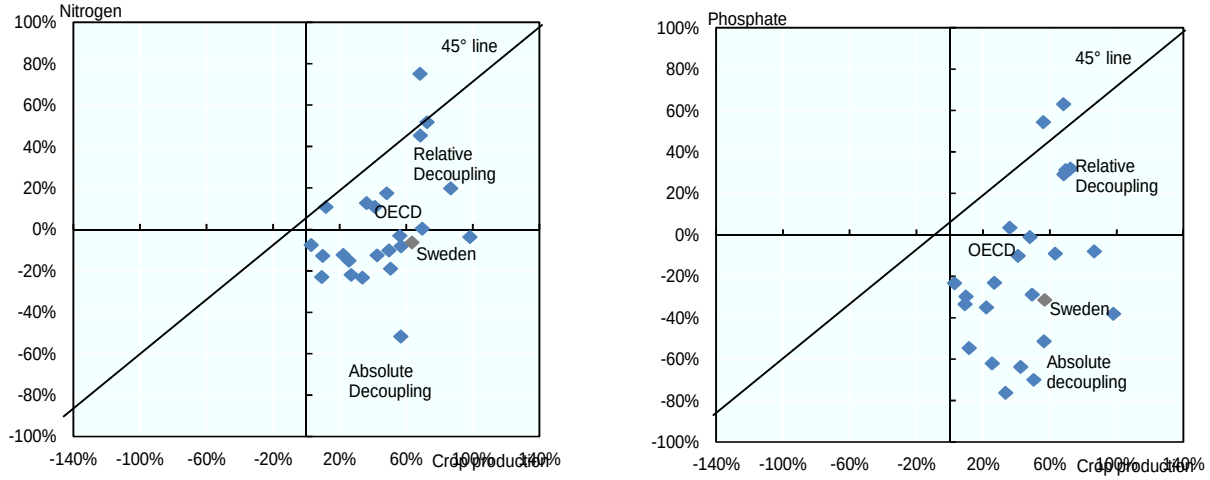
Figure 2.19. Sweden has decoupled fertiliser consumption from crop production



Notes: Consumption of commercial fertilisers is expressed in kg/ha of agricultural area. Crop production value is expressed in USD using 2010 prices and Purchasing Power Parities. OECD excludes the Czech Republic.
Source: Adapted from Figure 4.2, OECD (2017), *Green Growth Indicators 2017*.

StatLink http://dx.doi.org/10.1787/888933709546

However, the physical geographic conditions and the ecosystem vary substantially across the country. Heterogeneous soils, climate and topography together with geographical concentrations of crop production, animal husbandry and human population have led to regionally different eutrophication pressures. Sweden's land area is large relative to the small size of agriculture and the human population and thus national averages can be misleading. Moreover, agriculture and the human population are highly concentrated in the southern part of Sweden. Hence, some parts of Sweden might have high nutrient pressures in highly populated areas at a level comparable with many other regions of Western Europe.

