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Cross-Country Comparison of Farm Size Distribution

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Comments are welcome and may be sent to tad.contact@oecd.org.

Abstract

CROSS-COUNTRY COMPARISON OF FARM SIZE DISTRIBUTION

Raushan Bokusheva and Shingo Kimura, OECD

This report summarises selected measures of the farm size distribution for fourteen OECD countries: Canada, Estonia, France, Germany, Ireland, Italy, Japan, Korea, Latvia, the Netherlands, Norway, Sweden, the United Kingdom (England) and the United States over the period 1995-2010. The farm size statistics are presented for four major production systems: crop, dairy, cattle and pig farming. The report documents consolidation of agricultural production in large-scale farms in most countries and sub-sectors covered by the report. Nevertheless, farm size growth rates show substantial differences across countries and periods which underlines the importance of country-specific natural, social, and economic conditions and the regulatory and policy environment for the evolution of farm structures. Increased inequality in farm size distributions, as captured using Gini coefficients, indicates a trend towards more polarized farm structures.

Key words: Agriculture, farm size distribution, structural change

JEL classification: D30, L11, Q12, Q18

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Executive Summary

A decline in farm population and an expansion of farm size are important characteristics of structural change in the agricultural sector of OECD countries. In the process of industrial transition from agriculture to manufacture and service industries, the farm size which could earn an equivalent income with other parts of the economy has increased over time, pushing the trend of farm-size expansion. In the advanced OECD countries, farm size continues to expand with a continuous development of labour-saving technologies. While large farms continue to increase in size, a large number of small farms remain in the sector for various reasons. As a result, very large farms and small farms co-exist, leading to highly skewed farm size distributions in most OECD countries.

Several OECD countries have identified facilitating structural change in agriculture as a strategic policy objective. Both setting policy objectives and evaluating the impact of policies on farm structures (OECD, 2008) require information on trends in farm size distribution. Based on the work carried out through the OECD Farm-Level Analysis (FLA) Network and available statistical resources, this report presents simple and comparable indicators of farm size distribution that can be used to assess structural change in the sector.

The hectare-weighted median or mid-point statistic was used along with other measures of the farm size distribution to investigate trends in the evolution of farm structures and compare changes in farm size distributions across fourteen OECD countries: Canada, Estonia, France, Germany, Ireland, Italy, Japan, Korea, Latvia, the Netherlands, Norway, Sweden, the United Kingdom (England) and the United States, over the period 1995-2010. The statistics are presented for all farms, and crop, dairy, cattle and pig farms. Census or full-scope survey data were used to obtain relevant measures of farm size distribution for Canada, France, Germany, Japan, Korea, the Netherlands, Norway, the United Kingdom (England) and the United States. Farm size distribution statistics were derived using sample data, mostly Farm Accountancy Data Network (FADN) data, for Estonia, Ireland, Italy, Latvia and Sweden. Because of differences in the definitions of minimum farm size and farm types, comparisons of farm size statistics across countries should be interpreted with care. Due to changes in the farm type classification in the European Union in 2010 when the concept of standard output replaced the standard gross margin for measuring farm economic size, comparisons between periods up to and after 2010 should be also conducted carefully for the EU member-states covered in this report.

The average farm size differs widely across the countries examined. It tends to show more variation in crop production systems compared to dairy, cattle and pig farming. North American crop production is primarily associated with large-scale operations, whereas crop farms in Europe tend to be of a comparatively moderate size. In Asian economies such as Japan and Korea, crop farming is characterized by very small-scale operations. North-American farms are also substantially larger, on average, than their European counterparts in dairy, cattle and pig farming.

The farm size statistics presented in this report document a substantial degree of structural change in most countries and sub-sectors examined. The average farm size showed a stronger increase when measured using the mid-point than when using the mean farm size statistic. This finding indicates a faster increase in the size of large-scale enterprises compared to small and medium-size farms.

Despite a general trend towards large-scale agriculture, growth in the farm size shows substantial differences across single countries and periods. These differences point to the importance of the external environment: country-specific natural, geographical, historical, social and economic conditions, as well as the policy environment play a significant role in the evolution of farm structures.

The farm size distribution tends to have lower dispersion in industries that are characterized by significant policy interventions, such as dairy in the European Union where production quotas[1] have constrained farm size growth. The size of operations is more diverse in production systems traditionally associated with higher degrees of diversification, lower asset specificity and more flexibility for off-farm employment as in crop production.

For most countries examined in this report, Gini coefficient estimates show that inequalities in the farm size distribution, have been increasing rather than decreasing during the last two decades. This indicates a trend towards a polarization of the existing farm structures: while large farms are further increasing the scale of their operation, many small-scale producers remain in the industry. More efforts are needed to understand this trend in the evolution of farm structures and factors determining competitiveness of small-scale farming. The concept of farm flexibility will be investigated within the OECD Farm Level Analysis (FLA) Network to understand factors explaining the coexistence of large and small-scale farms and derive implications for policies concerning competitiveness and structural change in the sector.

1. The EU milk quota regime came to an end on 31 March 2015.

1. Introduction

Structural change in OECD countries is characterised by a decline in the farm population and an expansion of farm size. In the process of industrial transition from agriculture to manufacture and service industries, the farm size which could earn an income that is equivalent to incomes in other parts of the economy increased over time, pushing the trend of farm-size expansion. In most OECD countries farm size continues to expand with the continuous development of labour-saving technologies. However, while large farms continue to increase in size, a large number of small farms remain in the sector for various reasons. As a result, very large farms and small farms tend to co-exist, leading to highly skewed farm size distributions (Box1).

A dualistic structure of farming is also observed in emerging economies combining very large landholdings, oriented to commercial production, usually with advanced technologies and paid labour, with small family farms, usually – but not necessarily – oriented to subsistence or semi-subsistence production with low levels of technology (OECD, 2015b).

The arithmetic mean is often used to measure farm size and changes in its distribution, often complemented by the median. While these two measures of central tendency in the distribution are highly informative for symmetric distributions, they are much less instructive in the case of highly skewed distributions. A dualistic structure of agriculture implies a highly skewed farm-size distribution and makes common measures of central tendency unsuitable for comparing farm size across time and countries. The mean and median are known to be sensitive to the total number of observations and to the problems related to the definition of the farm population (Lund and Price, 1998). The average farm size tends to be biased downward when measured using the mean or the median if small non-commercial entities are included in the calculations (this is because small farms are usually numerous but operate a small fraction of the total agricultural land and have low shares in the country's agriculture production). Under such circumstances, farm size measured by the mean or the median will not properly represent the sub-population of farms that produce most of a country's gross agricultural output.

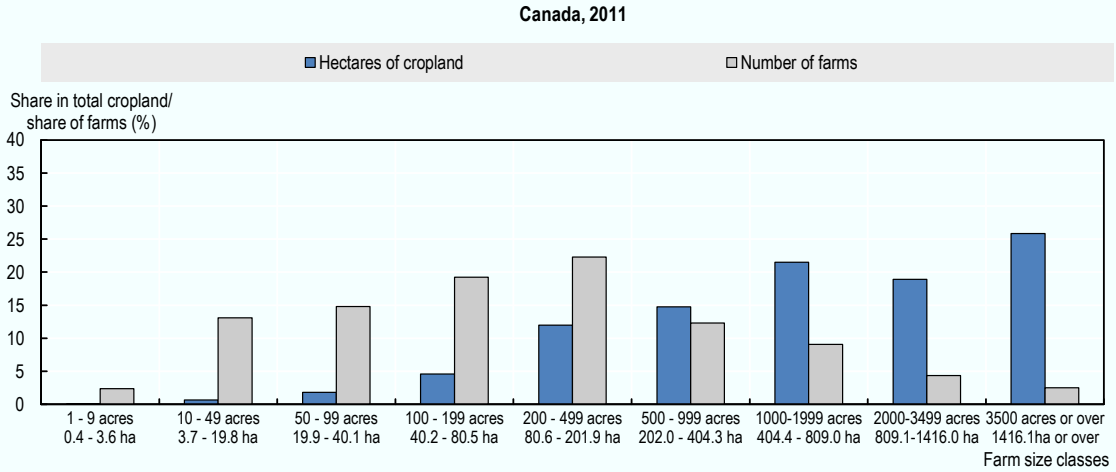
The above-mentioned drawbacks of the standard measures of central tendency (the mean and median) hinder a consistent comparison of the farm average size across countries that apply different farm size minimum thresholds when defining the farm population. Moreover, the presence of a large number of very small farms in the farm population hampers inter-temporal comparisons within a country: under these circumstances, the mean and the median are not sufficiently sensitive to describe changes in farm structures and thus have limited capacities to capture adequately consolidation of land and other resources into large farms.[2]

The Lorenz Curve and Gini coefficient are further important characteristics of the distribution. An earlier OECD cross-country study carried out through the OECD Farm-Level Analysis (FLA) Network used these measures to evaluate the distribution of support and income in agriculture across different farm size classes (Moreddu, 2011). The Lorenz curve provides a comprehensive overview of changes in different parts of the distribution of a relevant variable. The Gini coefficient is a measure of dispersion in the distribution and often is used to measure income inequality in a population. Therefore, it is well suited to describe potential disparities in the farm size distribution. Accordingly, the evaluation of Gini coefficient dynamics for farm size distributions is expected to provide valuable insights into the extent of structural change in agriculture of OECD countries and its effect on the composition of the farm population by farm size.

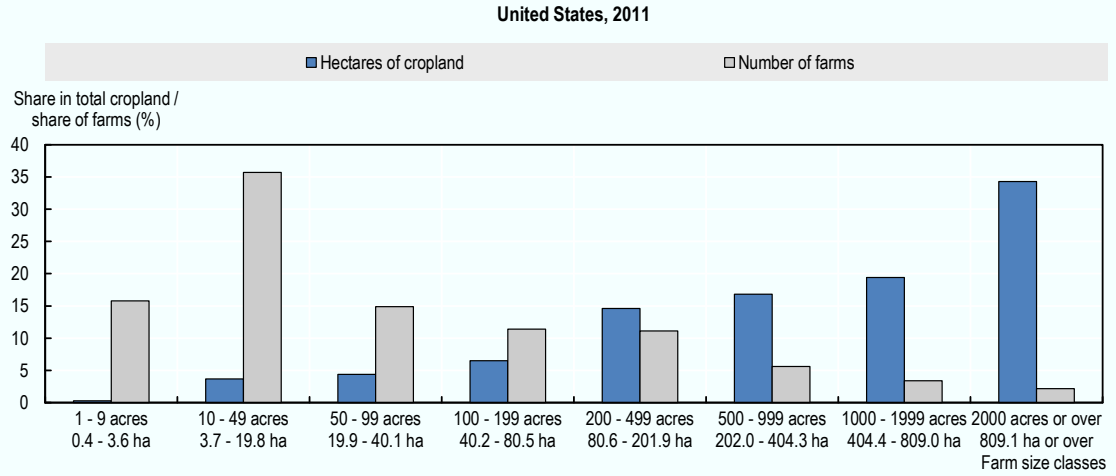
2. Simultaneously, the mid-point might be less affected than the mean by changes in farm sampling procedures such as change in minimum farm size threshold.

Box 1. Distribution of land and farms by farm size in crop farming in five OECD countries

For all five countries presented below, farms which operate large areas have very high shares in the total crop area. Recent statistics show that 16% of farms of 404.4 ha and more operate 66.3% of the total cropland in Canada. In the United States, 2.2% of crop farms larger than 809 ha operate more than one-third of the total cropland in U.S. crop farming. One-third of the total cropland is used by approximately 1.5% of farms cultivating more than 19 ha of cropland in Japan. In France, the 18% of farms operating more than 99 ha account for more than half of the total Utilized Agricultural Area (UAA). Simultaneously, a large number of small farms are present in the sector. In the United States, more than half of farms operate less than 20 ha, and in Japan more than half of farms operate less than 1.0 ha. In Canada, the share of farms operating less than 20 ha accounts for 15.4% of the total population of farms and operates less than 1% of the total cropland. Farms of less than 5 ha account for 22.6% in the total population but only for 3% of the total cropland in French crop farming. Though the farm size distribution seems to be generally less asymmetric in the Netherlands, the largest 20% farms (as measured in hectares of UAA) operate almost as much land as the remaining 80% of farms in Dutch agriculture.

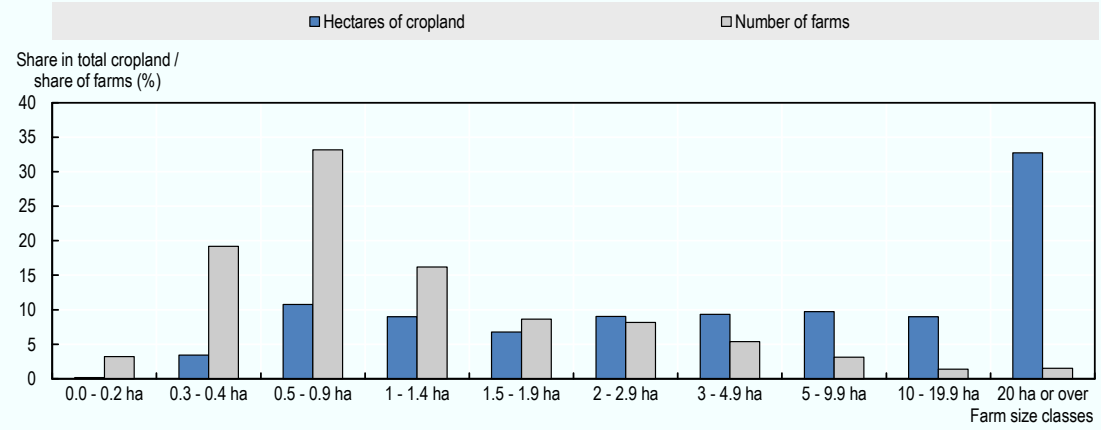


Source: Statistics Canada, 2011 Census of Agriculture.



Source: USDA Agricultural Resource Management Survey, 2011.