Pesticides

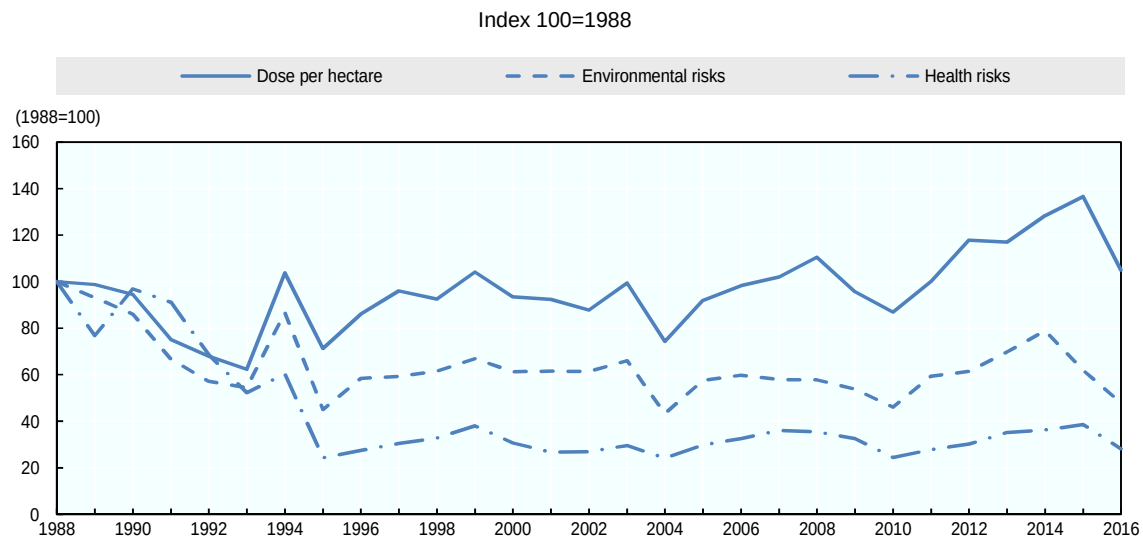
Viewed in a longer perspective, health and environmental risks from pesticides, expressed as indexes, have decreased (Figure 2.20). This is especially true for the health risk index.[14] Compared with the base year 1988, the estimated health and environmental risks for 2015 have fallen from 100 to 31 and 69, respectively. The main decrease in the risk index is at the beginning of the period (Swedish Environmental Protection Agency, 2017). The risk reductions are partially attributable to targeted information and advisory initiatives, successful regulation of certain problem products and product development that has resulted in lower risks, reinforced in 2014 by the requirement to apply Integrated Pest Management according to EU-legislation.

Efforts to ensure the environmental sustainability of crop protection and minimise the associated risks with pesticides are pursued under the National Action Plan on Sustainable Plant Protection, as required by the Directive on the Sustainable Use of Pesticides (Directive 2009/128/EC) (Chapter 4).

In terms of pesticide concentrations in aquatic environments, evidence from the national environmental monitoring exercise since 2002 suggest a declining concentration of pesticides in both surface and groundwater, although situations vary a great deal across locations, depending on the agricultural context (Swedish Chemical Agency, 2017). However, the risk that plant protection products used in agriculture leak to the surface water and negatively affect aquatic organisms has not decreased since 2002 according to the environmental monitoring (Swedish Agricultural University, 2015). However, since mid-90s achieving further reductions in the volume of sales is becoming difficult, as the national action plans have shifted from reduction to focus more on minimising of risks both regarding health and environment and the use of integrated pest management.

Although the goal that the level of plant protection products found in surface and groundwater should be close to zero has not been fulfilled, the levels found in groundwater is dominated by active substances of pesticides that are no longer in use in Sweden and most of them were applied outside the agricultural sector. Seen over three decades the levels have decreased both in ground and surface water (SBA, 2017). The risks for users of pesticides are small. In the study that was made in 2017, the results show that almost all professional users of pesticides use protective equipment, and have procedures in place to minimise risks.

Figure 2.20. Trend in pesticide risk index in Sweden, 1988-2016



Source: Swedish Chemical Agency (2017), "Risk indicators for plant protection products", webpage available at http://www3.kemi.se/en/Content/Pesticides/Plant-Protection-Products/Plant-protection-products-in-Sweden/Risk-indicators-for-plant-protection-products/

StatLink http://dx.doi.org/10.1787/888933709565

Biodiversity

Much of the biodiversity of the agricultural landscape is found in meadows and pasture lands, which are among the lands with the richest variety of species in Sweden.[15] Biodiversity, cultural heritage qualities and landscape amenities of agricultural areas have declined mainly due to a reduction in semi-natural grasslands and decreasing animal production. The area of traditional meadows and permanent pastureland has fallen by 12% between 2003 and 2015 (SBA, 2016a). Moreover, it is projected that the area of pastureland will decrease by a further 25-30% by 2030, if the present agricultural policies are not altered (SBA, 2016d).

The area and number of grassland habitats is below the minimum level of good conservation status for 19 of the 22 habitat types of cultivated landscapes, with a negative trend for 16 of these habitats (SSIC, 2014). The green infrastructure of the cultivated landscape is not considered satisfactory in many regions due to the loss of area and field elements, and the subsequent fragmentation of grassland habitats (SEPA, 2012).

As a result of intensive farming – mainly in southern plain areas – there has been a decline in biodiversity, cultural heritage qualities and landscape amenities. About 50% of the threatened species are found in agricultural landscapes (SSIC, 2015). The long-term population trend is negative for many bird species, and also for several common species that contribute to the agricultural ecosystem (Green and Lindström, 2015). About 3% of agricultural land is legally protected by specific management plans, whether publicly owned land, or private land regulated by Natura 2000, or other nature reserve prescriptions.

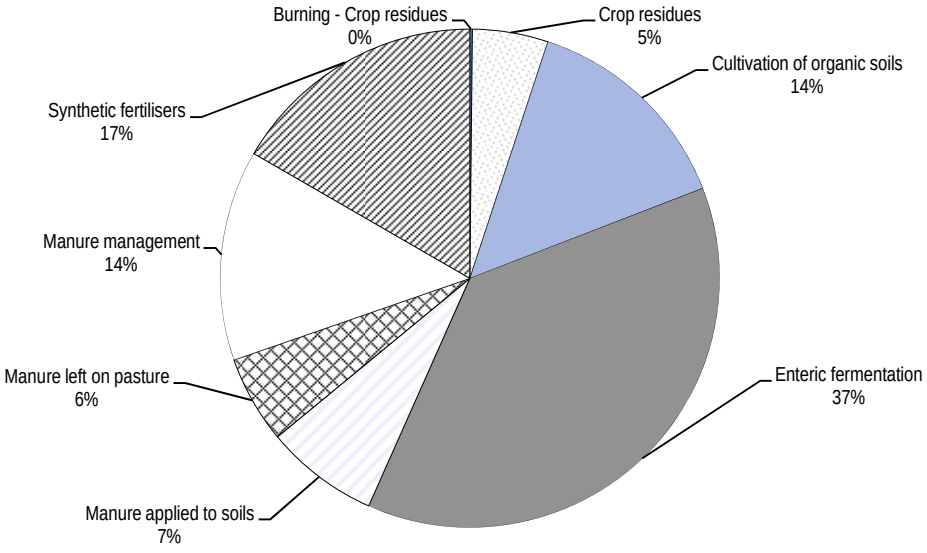
There are special interim targets related to conservation and management of meadows and pastures. All land areas must be conserved and the extent of particularly valuable areas such as meadows and pastures of the most endangered types must be increased. The latter include limestone pavements (*alvars*), forest pastures, summer pastures, heather moorlands and pastures in Norrland.

Greenhouse gas emissions

Agriculture accounts for around 12% of total GHG emissions (similar to the EU average). The main agricultural GHG emissions are CH_4 emissions due to the fermentation in ruminant digestive systems (37%), followed by the use of synthetic fertilisers (17%), manure management and cultivation of organic soils (14% each) (Figure 2.21). Over the period 1995-2014, total agricultural GHG emissions decreased constantly, while agricultural production has varied widely between years. Overall, the carbon productivity – measured as agricultural production per unit of CO_2 emitted – of Swedish agriculture has improved, as GHG emissions decreased at a higher rate than agricultural production (Figure 2.22).

The main drivers of this trend are a decline in the livestock population, particularly for pigs, cattle and dairy cows, and reduced use of fertilisers and animal manure. Sweden's main policies for addressing emissions from agriculture focus on switching away from fossil fuels to renewable energy and through greater energy efficiency in agricultural buildings. These policies include targeted agri-environment payments and investment support under the Rural Development Programme; energy and carbon dioxide taxes and support for biogas production (Chapter 6).