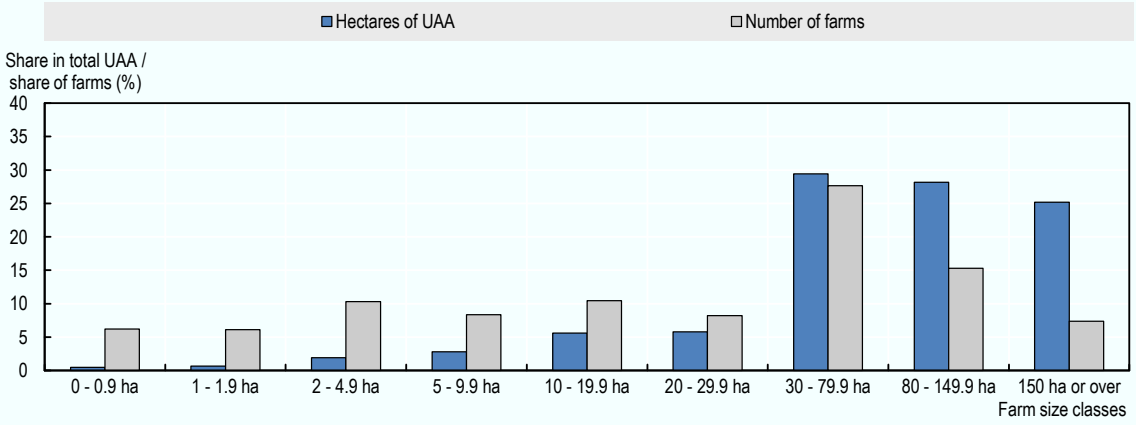
Japan, 2010



Note: For Japan, the data refer to all farms.

Source: Agricultural Census, 2010.

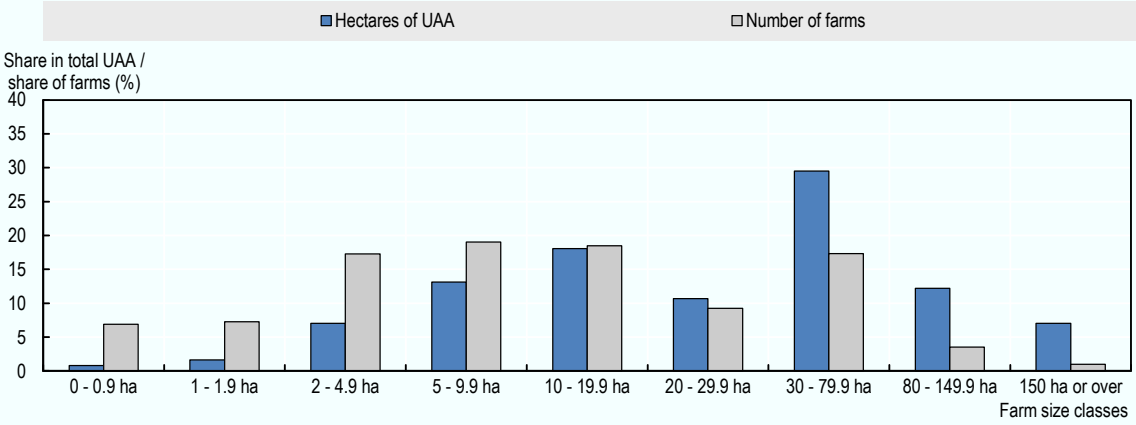
France, 2010



Note: UAA: Utilized Agricultural Area.

Source: Eurostat (based on 2010 full-scope Farm Structure Survey), 2011.

Netherlands, 2010



Note: UAA: Utilized Agricultural Area.

Source: Eurostat (based on 2010 full-scope Farm Structure Survey), 2011.

Based on the work carried out through the OECD FLA Network and available statistical resources, this report presents several measures of farm size distribution that can be used to assess structural change and communicate outcomes of policies aimed at fostering structural change. The hectare-weighted median or mid-point statistic was used along the mean, Gini coefficient, quartiles and size-weighted quartiles of farm size distribution to investigate trends in the evolution of farm structures and compare changes in farm size distributions across fourteen selected OECD countries: Canada, Estonia, France, Germany, Ireland, Italy, Japan, Korea, Latvia, the Netherlands, Norway, Sweden, the United Kingdom (England) and the United States, over the period 1995-2010.

The report starts with an overview of the methodology applied. Then, statistics of average farm size and farm size dispersion consolidated within the project are presented and discussed. Conclusions are drawn in the final section. Annex A presents the Terms of Reference developed for the project through the OECD FLA Network, while Annex B compiles data provided by the participating countries.

2. Methodology

2.1. Measures of farm size distribution

To overcome the limitations of conventional measures of average size in comparing farm-size distributions, Lund and Price (1998) and MacDonald et al. (2013) propose using a single measure, the hectare-weighted median or mid-point, to capture the degree of land use concentration. The hectare-weighted median corresponds to a farm size that separates the farm size distribution into two parts: 50% of the total area of the national farmland operated by the farms of a larger size and the other 50% by the farms of smaller size than the hectare-weighted median.[3]

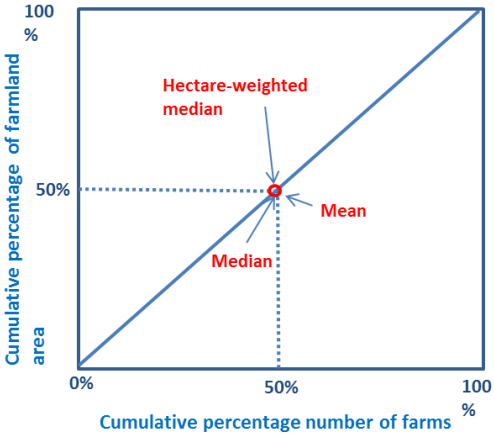
In Figure 1, a Lorenz curve is used to compare the performance of three measures of average size – the mean, median and hectare-weighted median – in two contrasting cases: 1) farmland is equally distributed across farms; and 2) farmland is concentrated on large farms. To build the two Lorenz curves presented in this Figure, all observations were first ranked by size, and then the cumulative percentage number of farms was plotted on the horizontal axis and the cumulative percentage number of hectares was plotted on the vertical axis. The difference between the two cases is obvious: the three statistics of the farm average size are identical if the farmland is distributed equally across farms (case 1) and differ largely if the land use distribution is unequal (case 2), with the mean and particularly the median farm size considerably smaller than the hectare-weighted median. In the latter case, more than 50% of land is on farms that are larger than the mean and more than 75% of land is on farms grater that the median.

Figure 2 presents another – more intuitive – example of the effect of a skewed farm size distribution on the performance of the three selected farm size statistics. When land use is equally distributed across farms (left side of Figure 2), the mean, the median and the hectare-weighted median are identical. However, if land is concentrated on larger farms (right hand side of Figure 2), the hectare weighted median becomes larger than the other two statistics. The mean farm size remains unchanged as long as the number of farms in the sample stays constant. The median farm size remains unchanged as long as the "middle" farm (here, 100 hectares) does not decrease or increase. This example shows that the land concentration to large farms would not be well reflected using the mean or the median.

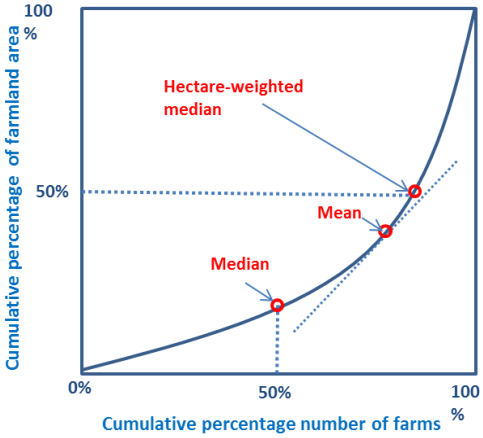
3. The definitions of all farm size distribution measures used in the report (un-weighted quartiles including the median, farm size-weighted quartiles including the mid-point and the Gini coefficient) can be found in Annex A.

Figure 1. Comparison of three measures of the farm average size using the Lorenz curve

1. Land distributed equally across farms



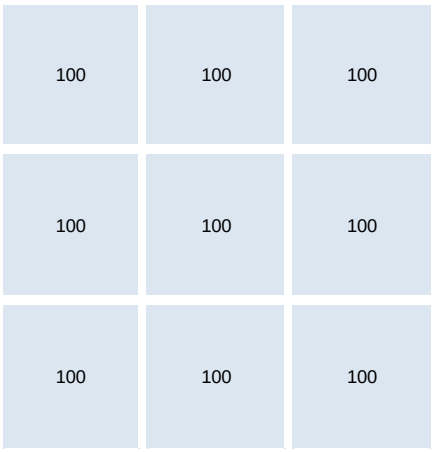
2. Land concentrated on large farms



Source: Adapted from the presentation by Heiko Hansen (based on Lund and Price, 2007, p. 5) at the 12th meeting of the OECD Network for Farm-Level Analysis, 12-13 November 2013.

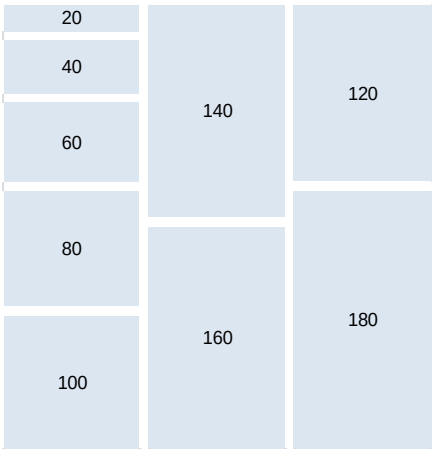
Figure 2. The effect of farmland distribution on three measures of farm average size: an example

1. Land distributed equally across farms



Mean (μ)	100
Median (m)	100
Hectare-weighted median (m_{hw})	100

2. Land concentrated on large farms



Mean (μ)	100
Median (m)	100
Hectare-weighted median (m_{hw})	100

Source: Heiko Hansen (2013).

The hectare-weighted median is also less sensitive to the presence of a large number of small farms that use a minor part of agricultural land. Given differences in how single countries define the farm population, it presents a more robust measure of farm average size than the mean and the median farm size statistics. The latter two may vary greatly depending on the choice of the minimum farm size threshold for farm sampling.

It should be also mentioned that the hectare-weighted median, hereafter referred to as the mid-point to make it applicable to different measures of farm size, has a key limitation. In particular, this statistic does not capture certain patterns of merging and fragmentation of farms. For example, the merger of two farms below the mid-point farm size into a farm remaining below that mid-point is not reflected in the statistic. Similarly, the merger or division of farms above the mid-point farm size would not affect the statistic. Considering these aspects, the analysis also presents farm size-weighted quartile statistics and Gini coefficients to draw comparisons of farm size development across OECD countries. To enable a better comparison farm size evolution across countries, it also reports farm size growth rates measured based on mid-point, mean and quartile statistics using exponential growth functions.

Farm size can be measured using different criteria (farm output or inputs) and measurement units (monetary values, volume indices and physical units). As farm output may vary largely across years, measuring farm size in quantity of a key input of the operation, namely farm land area or animal number, provides an important advantage: input use is more stable in the short term and less influenced by other factors than structural change. Additionally, the measurement in physical units makes it easy to compare farm size across countries and over time compared to production values which might be influenced by a number of macroeconomic factors that may vary substantially across countries and periods. An example of such an input-based farm size measure is the Standard Labour Requirement (SLR) indicator of farm labour input used in the United Kingdom. The farm total annual SLR is calculated by multiplying the areas of different crops and numbers of different livestock by the relevant SLR coefficients and summing up the results. The total annual labour requirement in hours is then converted to an equivalent number of full-time workers (DEFRA, 2016). Such an additional measure can serve as a reference indicator for monetary measures of farm size because labour requirements change less often than agricultural product prices. This can help to avoid structural breaks in historical data when switching between monetary output-based measures of farm size or when re-adjusting monetary coefficients to changes in farm-gate prices.

2.2. Definition of farm population and variables

The report summarises farm size statistics for all farms[4] and four major farm types: crop, dairy, cattle and pig farms. Farms are assigned to a particular specialisation type by specifying the product group with the largest share in the farm total receipts or gross margin (for EU Member States, Standard Gross Margin, SGM, until 2010 and Standard Output, SO, since 2010).

Annex Table A1 summarises the definition of the farm population in agricultural statistics of selected OECD regions. It shows that the major difference between countries arises from the definition of the minimum threshold of farm land or gross agricultural output (GAO). Differences in the minimum size threshold present a major problem when comparing EU farm statistics with statistics of North American or Asian countries. In many EU member states, farms are defined using higher minimum farm size thresholds. As a result, a significant number of small producers are excluded from the farm population. In other OECD regions, these thresholds are significantly lower (Moreddu, 2011). The latter leads to significant differences in the farm population definition and hence the farm size distribution.

4. The category "All farms" refers to the population of farms obtained after excluding from the total farm population farms with small gross agricultural output values so that the retained population of farms account for 90% of the total value of the national gross agricultural output.

This report uses hectares of cropland and GAO (in units of the national currency[5]) to measure the size of all farms and hectares of cropland to indicate farm size in crop farms. Annual average number of heads in standard livestock units (LSU) was employed to measure the size of dairy, cattle and pig farms. Since only a few of the participating countries provided statistics for poultry and egg-producing farms, the report does not cover these two latter types of farms as was initially envisaged. The reporting period varied largely from country to country. The data presented in the report refer, in general, to the period between 1995 and 2010. For selected countries, longer time series are presented.

Table 1 summarises data sources used to compute relevant statistics. They comprise agricultural census data, farm structure surveys (FSS),[6] or Farm Accountancy Data Network (FADN). It should be indicated that agricultural census data covering the total farm population are more adequate for analysing structural change in the sector. This is because FADN and other sample survey data usually apply higher minimum farm size thresholds for sampling. Additionally, some biases can be present in sample survey data due to coverage, sampling and nonresponse errors. Given this, a direct comparison of statistics derived using census or full-scope survey data with those based on sample survey data is rather problematic and should be done and interpreted with care. Nine participating countries (Canada, the United States, Japan, Korea, France, Germany, the Netherlands, Norway and the United Kingdom) provided farm size statistics based on census or full-scope survey data and five countries (Italy, Estonia, Latvia, Sweden and Ireland) used FADN or FSS data. This report therefore derives farm size statistics for the first group of countries by excluding from the total farm population the smallest farms accounting for 10% of the sector gross agricultural output. This adjustment might have caused some inaccuracy in the assessments of the extent of structural change as well as an underestimation of the magnitude of farm size dispersion.