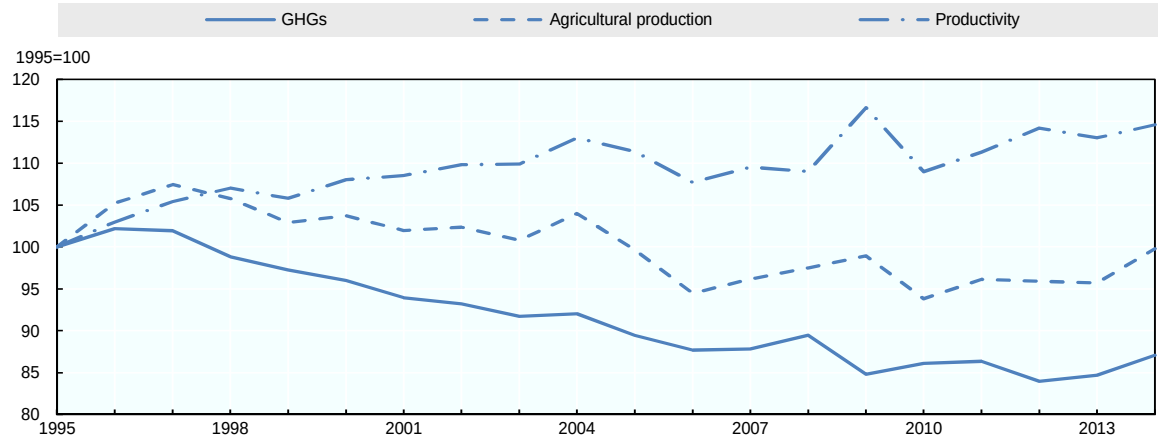
Figure 2.21. Emissions by source (CO2eq), average 1995-2014



Source: FAOSTAT.

StatLink http://dx.doi.org/10.1787/888933709584

Figure 2.22. Decoupling GHG emissions from agricultural growth



Source: FAOSTAT.

StatLink http://dx.doi.org/10.1787/888933709603

Climate change and sustainable productivity

Climate change is expected to have significant effects on agriculture in Sweden. Atmospheric carbon dioxide is expected to double in concentration, and temperature to increase and become more similar to that of central and southern Europe of today. However, the extreme seasonal variations in day length and low solar elevations at Nordic latitudes will remain the same, and also in the future give low radiation levels during autumn, winter and spring, and high levels during summer, compared to more southern latitudes. Water conditions are also expected to change compared to present. Although it is more difficult to generalise this change, and large spatial differences might occur, a general expectation is that precipitation will increase.

Box 2.4. Impact of climate change on Swedish agriculture

The vegetation and cultivation period will be considerably prolonged according to the climate scenarios. Increased temperatures will lead to increased growth, particularly in the spring, when growth is currently severely restricted by temperature. By the end of the century, the vegetation period in the south may be up to 100 days longer compared with the period 1961–90 (Swedish Portal for Climate Change Adaption, 2016). The improved cultivation conditions present opportunities for increased harvests throughout the country. Yields of autumn-sown crops will increase, and new crops may be introduced. Conditions for livestock farming will be improved by a prolonged grazing season and increased harvests of forage crops.

The change of crop yield in 2080 compared to 1990 has been estimated based on several combinations of models and scenarios; the outcomes show an increase ranging from 20.4% – 36.4%. One estimate is that the yield will increase by 50% in Norrland, 30% in Svealand and 20% in Götaland. If prices, land area and choice of crops remain unchanged, this would result in increased grain harvests worth SEK 1 billion annually at today's prices and earnings will increased by approximately 60%, or SEK 2.8 billion annually.

However, increased production requires increased use of fertilisers. Problems with pests such as insects, fungi and viruses will increase in a warmer climate. If the use of pesticides were to rise to Danish levels, this would mean almost twice the present levels used. Access to water in the future climate will lead to more precipitation in winter time but less in summer time will make new demands on both drainage and irrigation. The increased temperatures in summer time may pose problems for the health and welfare of pig and poultry rearing in particular.

Source: Swedish Government (2007).

Crop suitability is likely to change throughout Europe, and crop productivity (all other factors remaining unchanged) is likely to increase in northern Europe. Longer growing seasons are already producing increased harvests and providing the potential for new crops. At the same time, more pests

and weeds are emerging, and new requirements for irrigation watering and drainage may arise due to the altered precipitation patterns (Swedish Government, 2007).

Despite the fact that the conditions for agriculture in Sweden will generally improve, the risk of extensive crop damage as a consequence of extreme weather events, such as drought, intensive rain and flooding, will probably increase (Swedish Government, 2007). The most serious consequence will be a threat to Saami culture if conditions for reindeer herding worsen. New crops, changed cultivation methods and systems, sowing and harvesting times as well as adapted fertilisation and control measures will be required in order for agriculture to draw full benefit from the fundamentally improved cultivation conditions that a changed climate will entail.