Table 1. Data source by country

Country	Source
Canada	Agricultural Census
United States	Agricultural Census
Japan	Agricultural Census
Korea	Agricultural Census
Estonia	FADN
France	Agricultural Census
Germany	Agricultural Census
Ireland	FADN
Italy	FADN
Latvia	FADN
Netherlands	Agricultural Census
Norway	Applications for direct payment, Landbruksdirektoratet[1]
Sweden	Farm Structure Survey
United Kingdom	June survey of agriculture and horticulture in England

1. Covers all farms that qualify for direct payments.

5. GAO was adjusted to the prices of 2010 using national agricultural producer price indices (FAOSTAT, 2015).

6. FSS has a form of a full scope survey that is carried out in the form of an agricultural census every ten years, Every 2 or 3 years, between the censuses, sample surveys are carried out (Eurostat, 2015).

3. Cross-country farm-size comparison

The average farm size and farm size dispersion differ largely across countries considered in this report. While North American crop production systems are associated primarily with large-scale operations, crop farms in Europe tend to be of a comparatively moderate size, and crop farming in Asian economies, such as Japan and Korea, is characterised by very small-scale operations (Box 2).

Box 2. Difference in average farm size across countries[1]

Average farm size varies largely across the fourteen OECD countries examined in this report as indicated by recent farm size statistics (Annex Figure B1). In crop farming, Canadian farms have the largest average size, followed by the United States and Latvia (based on the mid-point statistic). The mean and mid-point size of Canadian crop farms were 493 and 809 ha, respectively. Crop farms in European countries have a moderate size, but the farm size varies considerably from country to country. The average farm size is relatively high in Estonia, Germany, the United Kingdom (England), France and Sweden, whereas farms tend to be smaller, on average, in Italy and Norway. The scale of crop farming is generally small in Japan, where the mid-point farm size is 4.6 ha (Annex Table B3). Though no statistics are available on Korean crop farms, the mean and the mid-point for all farms in Korea (as measured in hectares of cropland) indicate that farm structures in Korea tend to be even smaller than in Japan (Annex Table B2).

Dairy farms in the United States appear to be of a similar size to dairy farms in the United Kingdom (England and Wales) if average farm size is measured by the mean. However, if measured by the mid-point farm size, operating scales in the US dairy sector are much larger than in all other countries examined. While the mid-point US dairy farm was 1 140 LSU (half of the national dairy herd is on farms with a herd larger than 1 140 LSU, and half is on farms with a herd less than 1 140 LSU), the mid-point of European dairy sectors varied between 44 LSU in Norway and 152 LSU in the United Kingdom (England). Farm structures seem to differ considerably between the two Baltic EU member states, Estonia and Latvia. The average Latvian dairy farm is smaller than the average Estonian dairy farm (measured by either the mean or mid-point). Moreover, the difference between the mid-point and the mean is smaller for Latvia than for Estonia, indicating that Estonia's dairy sector has a more polarized structure than the dairy sector in Latvia.

Cattle farms in Europe are substantially smaller than those in Canada. The average size of Canadian cattle farms was 180 LSU. The mid-point farm size for Canadian cattle farms was 280 LSU compared to 114 LSU in the United Kingdom (England) and 113 in France. Farm structures in the cattle sectors of France and the United Kingdom show similarities not only in terms of the mid-point farm size but also if the mean is used to measure the average farm size. Another group of countries with similar structures in cattle farming comprises Germany, Ireland, Norway and Sweden.

In general, pig farms are larger in North-America than in Europe: the mid-point LSU of US pig farms is 9 600 LSU, which is 4.9 and 9.7 times larger than the mid-point LSU of Canadian and Dutch pig farms, respectively. Dutch pig farms have the largest average size among the European countries considered in this analysis, while Norway appears to have the smallest farm size, on average, in this group of countries. Average farm size of Norwegian pig farms is 53 and 83 LSU, as measured using the mean and mid-point, respectively. The mid-point pig farm size for other European countries examined varies between 376 LSU in Germany and 726 LSU in the United Kingdom (England).

1. The comparison of average farm size statistics across countries presented in the box should be treated with caution due to differences in the coverage of total farm population in the data from single countries.

3.1. Trends in average farm size

The statistics document a trend towards large-scale production (Figure 3). Comparing the farm size growth rates across five selected OECD countries (Canada, the United States, Japan, France and the Netherlands) using the mid-point measure shows that the size of crop farms was increasing fastest, on average, in Japan. Crop farms in Canada, the United States and France followed. Average crop farm size increased at the lowest rate in the Netherlands. Despite differences in the farm size growth rates, a general trend for all five countries can be observed: the margin between the mid-point farm size and the mean farm size was increasing over time, indicating a faster expansion of larger farms. This result also holds for most other countries and types of farms covered in this report (Annex Figures B2 to B7).

The mid-point farm size showed different growth rates in different time periods. In Japan, the mid-point farm size increased at a much higher rate after 2000. Specifically, it increased by 9.7% per annum in the period from 2005 to 2010 (compared to 4.1% in 1985-2010 and 5.7% in 1995-2010), showing that the structural change in farmland accelerated during the last ten years, a feature that is not captured if measuring the growth rates based on the mean cropland size. In the United States, the speed of structural change in crop farming was highest in the late 1990s and the early 2000s, and has slowed down more recently. Similarly, the speed of structural change in France was the highest in the 1990s and 2000s, while Dutch farms showed a relatively moderate growth in the 1980s and 1990s as opposed to the 1970s and the last decade.[7]

The magnitude of the farm size growth depends on the measure of average farm size used. Figure 3 shows that the mean size of US crop farms hardly changed over the past 30 years, whereas the mid-point size of US crop farms increased at an average annual rate of 2.4% between 1982 and 2012 (as measured in cropland hectares). For Japan, both measures of average size indicate a substantial increase in the size of crop farms for a similar period (1985-2010), however, the mid-point signals a much faster farm size growth (4.1% per annum[8]) than the mean (2.1% per annum). The mid-point was growing also more rapidly than the mean in Canada: by 4.1% per annum, on average, compared with 2.9% for the mean between 1990 and 2010. In contrast, the mean size of crop farms in France and all farms the Netherlands increased at a faster rate than the mid-point size in the last three decades. The average annual growth rates were 2.3 and 1.9% for the mid-point farm size in France and the Netherlands, respectively, while the mean farm size grew at an annual average rate of 2.6% in each of these two countries in the above indicated period.

The definition of the farm population is much less restrictive in Canada, the United States and Japan than in European countries, which results in the presence of a large number of very small entities in the farm population. This explains significant differences between the two average farm size measures for these three countries. Even though farm size appears to be satisfactorily captured by the mean for France and the Netherlands, mean farm size would be not informative for comparisons across countries that apply different minimum farm size thresholds for farm population.

Average farm size growth rates summarised in Table 3 show that the trend towards large-scale production has occurred in most OECD countries and across most types of farms examined in this report (for the period 1995 to 2010). The statistics suggest that US dairy farms have continued to expand over the last two decades. Moreover, the mid-point farm size increased 3.5 times faster than the mean farm size, suggesting that the consolidation of the national dairy herd has taken place primarily through the expansion of large-scale dairy operations. The US pig farms have also increased in size over time: the annual average growth rate of the midpoint farm size was 10.6%. A substantial consolidation of animal stock has taken place also in Norway, where the mid-point farm size was increasing, on average, by 7.4% and 13.7% per annum for cattle and pig farms, respectively. Pig farms also demonstrated a rapid expansion in Canada, increasing by 7.2% per annum, on average.

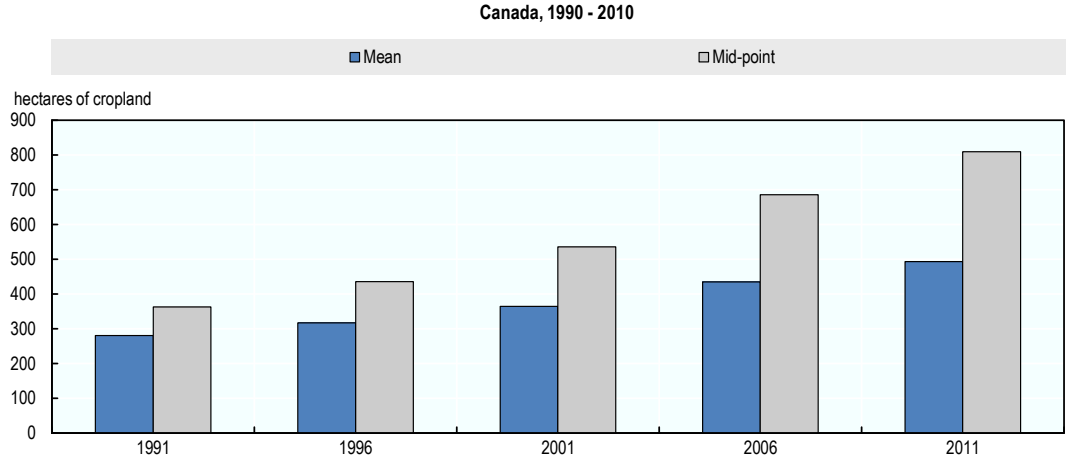
7. As data for Dutch farms are on all farms with cropland, these result have to be treated with caution. For example: if measured using the cropland distribution for all farms (i.e. not only for specialised crop farms), mid-point growth rates were highest in the 1970s and 2000s (4.7% and 5.0%, respectively) in France; growth rates of farm cropland were also substantial in the 1980s and 1990s for all farms in France.

8. Between 1990 and 2010, the mid-point growth rate was 4.8%.

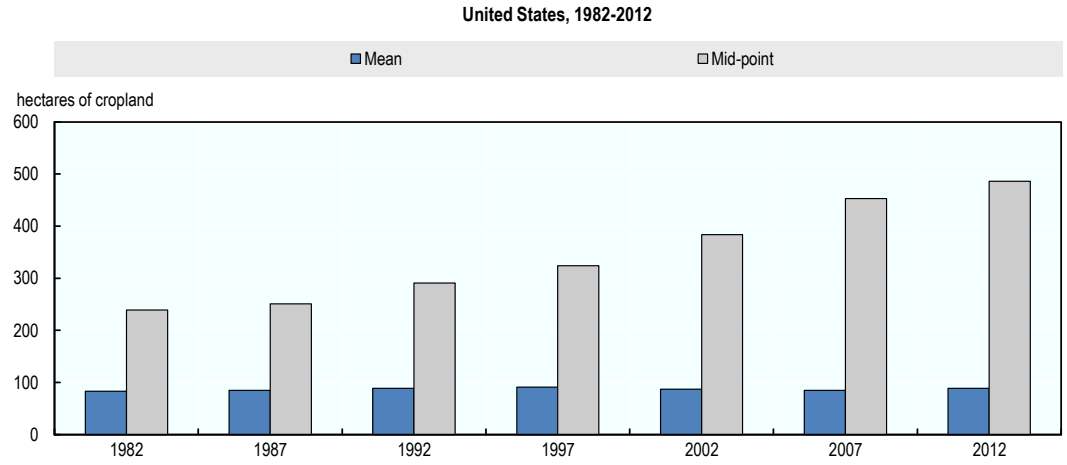
In Estonia, average annual farm size growth was 14.4% from 2000 to 2010, while Latvian crop farms grew at an average annual rate of 8.0% since 2005. This reflects the rapid land consolidation in crop farming that followed land privatisation and restitution in Estonia and Latvia in the 1990s.[9] The speed of structural change was also high in crop farming of Italy and Japan suggesting the presence of scale effects in crop production of these two countries.

Comparing sub-sectors, the highest rates of growth in average farm size are observed in pig farming. Crop farms in several countries also experienced strong growth, particularly in Estonia and Latvia. The extent of structural change was also high in countries characterised by small-scale crop farming, such as Italy and Japan.

Figure 3. Evolution of crop farm size distribution in five selected OECD countries, long-term trends

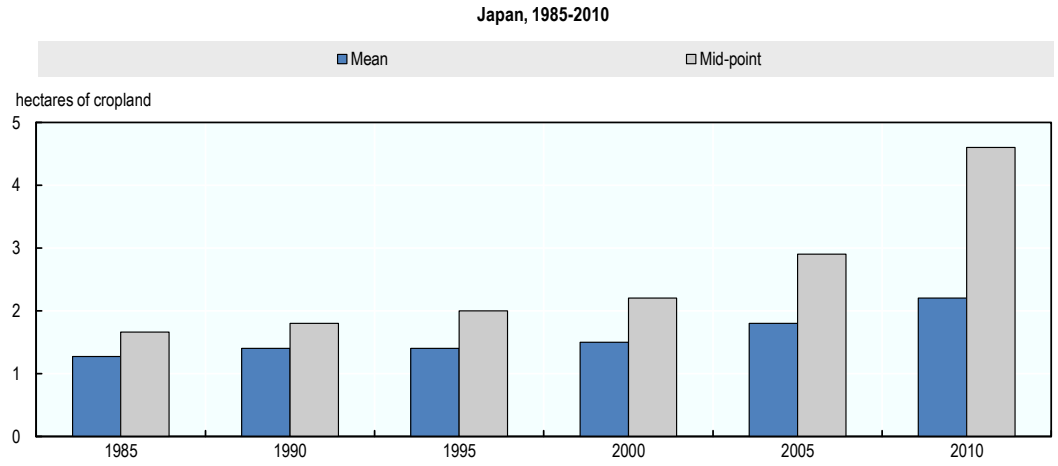


Source: 1991, 1996, 2001, 2006 and 2011 Agricultural Censuses.

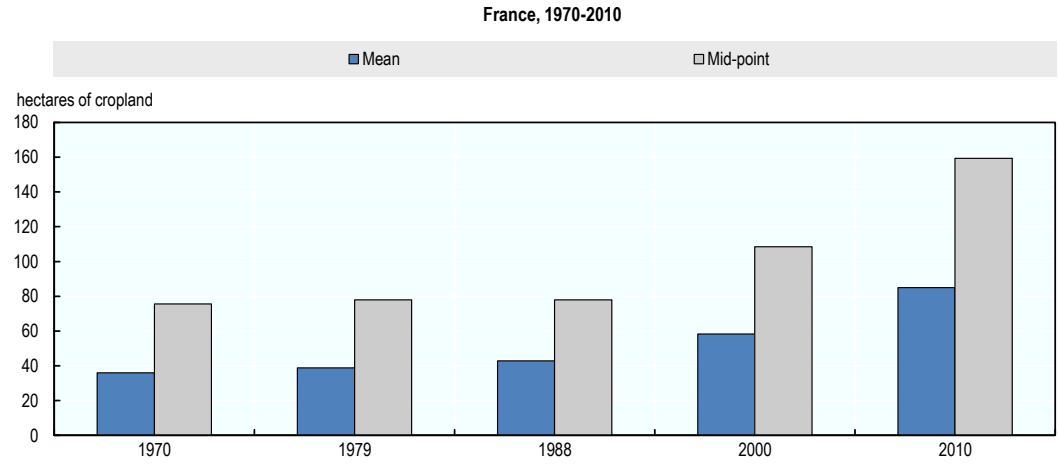


Source: Adapted from MacDonald et al. (2013).