Notes

1. Sweden, with a total land area of 41 million hectares, accounts for nearly 10% of the total area of the EU28.
2. For example, in Skåne county, located in the southernmost part of Sweden, nearly half the land area in 2010 consisted of agricultural land, while the corresponding figure for Norrbotten county, in the far north, was less than 1%. Of the total agricultural land area in Sweden, about 16% was in Skåne county, even though it has less than 3% of the total land area of the country. The reverse situation applies to forests, which in Skåne county amounted to 37% of the land area, while the forested land area in Västernorrland and Gävleborg counties amounted to nearly 90%.
3. In general, RCA values greater than 1 indicate a comparative advantage and a country's specialisation in exports for that sector, meaning that the sector is competitive within the economic system of the country with respect to other sectors. Values less than 1 indicate that a country has not specialised in that sector and that it has no comparative advantage. RCA values less than 0.8 indicate weak comparative advantage.
4. It should be noted that forward and backward linkages are also determined by structural variables such as the size of the economy and remoteness. A country with an important domestic market will have low a backward linkage – as it already has the demand within its border to grow industries –, while the remoteness may exclude the country from the GVCs circuits.
5. In the 1980s, expenditure on food accounted for 18% of household expenditure, but fell to 12% in 2000 and has since then been relatively constant. During the same period the share of household expenditure spent at restaurants and hotels increased from 4% to 6% (SBA, 2015a).
6. In terms of Annual Working Units (AWU), the number of people employed in agriculture has declined from 72 000 AWU in 2005 to 57 000 AWU in 2015.
7. The largest forestry co-operative is Södra Skogsägare (Södra, which has international operations, owns paper pulp mills and saw mills, and is the world's largest exporter of paper pulp (Nilsson et al., 2012).
8. Manevska-Tasevska and Rabinowicz (2014) study finds low TFP for the Swedish agricultural sector as compared to its main competitors (Denmark, Germany, Netherlands, Finland, Ireland, Poland, and the United Kingdom), suggesting the existence of high input costs relative to production value. The study points to a range of factors explaining this low TFP, reflecting Swedish climatic conditions with higher costs of inputs compared to other countries, such as feed, labour costs and the weight of investments. After 2001, the TFP for Sweden increased to the level found for farms in Denmark and the United Kingdom (input costs still higher than production output).

9. Sweden was also among the countries showing high average TFP growth, especially for the period 2000-09. For the period 2004-08, Manevska and Rabinowicz (2014) report 3.7% for Sweden, 0.2% for Germany and 1.3% for Poland; Hansen et al. (2011) estimated that in 2000-09, TFP in Sweden grew at a rate of 2.3% per annum, which compares very favourably with the average growth of 1% for EU15 and 1.2% for EU25. USDA (2017) estimated TFP annual growth rates of 1.1% for the period 2001-14.

10. Between 2010 and 2015, agricultural land decreased by over 45 000 ha.

11. The competitiveness of Swedish food manufacturing and its sub-sectors has been estimated in comparison with its major competitors using the analytical framework developed in Wijnands et al. (2007) and Wijnands et al. (2015). The methodology is based on trade related indicators (market shares in the world market and trade specialisation) and economic performance indicators (annual growth rates of turnover in real terms, labour productivity and share in total manufacturing). The assessment of overall competitiveness is made based on the average of five indicators. The benchmark countries include Austria, Finland, France, Germany, Italy, Netherlands, Norway, United States, and EU28.

12. The fact that the Swedish Environmental Protection Agency is one of the oldest in the world illustrates how important this country's concern for environmental issues is in the Swedish national context.

13. About 77% of Sweden's arable land is fertilised. On this land, the fertiliser application was 107 kg N/ha and 23 kg P/ha per year on average in 2012/13, with a regional variation from 49 kg N/ha/year in Jämtland County to 129 kg N/ha/year in Skåne County (Statistics Sweden, 2016).

14. Sweden uses risk indicators to track risk trends associated with pesticide use over time. The system has been in use since 1997. Results are reported annually in an index with 1988 as the baseline year. It is based on a scoring system of the intrinsic properties of each active substance related to the operator health and the fate and impact on the ecosystems. Also exposure factors used for a reference product and data on use intensity are included. The index shows the trend in the number of hectare doses sold each year (black line), the risk to human health (red line) and the risk to the environment (green line). The number of per-hectare doses (use intensity) is calculated based on sales volumes and the recommended dose rates for each active substance. The number of hectare doses, which remained broadly unchanged for over 20 years, increased significantly during the period 2010 to 2015. A possible explanation can be attributed to an increase in the acreage of winter cereals in Sweden. However, over the long term health and environmental risks have been reduced significantly according to the index.

15. For example, the prescriptions of the Swedish Environmental Code state that: landscape elements such as alleys, cultivation cairns, ponds and stone walls must not be removed or damaged; trees that are valuable for biodiversity or have had a function in old land use must not be cut or damaged when clearing pastures and forest fringes for agricultural land; traditional meadows and semi-natural pastures must not be destroyed by soil cultivation or land reclamation; fertilisation is forbidden on semi-natural pastures and on landscape elements close to arable fields; stones and soil should not be dumped on landscape elements that are valuable for cultural heritage or biodiversity; and fallow fields should not be cut between 1 March and 30 June.

References

AgriFood (2014), "Competitiveness of Swedish agriculture: indicators and driving forces", *Economics Centre*, Working Paper, 2014:16.

AgriFood (2013), "Policy impact on farm level efficiency in Sweden 1998-2008", *Economics Centre*, Working Paper 2013:6.

Cogeca (2015), "Development of agricultural co-operatives in the EU 2014, European agri-co-operatives", General Committee for Agricultural Cooperation in the European Union, Brussels.

Delfi (2013), *Food service guide*, Delfi MarknadsPartner AB, Stockholm.

Engström, R., A. Wadeskog and G. Finnveden (2007), "Environmental assessment of Swedish agriculture", *Ecological Economics*, Vol. 60, pp. 550-563.

European Commission (EC) (2016), Productivity in EU Agriculture, EU Agricultural market Briefs, No. 10, December, https://ec.europa.eu/agriculture/sites/agriculture/files/markets-and-prices/market-briefs/pdf/10_en.pdf

Eurostat (2017), *Farmers in the EU – Statistics*, http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Farmers_in_the_EU_-_statistics&oldid=365654#Farm_work_characteristics

Eurostat (2016), *Statistical Factsheet Agriculture in the European Union and the Member States: Sweden*, European Commission, https://ec.europa.eu/agriculture/sites/agriculture/files/statistics/factsheets/pdf/fi_en.pdf

Eurostat, *Farm Structure Survey 2005 and 2013*.

Food and Bioscience (2016) Nationell Samordning för att Stimulera tillväxt i Livsmedelsbranschen (National co-ordination to stimulate growth in food business).

Green, M. and A. Lindström (2015), "Övervakning av fåglarnas populationsutveckling. ÅrsReport för 2014", Lund University.

Greenville, J., K. Kawasaki and R. Beaujeu (2017), "How Policies Shape Global Food and Agriculture Value Chains", *OECD Food, Agriculture and Fisheries Papers*, No. 100, OECD Publishing, Paris, http://dx.doi.org/10.1787/aaf0763a-en

Hansen, J., J. Andersen, S. Rasmussen and L. Jacobsen (2011), Landbrugets og fødevareindustriens Produktivitetsudvikling, Fødevareøkonomisk Institut, Københavns Universitet.

Karlsson, J and P. Nilsson (2014), "Capitalisation of Single Farm Payment on farm price: an analysis of Swedish farm prices using farm-level data", *European Review of Agricultural Economics*, Vol. 41, No. 2.

LRF (2012), Grön konkurrenskraft – produktivitetsutveckling i Sverige och i våra konkurrentländer, Lantbrukarnas Riksförbund, Stockholm.

Lönnroth, M. (2010), *The organisation of environmental policy in Sweden – a historical perspective*, Report 6404, The Swedish Environmental Protection Agency.

Manevska-Tasevska, G. and E. Rabinowicz (2014), *Competitiveness of Swedish agriculture: indicators and driving forces*", *AgriFood Economics Centre*, 2014-04-16.