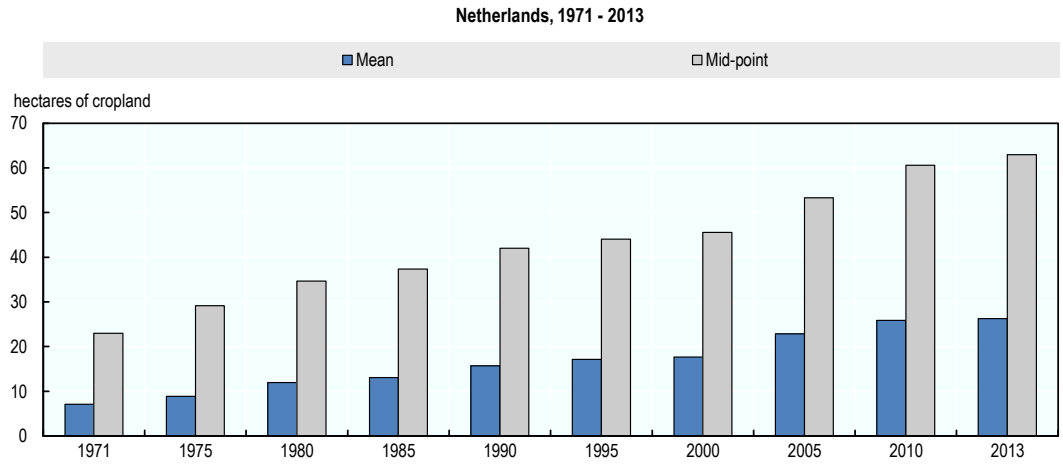
9. In Estonia, the number of farms increased from 7 400 in 1991 to 55 700 in 2001. By 2010, the farm population had decreased to 19 600 farms, while agricultural area expanded by 8% from 2001 to 2010. The decrease in the number of farms occurred mainly on account of smaller holdings. Agricultural area and production concentrated mainly into larger holdings. Almost 900 large holdings had in their possession 55% of the utilised agricultural area and 83% of the livestock units in 2010 (Statistics Estonia, 2015).



Source: 1985, 1990, 1995, 2000 and 2010 Agricultural Censuses.



Source: 1970, 1979, 1988, 2000 and 2010 Agricultural Censuses.

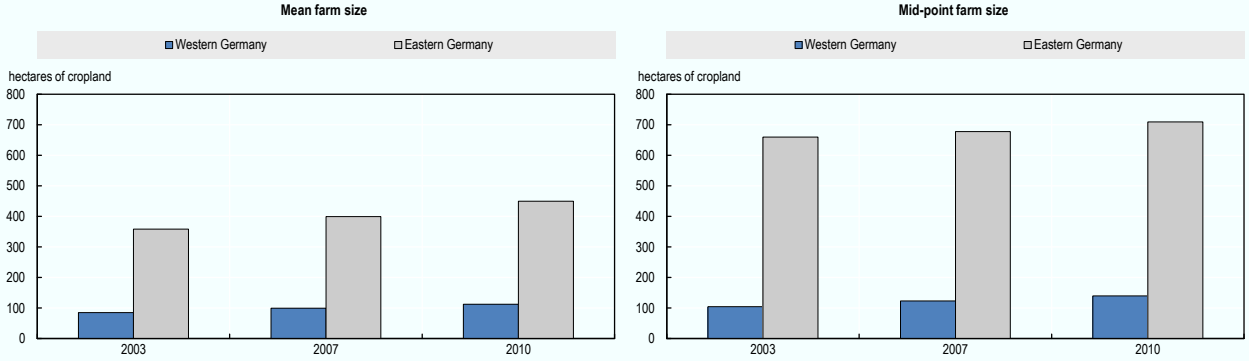


Source: 1971, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010 and 2013 Agricultural Censuses.

Box 3. Evolution of farm structures in Germany[1]

Farm structures in West and East Germany differ substantially. While West German farms are mostly small-scale family farms, East German farms tend to be large-scale corporate farms (BMELV, 2011). The dispersion of farm size is also greater in eastern Germany than in the western part of the country, with the largest farms utilizing a larger share of the production factors.

Figure 4. Average crop farm size in West and East Germany, 2003-2010



Prior to World War II, farms in the eastern part were somewhat larger than farms in the West. The mean farm size was 10.5 ha in the East and 5.9 ha in the West. While 36% of arable land was cultivated by farms of 50 ha and larger in the East, the corresponding number for the western part was 11% (Koester, 1999). These differences in farm size were mainly due to differences in inheritance laws in different regions of the country which also explained differences in farm structures between North and South Germany.

After the war, East German farmers possessing more than 100 ha of agricultural land were expropriated by the government of the German Democratic Republic (GDR); expropriated land was used for establishing large-scale state and collective farms. As a result, most agricultural land was operated in large-scale state and collective farms prior to the unification of the country. In 1989 the average crop farm size was 5012 ha for state farms and 4538 ha for collective farms (Koester, 1999). In contrast, West German farms remained family-owned and relatively small.

The unification of Germany in October 1990 changed the political and economic system in East Germany and caused fundamental adjustment in all sectors of the economy (Beckmann and Hagedorn, 1995). This process was accompanied by re-establishing private property in land and restructuring state and collective farms. In the 1990s, the development of agricultural structures in East Germany was characterized by a steady increase in the number of farms and a steady decrease in farm size. However, the average size of East German farms grew more recently (Table 2). The average farm size increased also in West Germany and even at a higher average annual rate than in the eastern part during the last decade. Nevertheless, agricultural structures in West and East Germany continue to exhibit substantial differences.

Table 2. Farm size and farm size distribution statistics for selected farm types in Germany

	Crop farms	Dairy farms	Cattle farms	Pig farms
West Germany				
mid-point size[1], 2010	139.6	67.0	97.3	333.1
mid-point growth rate, %, 2003-2007	4.3	2.8	1.9	3.3
Gini coefficient, 2010	0.40	0.31	0.37	0.39
East Germany				
mid-point size[1], 2010	709.3	477.0	364.7	880.0
mid-point growth rate, %, 2003-2007	0.7	2.1	1.3	0.5
Gini coefficient, 2010	0.49	0.56	0.48	0.57

1. Hectares of crop land for crop farms, livestock units for livestock farms.

1. The material presented in the box is based on the analysis conducted by the Thünen Institute – German Federal Research Institute for Rural Areas, Forestry and Fisheries – using Agricultural Structure Survey data (Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder, 1999-2010).

3.2. Trends in farm size dispersion

Inequalities in the farm size distribution increased in most OECD countries during the last two decades as indicated by increasing values of the Gini coefficient for single countries over time (Annex Tables B1 to B6). This implies a trend toward stronger polarisation of the existing farm structures. The average growth rates for single quartiles of the farm size distribution (Annex Table B7) indicate that, despite a substantial growth in the mid-point farm size, the average size of small farms was decreasing for some countries and types of farms between 1995 and 2010. This was the case for crop farms in Ireland, Italy, Latvia and Sweden; dairy farms in Estonia, Germany and Latvia; cattle farms in Sweden; and pig farms in the United Kingdom (England). In most of the above-mentioned countries/sub-sectors, this process was accompanied by an increase in the size of largest farms. This development has been described as the "disappearing middle" and results in an industry dominated by small and large scale operations. This phenomenon can be explained, on the one hand, by economies of scale that induce full-time farms to increase their operations and, on the other hand, by part-time farming when farms of a moderate or small size keep their operations small or even reduce scales of production to undertake (additional) off-farm employment (Weiss, 1999). Another explanation for this development might be an increase in the number of organic farms and other extensive production systems that tend to have a comparatively moderate size (Brock and Barham, 2009).[10]

Figure 5 presents trends in the value of Gini coefficient estimates for the crop and dairy sectors of several OECD countries.[11] Comparing estimates of the Gini coefficient suggests that the farm size distributions have become more dispersed for crop farms in Canada, Japan, Estonia, Latvia and Sweden, and dairy farms in Canada, Estonia, Germany, Latvia, Sweden and England. Growth rates at single quartiles of the farm size distribution (Annex Tables B9 and B10) confirm the results obtained using the Gini coefficient. It shows that in Canada and Sweden, crop farm size increased for all farm size classes[12] (the entire farm size distribution has shifted to the right). However, larger crop farms grew at a slightly higher rate in these two countries. In Latvia and Estonia, the size of the smallest crop farms (those around the first quartile) declined, while medium-size farms grew strongly. In Japan, the shift in the farm size distribution of crop farms was mainly a result of extremely fast growth in the size of largest crop farms.

In Germany's and Latvia's dairy sectors, the farm size distribution became more dispersed as a result of an increase in the size of largest farms (around the third quartile and above). Growth in the average size of dairy farms in Sweden and the United Kingdom (England) was more homogenous; in these two countries farms at all three quartiles grew strongly. Notwithstanding strong growth across all size classes, the farm size distribution became more skewed to the left in Sweden and the United Kingdom (England) as indicated by the Gini coefficient. This suggests that there should be a fraction of small-scale farms whose size stayed unchanged or even reduced.

10. Brock and Barham (2009) report that alternative production systems as moderate-sized organic and extensive pasture-based dairy production emerged contiguous to large-scale farms in Wisconsin dairy farming. The authors refer to this development as the "second" structural trend that has been occurring in Wisconsin dairy farming. Brock and Barham refer to the "first" structural change trend as the emergence of large confinement farms that have been replacing mid-sized confinement farms in Wisconsin since the 1990s.

11. The representation is done only for those countries which provided Gini coefficient estimates. Additionally, it considers crop and dairy farms exclusively, as there were not sufficient data for other farm types for most countries.

12 . A declining trend in the size of Swedish crop farms from 1995 to 2000 might be related to changes in the sample composition due to replacing farm surveys by a farm register in 2000.

In a few countries, however, the dispersion of the farm size distribution stayed unchanged or even decreased over the last two decades. A comparison of growth rates at different quartiles shows that French crop farms grew at similar rates over the entire farm size distribution that explains why Gini coefficient values stayed constant over the considered period. In the United Kingdom (England), small crop farms grew at a faster rate than larger farms. This means that the crop farm size distribution has become less skewed in the United Kingdom (England).

The Gini coefficient estimates suggest a trend toward less polarised farm structures also for the French dairy sector. French dairy farms around the 1st quartile showed a higher growth rate compared to their counterparts at the median and at the 3rd quartile during the last two decades in France. This reflects the French system of managing milk quotas: quotas are non-tradable, linked to land, and managed at the level of the *Département*. Moreover, quota reserves are allocated preferably to young farmers and smaller farms, and thus limit farm enlargement. The Gini coefficient was not available for Irish farms. However, it can be assumed that the farm size distribution became also less skewed in Ireland, as small dairy farms grew considerably faster than farms at both higher quartiles – the median and 3rd quartile – of the dairy farm distribution in Ireland (Annex Table B.13).

Figure 5 also shows that farm size distributions have country and region specifics. Farm structures are more polarised in transition countries such as Estonia and Latvia, where small family farms coexist with large-scale farms – the successors of former collective farms. It can be anticipated that the farm size distributions for total farm populations in both countries might exhibit an even stronger skewness, as statistics for these countries are based on FADN data that apply minimum farm size thresholds for farm sampling. Farm size inequality is comparatively low in Canada where agriculture is dominated by large-scale farms[13] and in such European countries as France, Sweden and the United Kingdom (England). Although the Gini coefficient was very low for Estonian crop farms in 2000 and 2005, it had increased significantly by 2010, signalling that structural change is still ongoing in Estonian agriculture.

Furthermore, a comparison of Gini coefficients between crop and dairy farming show that farm size distributions in dairy farming sectors are less dispersed than in crop farming: dairy farms demonstrate, in general, less inequality in size than crop farms. This phenomenon might be related to a higher degree of regulation in the dairy sector due the milk quota system, which has constrained growth in the size of dairy farms. An additional explanation for this result may be related to differences in technologies between these two production systems. Technologies in crop production are generally characterized by lower asset specificity and higher degrees of diversification. Cropping technologies might be more accessible for small-scale farmers, who are often constrained by poorer resource endowment or institutional constraints. Moreover, crop farming is generally easier to reconcile with off-farm employment.

13. Farm size at the first quartile of the farm size distribution was found to be 159.9 hectares in crop farming in Canada compared to 31.4 hectares in the United Kingdom (the highest magnitude of this statistic across European countries covered in this report) and 0.6 hectares for Japanese crop farms.

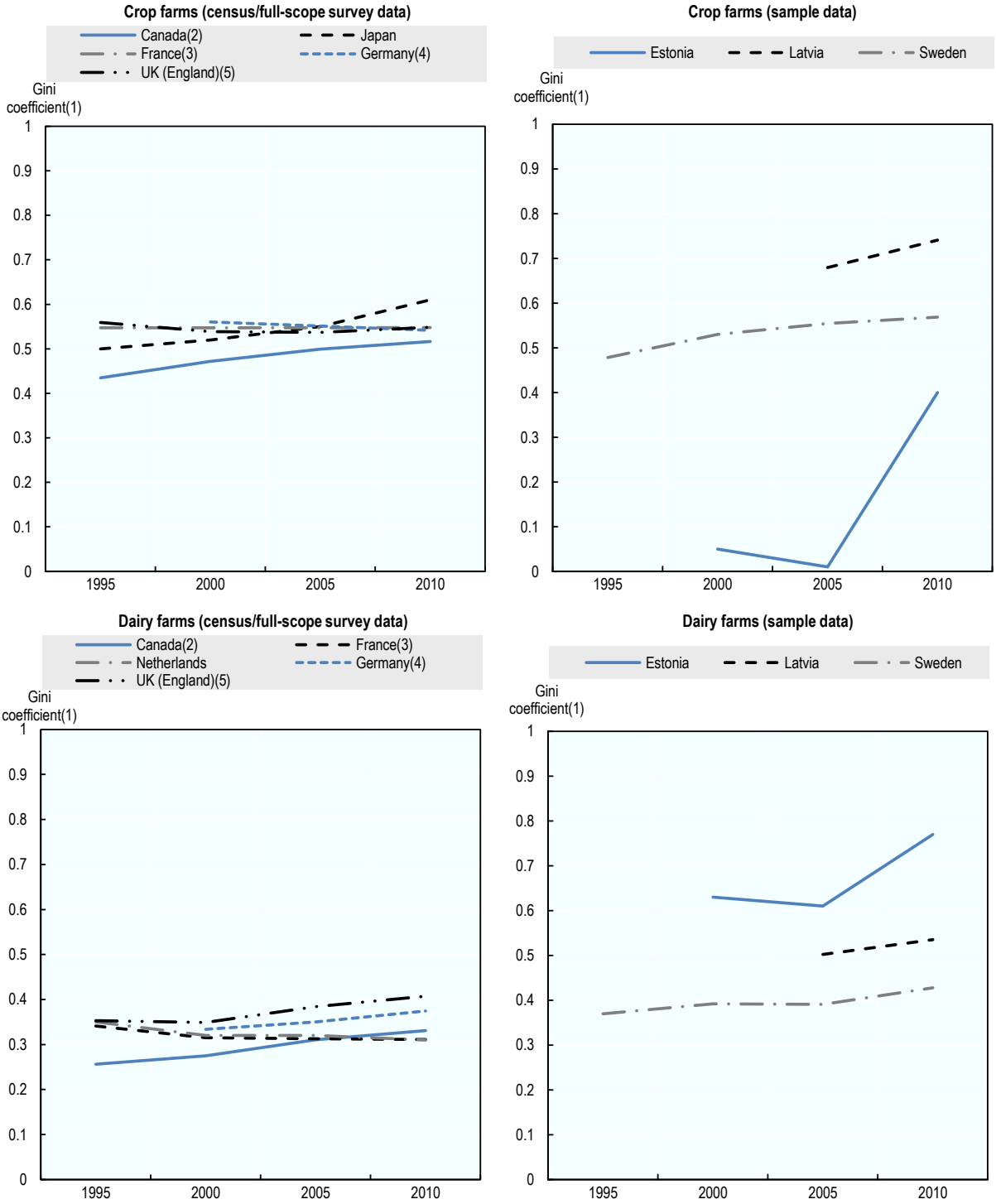
Table 3. Average farm size growth rates by farm type, 1995-2010, in % per annum[1]

	Average growth rate, 1995-2010, in % per annum							
	Crop farms, ha of cropland		Dairy farms, LSU		Cattle farms, LSU		Pig farms, LSU	
Country	mean	mid-point	mean	mid-point	mean	mid-point	mean	mid-point
Based on census or full-scope survey data								
Canada[2]	2.98	4.21	3.36	3.78	3.10	3.87	7.53	7.24
United States[3]	-0.15	2.74	4.17	15.01				10.55
Japan	3.06	5.71						
Korea[4]	4.03	5.11						
France[5]	3.52	3.64	3.39	3.18	3.38	3.04	3.50	3.39
Germany[6]	4.21	3.84	3.24	3.04	2.00	1.67	3.19	1.10
Netherlands[7]			3.35	2.82			6.93	6.87
Norway	4.50	3.45	3.65	3.65	6.95	7.40	13.22	13.66
United Kingdom[8]	0.81	0.61	2.66	3.16	2.71	3.32	0.40	0.00
Based on sample survey data								
Estonia[9]	8.75	14.44	2.06	3.31				
Ireland	2.02	2.57	3.01	3.06	1.44	1.07		
Italy[10]	-1.81	6.85						
Latvia[10]	2.95	7.98	1.92	5.73				
Sweden	-0.16	1.73	5.67	5.96	4.07	4.80	10.88	7.90

Notes:

1. Growth rates are calculated as the average growth rate between 1995 and 2010.
2. For Canada, the average growth rates are calculated for the 1996-2011 period.
3. For the United States, the average growth rates are calculated for the 1997-2012 period.
4. For Korea, data are on all farms having cropland.
5. For France, the average growth rates are calculated for the 1997-2010 period.
6. For Germany, the average growth rates are calculated for the 2003-2007 period.
7. For the Netherlands, data are on all farms having cropland, dairy cows and hogs, respectively.
8. For the United Kingdom (England), 2009 data are taken for 2010.
9. For Estonia, the average growth rates are calculated for the 2000-2010 period.
10. For Italy and Latvia, the average growth rates are calculated for the 2005-2010 period.

Figure 5. Gini coefficient estimates for crop and dairy farming in eight selected OECD countries, 1995-2010



Notes: 1. Gini coefficient is a measure of dispersion in the distribution and is usually used to measure inequality of income distribution in a society. A Gini coefficient of zero expresses perfect equality of values, whereas a Gini coefficient of one corresponds with maximal inequality among values. Applied to the farm size distribution, zero value of the coefficient corresponds with a hypothetical case when all farms would have the same size, while the value of 1 would indicate that one single farm possesses all the land and other farms have none.
2. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For France, the 1995 value is calculated as the average of the 1988 and 2000 data, and the 2005 value is calculated as the average of the 2000 and 2010 values.
4. For Germany, 2003 data are used for 2000 and 2007 data for 2005.
5. For the United Kingdom (England), 2009 data are used for 2010.

Conclusion

This report summarised selected measures of the farm size distribution for fourteen selected OECD countries: Canada, Estonia, France, Germany, Ireland, Italy, Japan, Korea, Latvia, the Netherlands, Norway, Sweden, the United Kingdom (England) and the United States. The hectare-weighted median or mid-point statistic was used along other measures of the farm size distribution to investigate trends in the evolution of farm structures across major agricultural production systems, and to draw cross-country comparisons. The report documents substantial structural change in most OECD countries examined. The difference between the mid-point farm size and the mean farm size has increased over time, implying consolidation of agricultural production in large-scale farms in many OECD countries. Despite an overall trend towards large-scale agriculture, growth in the size of farms shows substantial differences across countries and periods. The presence of these differences points to the importance of the external environment of farming: country-specific natural, geographical, historical, social and economic conditions, as well as the policy environment play a significant role for the evolution of farm structures.

Inequality in farm size distributions has increased over the last two decades in most OECD countries examined in this report. This indicates a trend towards more polarized farm structures. Despite an overall trend towards large-scale farming, many small-scale producers remain in the industry. This may occur due to many reasons that might be of both economic and non-economic character. While exploiting economies of scale is an important driver behind the expansion of farm size, institutional, organizational, product and process innovations may generate a sound economic basis for small-scale farming to continue to operate.

The analysis of the Gini coefficient shows that the farm size distribution tends to be less dispersed in industries with much policy intervention, such as the dairy industry in the European Union. This likely arises from constraints to farm size growth caused by production quotas that were in place until 2015. The size of operations varies more strongly in production systems traditionally associated with higher degrees of diversification, lower asset specificity and more flexibility for off-farm employment, such as crop production.

Overall, the report shows that structural change cannot be characterized by a single trend towards large-scale operations and might show different dynamics across countries, production systems and over time. Several structural trends might be present at the same time within single sub-sectors and countries. A trend towards consolidation of land and production in large-scale farms can be accompanied by emergence of small and moderate-size operations in some niche markets, such as organic food, traditional specialities and regional products.

Availability of comparable long time series of farm level data is an important precondition for studying structural change in agriculture. In particular, differences in the definition of minimum farm size across countries and changes in farm type classifications put a constraint on comparability of farm size statistics and studying long-term trends in the evolution of farm structures in single countries and drawing international comparisons.

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Annex A.

Terms of Reference (TOR)

Data source

Since the information regarding the tail of the farm size distribution, in particular large farms, is important in this project, the Agricultural Census data which includes whole population of farms would be preferred to the survey sample based data source. However, in case that access to farm-level records is difficult, the participants to this study can use either 1) sample survey data (such as FADN) or 2) interpolated data from the Agricultural Census.

Population of farm

A farm could be defined as an operation engaged in agricultural activities, including both family farms and corporate farms. As discussed, the cross-country differences in minimum farm size threshold in farm definition strongly affect the mean and median farm size, while farm size-weighted quartile is much less biased. Given that this study utilizes three types of statistics of farm size distribution (mean, median and hectare-weighted quartile), this TOR suggests to exclude farms with small output value so that the total farm population accounts for 90% of the total value of gross agricultural output. However, the excluded part of the distribution captures the trends of the increase in the number of small farms. This TOR also aims to collect information on this excluded part of the distribution.

Table A1. Definitions of farm population in selected OECD regions

Country	Definition of farm
Canada	Agricultural operation that produces at least one of the following products intended for sale: crops, livestock, animal products, or other agricultural products. Since 1996, census farms include commercial poultry hatcheries and operations that produced only Christmas trees.
European Union	The agricultural holdings surveyed by the Farm Structure Survey consists of all agricultural holdings at least 1 hectare and those of less than 1 hectare provided the latter market a certain proportion of their output or produce more than a specified amount of output. For FADN survey, non-commercial farms below a minimum economic size (measured by standard output) are excluded from the population.
Japan	All establishments that either perform agricultural production directly or on contract and fulfil one of the following conditions: 1) manage more than 0.3 hectare of cultivated land, 2) possess planted or cultivated area or a number of livestock being raised or delivered that is equal to or greater than predetermined standards by the type of farming, 3) accept farm work on contract.
United States	All establishments, except institutional farms, that sold or would normally have sold at least USD 1 000 of agricultural products during the year

Definitions of sub-sector

In addition to the total farm population including all farms, this study aims to capture the trend of structural change in selected sub-sectors of agriculture. The population of each sub-sector of agriculture can be defined by the following farm types which cover the population of farms specialized in producing in certain groups of commodities.

- Field crop farms
- Dairy farms
- Cattle farms (including both rearing and fattening)
- Pig farms
- Broiler farms
- Egg farms

This TOR proposes to define each farm type as a farm with more than half of total value of production from selected commodity production. However, if non-specialized farms account for more than 10% of the production of the selected group of commodities, participating countries should include other types of farms in the population so that the selected population accounts for more than 90% of production.

Definition of farm size

Farm size can be defined by multiple criteria such as volume of certain output and input and no single criteria exists to measure farm size. The economic size of farm is typically measured by the size of gross agricultural output value which can be measured consistently across different types of farms. However, economic size is strongly influenced by price development and its comparison across time and countries needs careful interpretation. In addition, structural change through farm consolidation occurs primarily in input markets such as land, labour and capital inputs. The change in the distribution of a key input use may capture the development of structural change more consistently. For example, land is a key input in capturing a structural change in crop farm sector, where land consolidation is the major driver of structural change.

On the contrary, land size is not a major constraint for farm size expansion in most of the livestock sectors. Farm size expansion in the livestock sector can be observed by the investment in capital such as a barn, house, feeding equipment and other facilities, which allow farmers to house a larger number of animals and produce its output more efficiently. In practice, it is difficult to measure the capital investment consistently across time and countries. The number of certain types of animals kept in a single unit of a farm can be a good proxy to the size of capital investment, which is the most appropriate measurement of farm size in the livestock sector.

Land size

The harmonized definition of farm size is crucial in cross-country comparison. The definition of "farmland" normally includes all types of land used for cultivation, meadow or grazing, irrespective of actual planting, harvesting, or grazing activity. In some cases, the definition of farmland includes land not used for cultivation such as the land used for a farm house, and storage and processing facilities. Given that the main interest of this TOR is a concentration of land use on large farms in field crop farms, the coverage should be limited to the land used for cultivation (cropland). Pasture, meadow and grazing land should be excluded from the definition of land. It also does not differentiate types of land use rights (ownership or tenancy).

Table A2. Definition of farmland in selected OECD regions

Country	Definition of farmland
Canada	Workable land is defined as all arable or cleared lands including area in hay, crops, summer fallow, and tame or seeded pasture land. For the purpose of this analysis, pasture land will be removed from the total.
European Union	Total utilised agricultural area comprising land under arable, grassland and permanent pasture, and permanent crops, but does not include areas used for mushrooms, land rented for less than one year on an occasional basis, woodland and other farm areas.
Japan	The cultivated area of land is the land intended for growing crops including ridges between paddy fields
United States	All cropland (harvested or not), all pasture, range, and forest land on the farm, and all other land owned or rented by the farm

Economic size

This study suggests measuring the size of the whole population of a farm by its economic size. The standard measurement of the economic size of farms is the size of gross agricultural output (GAO). The definition of GAO includes market receipts for sales of agricultural products and services such as custom work, income rental of land, quotas, building and machinery, but excludes payments from the government. Table A3 compares the definition of GAO across countries.

Table A3. Definition of gross agricultural output in selected OECD regions

Country	Definition
Canada	Gross agricultural output is defined as gross revenue for farm business minus government payments.
European Union	Total of output of crops and crop products, livestock and livestock products and of other output. Sales and use of (crop and livestock) products and livestock + change in stocks of products (crop and livestock) + change in valuation of livestock - purchases of livestock + various non-exceptional products.
United States	Gross agricultural output is defined as gross receipts minus government payments and Federal crop insurance indemnities. Gross receipts are defined as gross cash farm income (in ERS ARMS nomenclature), which includes receipts from sales of farm products, receipts from contract fees and revenues, revenue from land rents, and farm-related income

Animal numbers

The measurement of animal numbers has at least two issues. First, livestock farms keep different varieties and ages of animals on a single farm. Farm size can be measured by a number of specific types of animal on a farm or by an index of animal numbers using certain coefficients by the type of animals. Second, livestock farms may specialize in a specific stage of the production process and have a high turn-over rate of animals in a single year. For dairy, broiler and egg farm types, the number of dairy cows, broiler chickens and laying hens are the most appropriate measure even though these farms may keep other types of animals.

On the other hand, it is not appropriate to measure the size of cattle and pig farms by only one type of animal because these farms tend to specialize in certain production processes such as rearing and fattening. It is also difficult to separate farm type definition by its specialization in a production stage across countries because there are many types of specialization even in a single country. This TOR proposes to use the conversion coefficient to aggregate different varieties and ages of animals to an index of animal number. Among the number of conversion coefficients, this TOR suggests applying the

livestock standard unit (LSU) measurement used in Eurostat. LSU is established initially on the basis of the nutritional or feed requirement of each type of animal (Table A4).[14]

Table A4. Definition of livestock unit coefficients

Type of animals	Variety and age	Livestock unit coefficients
Bovine animals	Under 1 year old	0.400
	1 but less than 2 years old	0.700
	Male, 2 years old and over	1.000
	Heifers, 2 years old and over	0.800
	Dairy cows	1.000
	Other cows, 2 years old and over	0.800
Pigs	Piglets having a live weight of under 20 kg	0.027
	Breeding sows weighing 50 kg and over	0.500
	Other pigs	0.300

Although animals can be counted in different time periods or production processes such as the number of animals sold and cumulative number of animals kept in farm, this TOR suggests the average number of animals kept during the calendar year as a measurement of animal numbers of the farm. Although farms in the same farm type may have different turn-over rates of animals depending on its specialization in production process, the average number of animals can measure the capacity of farms to host animals and can be a reasonable proxy for the size of fixed capital such as building and machinery. Table A5 summarises the definition of farm size and its measurement criteria by farm type.