Manevska-Tasevska, G., H. Hansson and E. Rabinowicz (2014), *Input saving possibilities and practices contributing to more efficient beef production in Sweden*, Working paper 2014:01, Agrifood Economics Centre, Department of Economics, Swedish University of Agricultural Science, Lund.

Manevska-Tasevska, G., E. Rabinowicz and Y. Surry (2013), *Policy impact on farm level efficiency in Sweden: 1998-2008*, Working paper 2013:06, Agrifood Economics Centre, Department of Economics, Swedish University of Agricultural Science, Lund.

Nilsson, P. and S. Johansson (2013), "Location determinants of agricultural land prices", Jahrbuch für Regionalwissenschaft, Vol. 33, No1.

Nilsson, J., P. Pyykkönen, P. Ollila, S. Bäckman, and H. Kauriinoja (2012), "Support for Farmers' Cooperatives; Country Report Sweden", Wageningen: Wageningen UR.

OECD (2017), *Green Growth Indicators 2017*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264268586-en

OECD (2016), *Farm Management Practices to Foster Green Growth*, OECD Green Growth Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264238657-en

OECD (2014), *Green Growth Indicators for Agriculture: A Preliminary Assessment*, OECD Green Growth Studies, OECD Publishing. http://dx.doi.org/10.1787/9789264223202-en

Statistics Sweden (2016), "Agricultural statistics 2016 including food statistics – tables", *Official Statistics of Sweden*.

Statistics Sweden (2015), "Dagens urbanisering – inte på landsbygdens bekostnad", Välfärd 2015:2.

Statistics Sweden (2013), "Land use in Sweden", 6th edition, Stockholm.

SOU, Statens offentliga utredningar (2015), "Attraktiv, innovativ och hållbar –strategi för en konkurrenskraftigjordbruks- och trädgårdsnäring, Slutbetänkande av Konkurrenskraftsutredningen", Fritzes Offentliga Publikationer, Stockholm.

SOU, Statens offentliga utredningar (2014), "Tillväxt och värdeskapande: Konkurrenskraft I svenska jordbruk och trädgårdsnäring, delbetänkande av konkurrenskraftsutredningen", Fritzes Offentliga Publikationer, Stockholm.

Swedish Agricultural University (2015), "Resultat från miljöövervakning av bekämpningsmedel (växtskyddsmedel)- Långtidsöversikt och trender 2002-2012 för ytvatten och sediment", Sveriges lantbruksuniversitet, Institutionen för vatten och miljö, Rapport 2015:5.

SBA, Swedish Board of Agriculture (2017), "Uppföljning av handlingsplanen för hållbar användning av växtskyddsmedel 2013-2017", Dnr 4.4.17-10793/17

SBA (2015a), "Livsmedelskonsumtionen i siffror – Hur har konsumtionen utvecklats de senaste femtio åren och varför?". Report 2015:15, http://webbutiken.jordbruksverket.se/sv/artiklar/ra1515.html

SBA (2015b), "Jordbrukspolitik, inlåsning och strukturomvandling", Report 2015:14, http://webbutiken.jordbruksverket.se/sv/artiklar/ra1514.html

SBA (2016a), "Food consumption and nutritive values, data up to 2015", Statistiska meddelanden, JO 44 SM 1601.

SBA (2016b), "Livsmedelsindustrins internationalisering: Effekter på sysselsättning och produktivitet", Report 2016:16.

SBA (2016c), "Konkurrenskraften i svenska gårdar: En jämförelse av lönsamhet och produktivitet bland svenska jordbruksföretag (2005–2013)", Report 2016:14. http://webbutiken.jordbruksverket.se/sv/artiklar/ra1614.html

SBA (2016d), "Sveriges utrikeshandel med jordbruksvaroroch livsmedel 2013-2015", Report 2016:14. http://webbutiken.jordbruksverket.se/sv/artiklar/ra1614.html

SBA (2012), "Marknadsöversikt- livsmedelsindustrin". Report 2012:42. http://webbutiken.jordbruksverket.se/sv/artiklar/ra1242.html

Swedish Chemical Agency (2017), "Risk indicators for plant protection products", http://www3.kemi.se/en/Content/Pesticides/Plant-Protection-Products/Plant-protection-products-in-Sweden/Risk-indicators-for-plant-protection-products/

Swedish Competition Authority (2011), "Mat och marknad: från bonde till bord", Report 2011:3.