Table A5. Definition of farm size and measurement criteria by farm type

Farm type	Farm size definition	Measurement criteria
All farms	Economic size	Gross agricultural output in local currency
	Land size	Cultivated area of farmland (cropland) in hectare
Field crop farms	Land size	Cultivated area of farmland (cropland) in hectare
Dairy farm	Animal number	Average number of dairy cows during the calendar year
Cattle farm	Animal number	Average number of cattle excluding dairy cows during the calendar year, converted to livestock units (LSU)
Pig farm	Animal number	Average number of pigs including piglets, breeding sows, pigs for fattening and other pigs during the calendar year, converted to livestock units (LSU)
Broiler farm	Animal number	Average number of broilers and other table chickens during the calendar year
Egg farm	Animal number	Average number of laying hens during the calendar year

14. The reference unit used for the calculation of livestock units (=1 LSU) is the grazing equivalent of one adult dairy cow producing 3 000 kg of milk annually, without additional concentrated foodstuffs.

Selected summary statistics of farm size distribution

The participants should report three types of summary statistics of farm size distribution overtime: **mean** (μ), **un-weighted quartile** (*u*); first quartile (*u1*), second quartile (median) (*u2*) and third quartile (*u3*) and **farm size-weighted quartiles**; first quartile (m_1), second quartile (median) (m_2) and third quartile (m_3). In addition, **Gini coefficient** (*Ig*) captures the degree of inequality of the distribution.[15] The definitions of these statistics are presented as below as taking an example of land size distribution (partly modified from the presentation by Heiko Hansen). In case that the participants use sample survey data, the sample weighting factor should be incorporated to replicate the population based statistics.

uaa_i : cultivated area of farmland

n : number of farms

Mean (μ),,

$$\mu = \frac{1}{n} \times \sum_{i=1}^{n} uaa_i$$

Un-weighted quartile (*u1*, u2, u3)

$$u_q = UAA_q$$

Hectare-weighted quartile (m_1, m_2, m_3)

$$m_q \approx uaa_\gamma \quad ;$$

$$\sum_{i=1}^{\gamma} uaa_i > \frac{q}{4} \sum_{i=1}^{n} uaa_i \leq \sum_{i=\gamma}^{n} uaa_i$$

Gini coefficient (*Ig*)

$$\mathrm{Ig} = \frac{\sum_i \sum_j |\,\mathrm{uaa}_i - \mathrm{uaa}_j\,|}{2\mathrm{n}(\mathrm{n}-1)\mu} \qquad \text{for i = 1 to n and j = 1 to n}$$

15. A Lorenz (or concentration) curve in Figure 1 represents the cumulative proportion of a variable as a function of the proportion of the population contributing to (accounting for) this variable. Gini coefficients capture the distance between the Lorenz curve for the variable and the equality line indicates the degree of inequality of distribution for the variable. The further the distance, the more concentrated the variable and the more unequal the distribution. These are twice the area between the Lorenz curve and the first diagonal. The greater the inequality, the higher the coefficient. When based on individual data, it ranges from 0 to 1.

Additional information on the farm-size distribution

In addition to these four summary statistics, the participants should report **total area of cropland (or animal number)**, **total gross value of agricultural output** and **total number of farms** for both all farm population and each farm type farm; **two types of quartile groups: un-weighted and farm-size weighted quartile groups** (in total representing 90% of the gross agricultural output) as well as for **the left out population** (representing the remaining 10% of the gross agricultural output).

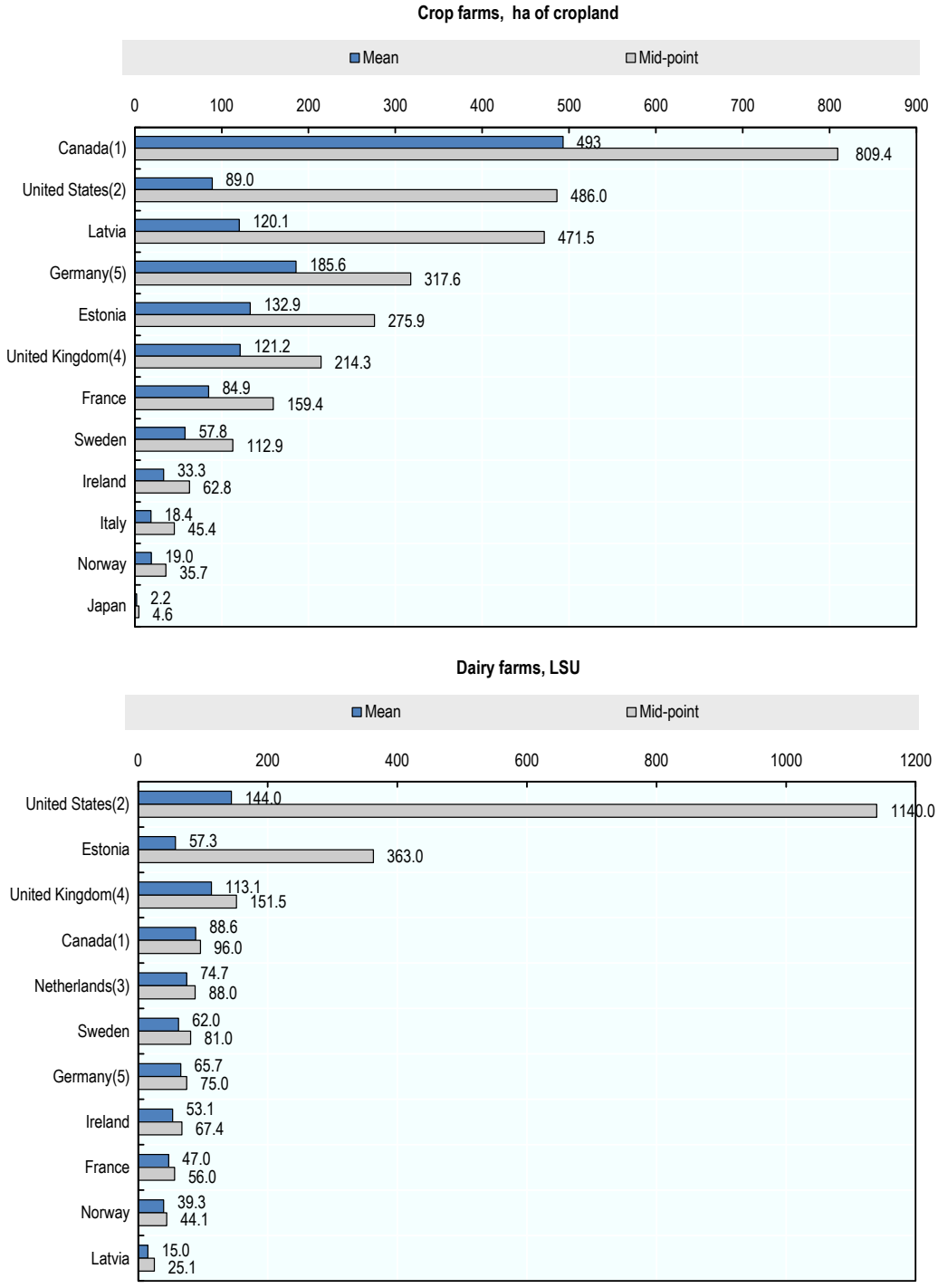
Time period

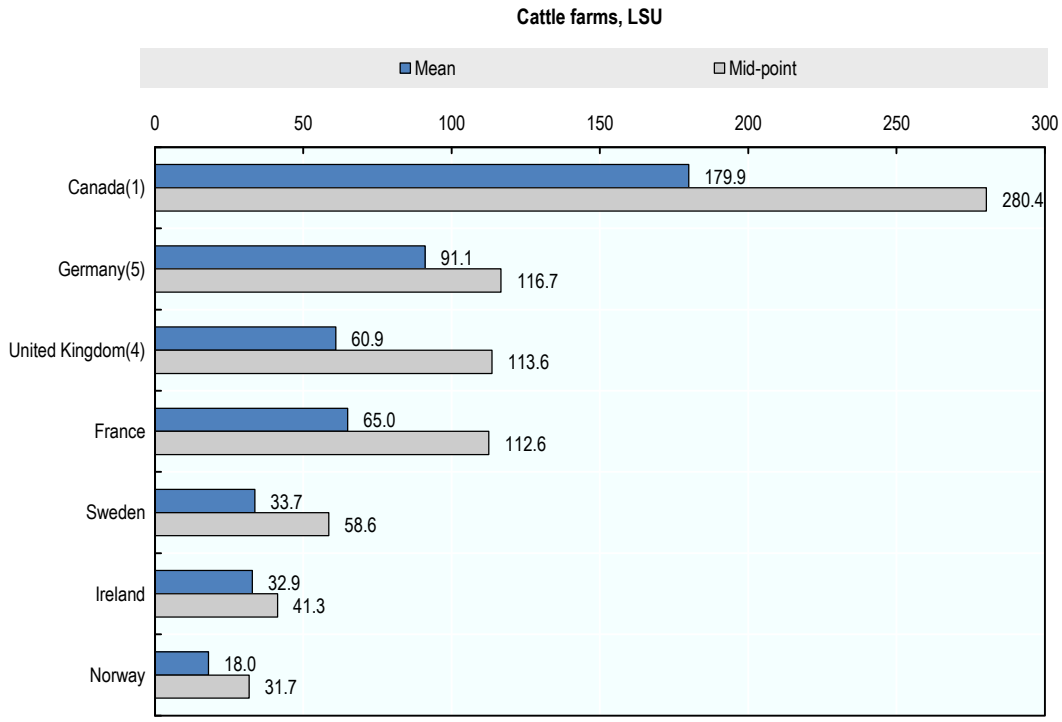
Given that structural change has to be assessed with a long/medium term perspective, the database should cover a 20-30 year period. The year of observation is determined by the Census year. If the participants intend to use survey based data, the data should include **every five years between 1980 and 2010** as long as the data is available. Participating countries are allowed to have some flexibility to extend or reduce the data series depending on the data availability.

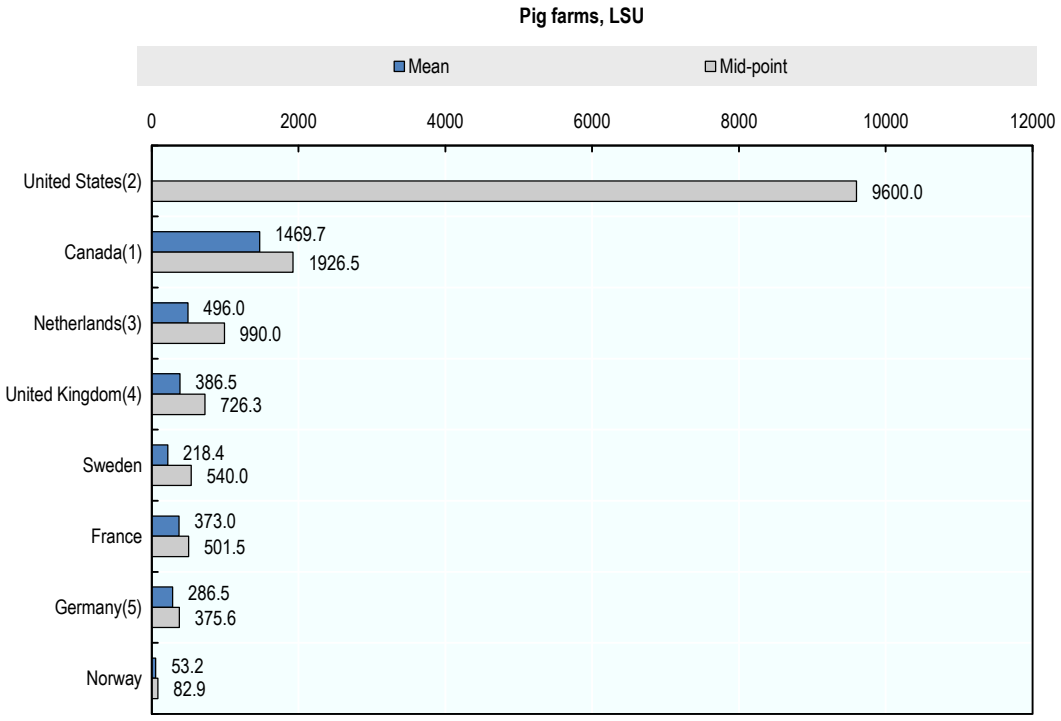
Annex B.

Background Tables and Figures

Figure B1. Mean and mid-point farm size across selected OECD countries (ranked by mid-point farm size), 2010







Notes:

1. For Canada, 2011 data are used for 2010.
2. For the United States, 2012 data are used as 2010 data.
3. For the Netherlands, data are on all farms having cropland, dairy cows and pigs, respectively.
4. For the United Kingdom (England), 2009 data are used for 2010 data.
5. For Germany, 2003 data are used for 2000 and 2007 data for 2005.

Table B1. Mean, median and mid-point farm size and Gini coefficient estimates: All farms (GAO[1]), 1995-2010

	1995				2000				2005				2010			
Country	mean	median	mid-point	Gini	mean	median	mid-point	Gini	mean	median	mid-point	Gini	mean	median	mid-point	Gini
Based on census or full-scope survey data																
Canada[2]	319 926	181 657	435 941	0.51	485 153	246 401	757 866	0.56	647 884	317 178	1 093 047	0.57	681 520	355 018	1 091 049	0.55
United States																
Japan	3	1	11	0.75	3	1	13	0.78	4	1	20	0.81	5	1	25	0.83
France																
Germany[3]					163 642	99 813	204 111	0.48	162 104	98 979	206 623	0.48	336 385	203 667	451 670	0.48
Netherlands																
Norway																
United Kingdom																
Based on sample data																
Estonia					53 370	19 495	195 231	0.41	77 834	18 681	483 760	0.59	71 909	13 246	565 672	0.75
Ireland	29 684	13 160	83 613		37 738	17 471	109 830		40 532	17 712	94 590		39 581	15 801	117 018	
Italy	122 219	70 630			145 787	76 261			63 500	24 392	165 061		55 653	20 494	154 900	
Latvia									42 702	16 466	130 931	0.67	41 903	13 684	183 620	0.71
Sweden					2 082 312	1 496 026	2 577 870	0.39	2 394 500	1 606 490	3 033 601	0.42	2 381 612	1 482 013	4 059 666	0.45

Notes:

1. Gross Agricultural Output measured in units of national currency, adjusted to 2010 prices. For Japan, GAO is in millions of the current national currency.
2. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For Germany, 2003 data are used for 2000 and 2007 for 2005.

Table B2. Mean, median and mid-point farm size and Gini coefficient estimates: All farms (hectares of cropland), 1995-2010

	1995				2000				2005				2010			
Country	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index
Based on census or full-scope survey data																
Canada[1]	288.1	161.9	546.3	0.57	334.9	173.2	673.0	0.60	377.9	178.1	818.3	0.62	448.7	219.7	947.0	0.62
United States[2]						182.7	212.0			220.9	750.0			259.1	750.0	
Japan	1.4	0.8	1.9	0.50	1.5	0.8	2.2	0.53	1.6	0.8	2.5	0.56	1.8	0.9	3.5	0.61
Korea	0.7		1.1		1.2		1.8		1.2		2.0		1.2		2.3	
France[3]	24.8	10.5	60.7	0.64	31.1	13.6	74.5	0.63	41.1	17.8	97.8	0.62	51.0	22.1	121.0	0.62
Germany[4]					59.0	29.2	113.9	0.64	69.7	34.5	136.2	0.64	78.2	38.4	159.3	0.65
Netherlands[5]	17.1	6.2	44.1	0.66	17.7	6.7	45.6	0.66	22.8	9.9	53.3	0.62	25.9	10.7	60.6	0.63
Norway	14.5	11.7	19.4		15.9	12.5	21.8		20.4	16.1	26.9		22.7	17.1	31.3	
United Kingdom[6]	36.3	3.8	152.5	0.80	39.9	3.4	166.0	0.80	37.8	0.4	172.4	0.82	39.9	1.0	178.1	0.81
Based on sample data																
Estonia					85.6	40.4	152.0	0.32	103.9	49.1	266.4	0.34	107.0	34.0	349.3	0.60
Ireland	2.2		26.3		2.8		42.9		3.9		32.4		3.6		43.7	
Italy	22.6	12.0			26.4	13.0			14.1	6.5	30.0		15.9	6.2	41.5	
Latvia									35.9	14.6	101.6	0.68	47.1	14.6	223.7	0.75
Sweden	31.7	17.2	58.1	0.56	34.3	16.6	70.0	0.60	35.7	15.1	81.2	0.63	37.0	13.8	94.8	0.66

Notes:

1. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
2. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
3. For France, 1995 data are calculated as the average between 1988 and 2000, and 2005 values are calculated as the average between 2000 and 2010.
4. For Germany, 2003 data are used for 2000 and 2007 for 2005.
5. For the Netherlands, data are on all farms having cropland, dairy cows and pigs, respectively.
6. For the United Kingdom (England), 2009 data are used for 2010.

Table B3. Mean, median and mid-point farm size and Gini coefficient estimates: Crop farms (hectares of cropland), 1995-2010

	1995				2000				2005				2010			
Country	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index
Based on census or full-scope survey data																
Canada[1]	317.2	230.7	435.8	0.44	364.0	240.8	535.8	0.47	434.7	275.2	685.5	0.50	493.1	291.4	809.4	0.52
United States[2]	91.0		324.0		87.0		384.0		85.0		453.0		89.0		486.0	
Japan	1.4	0.8	2.0	0.50	1.5	0.9	2.2	0.52	1.8	0.9	2.9	0.55	2.2	1.0	4.6	0.61
France[3]	50.5	32.1	93.2	0.55	58.2	37.1	108.5	0.55	71.6	46.6	133.9	0.55	84.9	56.2	159.4	0.55
Germany[4]					143.0	71.6	259.0	0.56	168.6	87.7	301.2	0.55	185.6	100.6	317.6	0.54
Netherlands																
Norway	9.8	4.8	21.5		10.9	5.3	24.0		16.6	10.2	31.1		19.0	11.5	35.7	
United Kingdom[5]	107.4	62.8	195.7	0.56	117.5	72.7	204.1	0.54	121.4	75.9	209.2	0.54	121.2	70.4	214.3	0.55
Based on sample data																
Estonia					57.4	37.0	71.6	0.05	116.7	67.5	174.9	0.01	132.9	67.9	275.9	0.40
Ireland	24.7	16.5	42.9		38.7	24.3	66.8		28.3	16.5	54.2		33.3	17.7	62.8	
Italy	24.2	16.0	0.0		32.3	18.0	0.0		20.4	9.7	32.6		18.4	11.0	45.4	
Latvia									103.8	36.7	321.2	0.68	120.1	30.6	471.5	0.74
Sweden	59.2	38.5	87.3	0.48	50.7	27.4	88.0	0.53	54.5	28.2	100.0	0.55	57.8	28.2	112.9	0.57

Notes:

1. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
2. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
3. For France, 1995 data are calculated as the average between 1988 and 2000 and 2005 data are calculated as the average between 2000 and 2010.
4. For Germany, 2003 data are used for 2000 and 2007 for 2005.
5. For the United Kingdom (England), 2009 data are used for 2010.

Table B4. Mean, median and mid-point farm size and Gini coefficient estimates: Dairy farms (LSU[1]), 1995-2010

	1995				2000				2005				2010			
Country	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index
Based on census or full-scope survey data																
Canada[2]	54.0	45.0	55.0	0.26	63.0	50.0	65.0	0.27	76.9	60.0	80.0	0.31	88.6	65.0	96.0	0.33
United States[3]	78.0		140.0		99.0	65.0	170.0		133.0	81.0	655.0		144.0	97.0	1140.0	
Japan																
France[4]	28.5	25.5	35.0	0.34	34.0	31.0	40.0	0.32	40.5	37.0	48.0	0.31	47.0	43.0	56.0	0.31
Germany[5]					48.5	38.0	55.0	0.33	55.1	42.0	62.0	0.35	65.7	49.0	75.0	0.37
Netherlands[6]	45.6	42.0	58.0	0.35	51.0	48.0	62.0	0.32	60.9	57.0	73.0	0.32	74.7	68.0	88.0	0.31
Norway	23.0	21.5	25.7		26.6	24.5	29.6		32.0	28.0	35.3		39.3	32.5	44.1	
United Kingdom[7]	76.3	65.0	95.0	0.35	85.8	73.0	107.0	0.35	88.6	70.1	115.0	0.38	113.1	94.3	151.5	0.41
Based on sample data																
Estonia					46.8	11.0	262.0	0.63	47.5	11.0	246.3	0.61	57.3	7.8	363.0	0.77
Ireland	34.0	27.8	42.9		39.1	35.0	46.9		46.8	44.0	56.4		53.1	45.9	67.4	
Italy																
Latvia									13.7	7.9	19.0	0.50	15.0	8.0	25.1	0.54
Sweden	27.1	23.0	34.0	0.37	34.0	28.0	43.0	0.39	46.0	36.0	57.0	0.39	62.0	44.0	81.0	0.43

Notes:

1. Livestock Standard Units (LSU).
2. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
4. For France, 1995 data are calculated as the average of 1988 and 2000, and 2005 data are calculated as the average of 2000 and 2010.
5. For Germany, 2003 data are used for 2000 and 2007 for 2005.
6. For the Netherlands, data are on all farms having cropland, dairy cows and pigs, respectively.
7. For the United Kingdom (England), 2009 data are used for 2010.

Table B5. Mean, median and mid-point farm size and Gini coefficient estimates: Cattle farms (LSU[1]), 1995-2010

	1995				2000				2005				2010			
Country	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index
Based on census or full-scope survey data																
Canada[2]	113.8	66.8	158.7	0.50	145.3	79.3	209.1	0.53	165.2	90.0	244.2	0.53	179.9	94.0	280.4	0.55
United States																
Japan																
France[3]	39.5	24.9	71.9	0.53	48.0	29.7	89.0	0.54	56.5	37.4	100.8	0.53	65.0	45.1	112.6	0.52
Germany[4]					73.8	51.0	98.1	0.44	79.9	55.2	104.8	0.43	91.1	63.3	116.7	0.43
Netherlands																
Norway	6.6	4.0	10.9		9.5	5.5	17.1		13.5	8.5	23.7		18.0	11.0	31.7	
United Kingdom[5]	40.8	24.8	69.6	0.53	45.5	26.2	78.7	0.53	50.2	30.3	84.9	0.53	60.9	33.3	113.6	0.57
Based on sample data																
Estonia																
Ireland	26.5	18.3	35.2		30.9	22.4	40.0		35.2	24.7	49.3		32.9	24.5	41.3	
Italy																
Latvia																
Sweden	18.5	12.6	29.0	0.49	25.5	17.4	39.7	0.49	27.9	18.3	45.3	0.51	33.7	20.1	58.6	0.55

Notes:

1. Livestock Standard Units (LSU).
2. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For France, 1995 data are calculated as the average of 1988 and 2000, and 2005 data are calculated as the average of 2000 and 2010.
4. For Germany, 2003 data are used for 2000 and 2007 for 2005.
5. For the United Kingdom (England), 2009 data are used for 2010.

Table B6. Mean, median and mid-point farm size and Gini coefficient estimates: Pig farms (LSU[1]), 1995-2010

	1995				2000				2005				2010			
Country	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index	mean	median	mid-point	Gini index
Based on census or full-scope survey data																
Canada[2]	494.9	312.4	675.0	0.47	802.0	489.8	1 091.7	0.47	1 134.9	675.0	1 491.6	0.46	1 469.7	866.3	1 926.5	0.47
United States[3]						440.0	3520.0			1 120.0	6560.0			1 800.0	9 600.0	
Japan																
France[4]	222.5	180.0	303.9	0.44	285.0	228.3	388.7	0.43	329.0	263.6	445.1	0.44	373.0	299.0	501.5	0.45
Germany[5]					265.4	163.3	359.0	0.52	300.9	208.2	375.1	0.46	286.5	205.2	375.6	0.45
Netherlands[6]	181.5	98.0	365.5	0.60	252.2	147.5	480.0	0.58	319.9	188.0	602.5	0.57	496.0	269.0	990.0	0.59
Norway	8.3	6.6	12.2		39.1	28.4	63.5		39.1	28.4	63.5		53.2	40.3	82.9	
United Kingdom[7]	363.8	196.6	726.0	0.61	391.7	204.3	829.2	0.61	296.7	115.2	715.8	0.66	386.5	230.2	726.3	0.58
Based on sample data																
Estonia																
Ireland																
Italy																
Latvia																
Sweden	46.4	10.5	172.6	0.75	90.2	20.0	282.0	0.74	155.2	50.4	415.5	0.69	218.4	87.1	540.0	0.68

Notes:

1. Livestock Standard Units (LSU).
2. For Canada, 1996 data are used for 1995, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
4. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.
5. For Germany, 2003 data are used for 2000 and 2007 for 2005.
6. For the Netherlands, data are on all farms having cropland, dairy cows and pigs, respectively.
7. For the United Kingdom (England), 2009 data are used for 2010 data.

Table B7. First and third quartiles of farm size distribution (standard and size-weighted): All farms (GAO[1]), 1995-2010

	1995				2000				2005				2010			
Country	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile
Based on census or full-scope survey data																
Canada[2]	120 175	214 942	302 409	1 384 403	157 733	322 936	424 525	3 267 870	196 684	448 253	571 521	4 410 427	218 963	474 974	641 254	3 595 332
United States																
Japan	0.3	4	2	37	0.3	4	3	41	0.2	6	2	74	0.3	9	3	200
France[3]																
Germany[4]					65 586.4	112 550	160 134	671 349	64 216.8	112 206	160 296	628 648	197 713.0	197 713	983 160	983 160
Netherlands																
Norway																
United Kingdom																
Based on sample data																
Estonia					13 188	35 870	34 781	969 199	11 260	95 436	39 863	1 440 674	6 531	106 188	38 279	1 714 287
Ireland	6 348	39 835	32 886	145 586	8 448	67 284	46 638	242 966	8 247	35 895	49 944	172 962	7 927	55 069	42 678	299 581
Italy	39 515		130 832		41 106		149 564		14 050	51 546	50 715	661 200	11 056	47 500	44 400	535 774
Latvia									10 425	26 822	25 748	1 149 290	8 789	32 153	23 290	881 628
Sweden					955 807	1 551 023	2 577 870	5 464 792	1 063 158	1 695 698	2 642 746	6 281 827	789 435	1 912 911	3 221 416	5 237 376

Notes:

1. Gross Agricultural Output measured in units of national currency, adjusted to 2010 prices. For Japan in millions of the current national currency.
2. For Canada, 1996 data are used for 1995 data, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.
4. For Germany, 2003 data are used for 2000 and 2007 for 2005.

Table B8. First and third quartiles of farm size distribution (standard and size-weighted): All farms (hectares of cropland), 1995-2010

	1995				2000				2005				2010			
Country	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile
Based on census or full-scope survey data																
Canada[1]	56.7	319.7	404.3	908.1	59.9	374.7	452.0	1 185.7	57.9	435.8	495.7	1 456.9	70.8	497.8	574.7	1 803.7
United States[2]					89.1	113.6	350.9	384.3	105.9	250.0	438.0	1 354.5	122.7	386.4	525.0	1 354.5
Japan	0.5	1.0	1.4	4.8	0.5	1.1	1.5	6.5	0.5	1.2	1.5	8.6	0.5	1.4	1.6	16.4
France[3]	3.9	27.4	29.6	111.2	4.8	34.8	38.5	130.4	5.9	47.8	53.2	165.4	7.0	60.7	67.8	200.5
Germany[4]					13.7	49.0	54.3	618.9	15.8	58.8	65.2	649.2	16.3	68.0	74.2	684.4
Netherlands[5]	1.7	22.9	22.6	71.7	2.0	22.0	21.8	77.9	3.6	25.9	29.0	92.8	3.7	30.6	33.4	107.0
Norway	6.4	12.5	18.9	30.0	6.7	13.7	20.8	34.0	9.2	17.0	25.9	42.9	9.3	19.0	28.8	52.5
United Kingdom[6]	0.0	70.8	34.8	308.3	0.0	79.5	39.2	325.4	0.0	83.6	34.9	335.0	0.0	83.6	37.1	361.7
Based on sample data																
Estonia					25.7	54.9	68.9	1 080.0	28.6	83.2	98.1	825.0	15.0	117.9	81.9	990.3
Ireland		13.0		54.2		17.8		83.4		15.4		68.8		19.2		162.7
Italy	6.0		25.0		6.1		28.4		3.4	11.6	13.6	81.5	3.1	14.5	14.5	110.0
Latvia									7.2	27.6	27.4	520.0	5.3	49.5	29.8	750.8
Sweden	7.7	29.5	39.5	109.4	7.0	34.0	40.9	140.0	6.0	37.5	41.3	165.1	5.7	41.2	40.2	196.2

Notes:

1. For Canada, 1996 data is used for 1995 data, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
2. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
3. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.
4. For Germany, 2003 data are used for 2000 and 2007 for 2005.
5. For Netherlands, data are on all farms having cropland/dairy cows/cattle and pigs.
6. For the United Kingdom (England), 2009 data are used for 2010.