Swedish Environmental Protection Agency (2017), *Environmental Objectives Portal*, http://www.miljomal.se/Environmental-Objectives-Portal/

Swedish Government (2007), *Sweden facing climate change – threats and opportunities*, Swedish Commission on Climate and Vulnerability, Final report of the Swedish Commission on Climate and Vulnerability, Swedish Government Official Reports

Swedish Portal for Climate Change Adaption (2016), https://www.smhi.se/en/climate/climate-indicators/climate-indicators-length-of-vegetation-period-1.91482

SSIC, Swedish Species Information Centre (2015), "The red list of Sweden 2015", http://www.artdatabanken.se/en/the-red-list/

SSIC, (2014), "Arter och naturtyper i habitatdirektivet – bevarandestatus i Sverige 2013". Ed: Eide, W., Uppsala

Swedish Trade Federation (2016), Digital mathandel 2016, Svensk Digital Handel.

USDA (United States Department of Agriculture) (2017), Economic Research Service, International Agricultural Productivity, www.ers.usda.gov/data-products/international-agricultural-productivity.aspx, (accessed January 2018).

Wijnands, J., S. van Berkum, and D. Verhoog (2015), *Measuring Competitiveness of AgroFood Industries: the Swiss case*, OECD, Paris.

Wijnands, J., B. van der Meulen and K. Poppe (2007*), Competitiveness of the European Food Industry: An economic and legal assessment 2007*, Office for Official Publications of the European Communities.

Annex 2A

Tables

Table 2.A1. Value of agricultural production, 1990-2016 (EUR million)

	1990	1995	2005	2010	2015	2016
Cereals (including seeds)	515	395	452	358	529	469
Wheat and spelt	186	136	207	177	274	237
Soft wheat and spelt	186	136	207	177	274	237
Barley	160	139	136	95	135	123
Industrial crops	222	163	169	203	234	226
Forage plants	551	527	508	608	710	637
Vegetables and horticultural products	229	277	322	368	451	458
Potatoes (including seeds)	112	122	133	116	120	126
Fruits	20	25	50	49	78	69
Crop output	**1 620**	**1 471**	**1 638**	**1 744**	**2 208**	**2 056**
Animals	936	960	998	1034	988	1004
Cattle	371	340	392	402	386	387
Pigs	377	422	366	378	331	332
Poultry	44	74	98	111	134	146
Animal products	1 258	1 195	1 181	1 082	1 140	1 128
Milk	1 082	1 035	1 019	922	959	930
Eggs	114	99	95	104	119	131
Animal output	**2 187**	**2 154**	**2 179**	**2 120**	**2 133**	**2 142**
Agricultural goods output	**3 780**	**3 596**	**3 817**	**3 872**	**4 365**	**4 220**

Note: At constant prices.
Source: Eurostat, Economic Accounts for Agriculture, 2018.

Table 2.A2. Swedish agri-food trade: Top 10 import and export trade partners, 2015

Ranking	Origin of imports		Destination of exports	
		%		%
1	Norway	26	Norway	12
2	Denmark	12	Denmark	10
3	Netherlands	10	Poland	9
4	Germany	10	France	9
5	Italy	5	Finland	8
6	Spain	4	United Kingdom	8
7	France	4	Germany	6
8	Belgium	3	Spain	5
9	United Kingdom	3	United States	4
10	Poland	2	Netherlands	4

Source: Statistics Sweden.

Table 2.A3. Average profitability change and main components by specialisation, 2005-13 (%)

	Profitability	Output growth	Output prices	Input prices	Productivity
Cattle	2	0	2	-3	2
COP	-2	1	1	-2	-2
Dairy	-1	0	2	-4	0
Pigs	1	3	3	-4	1

Source: Swedish FADN, SBA, 2016c. Profitability change is measured in relation to total costs. Productivity change is calculated using production functions with technical inefficiency, one for each specialisation. The production function includes total production value including subsidies and four inputs: capital, land, labour and intermediate inputs.