Table B9. First and third quartiles of farm size distribution (standard and size-weighted): Crop farms (hectares of cropland), 1995-2010

	1995				2000				2005				2010			
Country	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile
Based on census or full-scope survey data																
Canada[1]	129.5	257.0	390.5	750.7	133.1	290.6	439.1	999.2	142.4	360.2	523.3	1 280.4	159.9	404.7	580.7	1 618.7
United States																
Japan	0.5	1.0	1.5	5.1	0.5	1.1	1.5	7.0	0.6	1.3	1.7	11.2	0.6	1.5	1.7	21.1
France[2]	9.5	55.3	73.1	148.4	10.2	66.0	86.6	166.8	11.6	82.2	107.4	203.1	13.1	98.3	128.3	239.4
Germany[3]					45.5	100.8	131.7	749.1	55.5	121.7	163.6	780.4	63.9	135.7	185.1	794.2
Netherlands																
Norway	1.2	11.5	13.3	37.5	1.5	12.7	14.6	42.3	3.1	17.0	22.1	54.4	3.5	19.3	24.7	65.2
United Kingdom[4]	25.2	102.9	135.2	365.8	30.5	109.5	148.7	374.6	32.6	111.0	153.0	387.1	31.4	110.3	149.5	419.0
Based on sample data																
Estonia					28.0	38.9	57.0	189.7	38.4	78.8	108.1	514.9	29.1	118.5	136.4	697.9
Ireland	7.2	19.9	33.2	73.0	11.3	39.3	47.2	172.0	8.1	25.5	32.8	93.1	3.6	37.0	37.6	227.6
Italy	9.5		28.5		10.0		34.7		5.8	14.7	18.5	80.3	6.0	17.6	22.1	113.8
Latvia									18.1	93.5	78.5	763.0	12.2	169.1	89.4	993.6
Sweden	22.9	46.7	69.8	167.0	15.6	40.0	57.9	184.0	15.8	44.7	60.7	208.9	15.7	47.6	62.9	238.2

Notes:

1. For Canada, 1996 data are used for 1995 data, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
2. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.
3. For Germany, 2003 data are used for 2000 and 2007 for 2005.
4. For the United Kingdom (England), 2009 data are used for 2010 data.

Table B10. First and third quartiles of farm size distribution (standard and size-weighted): Dairy farms (LSU[1]), 1995-2010

	1995				2000				2005				2010			
Country	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile
Based on census or full-scope survey data																
Canada[2]	35.0	40.0	60.0	84.0	40.0	46.0	70.0	100.0	45.0	55.0	85.0	140.0	50.0	60.0	99.0	170.0
United States[3]					47.0	78.0	73.0	680.0	53.5	164.0	70.1	1890.0	60.0	250.0	94.3	3100.0
Japan																
France[4]	16.5	25.5	37.5	49.5	21.0	30.0	43.0	56.0	25.5	35.5	51.5	66.5	30.0	41.0	60.0	77.0
Germany[5]					27.0	36.0	56.0	84.0	30.0	40.0	63.0	100.0	33.0	48.0	73.0	127.0
Netherlands[6]	25.0	42.0	60.0	79.0	31.0	46.0	66.0	84.0	37.0	54.0	78.0	99.0	46.0	65.0	94.0	122.0
Norway	15.5	19.4	28.0	34.0	18.0	22.1	32.0	43.0	20.5	25.8	38.0	57.0	23.0	30.7	46.0	81.0
United Kingdom[7]	41.0	64.0	98.0	140.0	46.3	72.0	110.0	158.0	43.2	72.2	112.0	180.6	54.9	98.9	147.4	232.2
Based on sample data																
Estonia					7.0	66.0	22.0	499.0	8.0	54.0	29.0	434.0	3.3	125.2	33.0	634.0
Ireland	16.3	28.0	43.0	68.9	21.2	33.7	49.6	67.7	28.7	41.7	61.1	72.8	28.2	44.8	69.3	98.7
Italy																
Latvia									6.0	8.5	10.3	64.0	5.6	9.0	11.3	85.0
Sweden	14.0	23.0	34.0	51.0	17.0	28.0	42.0	68.0	23.0	36.0	55.0	98.0	27.0	48.0	73.0	148.0

Notes:

1. Livestock Standard Units (LSU).
2. For Canada, 1996 data are used for 1995 data, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
4. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.
5. For Germany, 2003 data are used for 2000 and 2007 for 2005.
6. For the Netherlands, data are on all farms having cropland/dairy cows/cattle and pigs.
7. For the United Kingdom (England), 2009 data are used for 2010.

Table B11. First and third quartiles of farm size distribution (standard and size-weighted): Cattle farms (LSU[1]), 1995-2010

	1995				2000				2005				2010			
Country	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile
Based on census or full-scope survey data																
Canada[2]	43.3	79.8	114.7	409.1	51.6	99.3	136.7	683.1	57.1	116.0	159.9	750.0	58.7	126.5	170.3	927.3
United States																
Japan																
France[3]	8.6	41.8	57.1	112.1	9.2	52.7	70.4	137.7	11.8	60.4	81.8	156.1	14.3	68.0	93.2	174.4
Germany[4]					31.0	56.1	85.4	183.3	34.9	59.9	92.3	198.0	39.8	68.2	103.8	223.7
Netherlands																
Norway	2.0	5.7	8.0	21.3	2.5	8.8	12.0	30.9	3.5	12.7	17.5	42.5	4.5	16.3	22.5	58.6
United Kingdom[5]	11.9	35.5	49.7	131.2	13.0	40.1	55.4	148.5	15.3	41.1	57.5	171.0	14.3	56.4	72.3	234.7
Based on sample data																
Estonia																
Ireland	11.4	19.3	31.5	65.5	14.3	23.6	36.9	74.0	14.9	27.1	43.8	87.0	15.6	25.7	38.9	77.7
Italy																
Latvia																
Sweden	5.9	16.3	23.6	50.4	8.3	22.7	32.9	68.8	8.3	25.2	35.5	81.6	8.5	31.5	41.9	113.1

Notes:

1 LSU: Livestock Standard Units.

2. For Canada, 1996 data are used for 1995 data, 2001 for 2000, 2006 for 2005 and 2011 for 2010.

3. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.

4. For Germany, 2003 data are used for 2000 and 2007 for 2005.

5. For the United Kingdom (England), 2009 data are used for 2010.

Table B12. First and third quartiles (weighted and unweighted): Pig farms (LSU[1]), 1995-2010

	1995				2000				2005				2010			
Country	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile	1st quartile	1st weighted quartile	3rd quartile	3rd weighted quartile
Based on census or full-scope survey data																
Canada[2]	195.0	357.7	532.5	1 530.4	322.9	555.0	838.3	2 374.6	471.9	755.0	1 189.9	3 482.8	600.0	985.5	1 454.4	4 824.5
United States[3]					166.0	1 190.0	1 000.0	11 826.0	330.5	2 601.5	2 500.0	26 763.0	495.0	4 013.0	4 000.0	41 700.0
Japan																
France[4]	93.1	197.4	283.3	492.2	126.3	249.3	362.6	621.9	139.6	289.7	414.0	745.8	153.0	330.0	465.5	869.7
Germany[5]					93.5	204.2	276.6	1 128.3	124.8	230.6	326.7	840.0	117.3	228.0	335.4	667.5
Netherlands[6]	190.0	190.0	681.5	681.5	249.5	249.5	878.5	878.5	306.0	306.0	1 100.0	1 100.0	487.0	487.0	1 962.5	1 962.5
Norway	2.8	8.0	11.4	18.3	6.3	27.2	37.7	63.8	11.4	38.4	55.0	93.1	18.0	52.5	76.0	116.4
United Kingdom[7]	66.0	360.0	427.7	1 522.0	54.6	422.8	510.3	1 514.0	21.7	404.1	411.6	1 268.0	60.9	414.9	527.3	1 291.0
Based on sample data																
Estonia																
Ireland																
Italy																
Latvia																
Sweden	2.7	69.6	42.3	354.0	3.6	145.2	103.5	555.0	7.3	219.4	205.8	713.8	7.4	295.1	293.7	1 350.0

Notes:

1. LSU: Livestock Standard Units.
2. For Canada, 1996 data are used for 1995 data, 2001 for 2000, 2006 for 2005 and 2011 for 2010.
3. For the United States, 1997 data are used for 2000 and 2012 for 2010. 2005 data are calculated as the average of 1997 and 2012 values.
4. For France, 1995 data are calculated as the average of 1988 and 2000 values and 2005 data are calculated as the average of 2000 and 2010.
5. For Germany, 2003 data are used for 2000 and 2007 for 2005.
6. For the Netherlands, data are on all farms having cropland/dairy cows/cattle and pigs.
7. For the United Kingdom (England), 2009 data are used for 2010.

Table B13. Average growth rates for three quartiles of farm size distribution by farm type, 1995-2010[1]

	Average growth rate, 1995-2010, in %											
	Crop farms, ha			Dairy farms, LSU			Cattle farms, LSU			Pig farms, LSU		
Country	1st quartile	median	3rd quartile	1st quartile	median	3rd quartile	1st quartile	median	3rd quartile	1st quartile	median	3rd quartile
Based on census or full-scope survey data												
Canada[2]	1.41	1.57	2.68	2.41	2.48	3.39	2.05	2.30	2.67	7.78	7.04	6.93
United States[3]				2.47	4.08	2.59				11.54	15.13	14.87
Japan	1.22	1.50	0.84									
France[4]	2.19	3.81	3.82	4.07	3.54	3.18	3.45	4.05	3.32	3.36	3.44	3.37
Germany[5]	5.12	5.20	5.57	2.67	2.53	2.99	3.01	2.00	1.96	7.50	6.25	4.25
Netherlands[6]				4.15	3.26	3.04				6.48	6.96	7.31
Norway	7.40	6.00	4.21	2.67	2.79	3.36	5.56	6.98	7.14	13.14	12.85	13.51
United Kingdom[7]	1.48	0.77	0.67	1.96	2.51	2.76	1.21	1.99	2.53	-0.53	1.06	1.41
Based on sample data												
Estonia[8]	0.41	6.27	9.12	-7.24	-3.38	4.14						
Ireland	-4.41	0.48	0.84	3.70	3.40	3.23	2.07	1.96	1.41			
Italy[9]	-3.00	-2.47	-1.68									
Latvia[9]	-7.56	-3.60	2.62	-1.37	0.25	2.02						
Sweden	-2.47	-2.05	-0.69	4.48	4.42	5.23	2.46	3.16	3.90	6.95	15.15	13.78

Notes:

1. Growth rates are calculated as the average growth rate between 1995 and 2010.
2. For Canada, the average growth rates are calculated for the 1996-2011 period.
3. For the United States, the average growth rates are calculated for the 1997-2012 period.
4. For France, the average growth rates are calculated for the 1997-2010 period.
5. For Germany the average growth rates are calculated for the 2003-2007 period.
6. For the Netherlands, data are on all farms having cropland, dairy cows and pigs, respectively.
7. For the United Kingdom (England), 2009 data are used for 2010.
8. For Estonia, the average growth rates are calculated for the 2000-2010 period.
9. For Italy and Latvia, the average growth rates are calculated for the 2005-2010 period.

Table B14. Average growth rates for three size-weighted quartiles of farm size distribution by farm type, 1995-2010[1]

	Average growth rate, 1995-2010, in %											
	Crop farms, ha			Dairy farms, LSU			Cattle farms, LSU			Pig farms, LSU		
Country	1st weighted quartile	mid-point	3rd weighted quartile	1st weighted quartile	mid-point	3rd weighted quartile	1st weighted quartile	mid-point	3rd weighted quartile	1st weighted quartile	mid-point	3rd weighted quartile
Based on census or full-scope survey data												
Canada[2]	3.07	4.21	5.26	2.74	3.78	4.81	3.12	3.87	5.61	6.99	7.24	7.96
United States[3]		2.74		12.35	15.01	16.38				12.93	10.55	13.43
Japan	2.74	5.71	9.93									
France[4]	3.91	3.64	3.24	3.22	3.18	2.99	3.30	3.04	2.99	3.49	3.39	3.87
Germany[5]	4.83	3.84	1.03	2.67	3.04	4.46	1.65	1.67	1.95	3.09	1.10	-7.11
Netherlands[6]				2.95	2.82	2.94				6.48	6.87	7.31
Norway	3.54	3.45	3.76	3.09	3.65	5.96	7.32	7.40	6.98	13.37	13.66	13.11
United Kingdom[7]	0.46	0.61	0.91	2.95	3.16	3.43	3.13	3.32	3.95	0.95	0.00	-1.09
Based on sample data												
Estonia[8]	11.78	8.68	13.91	6.61	3.31	2.42						
Ireland	4.23	2.57	7.88	3.19	3.06	2.42	1.92	1.07	1.15			
Italy[9]		6.85										
Latvia[9]	12.59	7.98	5.42	1.15	5.73	5.84						
Sweden	0.12	1.73	2.39	5.03	5.96	7.36	4.49	3.90	5.54	10.11	7.90	9.33

Notes: 1. Growth rates are calculated as the average growth rate between 1995 and 2010.
2. For Canada, the average growth rates are calculated for the 1996-2011 period.
3. For the United States, the average growth rates are calculated for the 1997-2012 period.
4. For France, the average growth rates are calculated for the 1997-2010 period.
5. For Germany the average growth rates are calculated for the 2003-2007 period.
6. For the Netherlands, data are on all farms having cropland, dairy cows and pigs, respectively.
7. For the United Kingdom (England), 2009 data are used for 2010.
8. For Estonia, the average growth rates are calculated for the 2000-2010 period.
9. For Italy and Latvia, the average growth rates are calculated for the 2005-2010 period.