



Sample of Dutch FADN 2013

Design principles and quality of the sample of agricultural and horticultural holdings

L. Ge, H.B. van der Veen, R.W. van der Meer and H.C.J. Vrolijk

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The EU Farm Accountancy Data Network (FADN) requires the Netherlands to yearly send bookkeeping data of 1,500 farms to Brussels. This task is carried out by LEI and CEI. This report explains the background of the farm sample for the year 2013. All phases from the determination of the selection plan, the recruitment of farms to the quality control of the final sample are described in this report.

Het Europese Bedrijveninformatienet (RICA) vereist dat Nederland jaarlijks de boekhoudkundige gegevens van 1.500 boerderijen naar Brussel stuurt. Deze taak wordt uitgevoerd door het LEI en CEI. Dit rapport geeft een toelichting op de steekproef voor het jaar 2013. Alle fasen van het vaststellen van het selectieplan, de werving van deelnemers tot de kwaliteitscontrole van de uiteindelijke steekproef worden beschreven in dit rapport.

Key words: FADN, sample, population, evaluation

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Preface

The EU Farm Accountancy Data Network (FADN) requires the Netherlands to yearly send bookkeeping data of 1,500 farms to Brussels. This task is carried out by LEI Wageningen UR and Centre for Economic Information (in Dutch, Centrum voor Economische Informatievoorziening, CEI). This report explains the background of the sample for the year 2013. All phases from the determination of the selection plan, the recruitment of farms to the quality control of the final sample are described in this report. This report provides essential background information for the European Commission, the Dutch Ministry, researchers and other organisations to fully understand the statistical aspects of the Dutch FADN sample.



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Summary

S.1 Key results

For the bookkeeping year 2013, 1,516 farm reports have been delivered to the European Commission. The target number of 1,500 farms has been reached. Farm data are of major importance in the evaluation of agricultural policies and the monitoring of the economic developments in the agricultural sector.

In 2013, 67,481 agricultural and horticultural farms operated in the Netherlands. The Dutch FADN aims at farms with a Standard Output (SO) of 25,000 euros or more. This field of observation covers 49,636 farms in 2013. These farms are responsible for 99% of total national production capacity measured in SO.

For the accounting year 2013, 120 new farms were recruited. The average response rate among farms asked to participate in FADN is 21%.

Table S.1 compares the averages in SO per farm of the population and the sample. For most of the variables, the differences are not significant, except for dairy and arable crops (averages estimated from FADN are greater than those calculated from census). Explanations other than sampling errors could be non-response bias. More attention will be paid to this issue in the recruitment process of new farms.

Table S.1

Comparison of economic activity per farm in the agricultural census and in the Dutch FADN

Variable	Economic activity (Standard Output in Euro), average per farm in 2013		Significant (5%)
	Census (Farms with SO ≥ 25,000 euros)	FADN	
Total	423,541	441,550	*
Arable crops	45,121	48,833	*
Grassland	15,962	15,606	
Horticulture open air	49,061	52,239	
Horticulture under glass	101,676	96,650	
Dairy	90,061	97,033	*
Veal	13,955	14,823	
Fattening pigs	28,507	30,718	
Breeding pigs	22,047	21,390	
Broilers	11,676	11,387	
Laying hens	12,752	12,568	

Standard errors of the estimates for a number of goal variables were estimated to assess the reliability of the estimates. There are clear differences in the reliability of estimates between different types of farming. The estimates for the dairy sector (non-organic) are the most reliable because of the large number of farms included in the sample.

S.2 Background

Member states are obliged to have a network for the collection of accountancy data on the incomes and business operation of agricultural holdings. This task is carried out by LEI Wageningen UR and Centre for Economic Information (in Dutch, Centrum voor Economische Informatievoorziening, CEI). The main purpose of the data network is defined as the annual determination of incomes on agricultural holdings and a business analysis of agricultural holdings. For the Netherlands, the European Commission requires the yearly establishment of a selection plan describing the sample of agricultural and horticultural holdings in the Dutch FADN. The selection plan contributes to the harmonisation of the samples from different countries in the EU.

The agricultural census provides the sampling frame for selecting farms to be included in the FADN. Based on the most recent agricultural census, farms are assigned to strata, which are defined by type of farming and economic size class. Only farms with an SO greater than 25,000 euros were included in the sampling frame.

For each stratum the number of farms to be included in the Dutch FADN sample is determined. This number is dependent on the economic importance of a sector, the number of farms in a stratum, the policy relevance of a group and the heterogeneity of the farms.

Samenvatting

S.1 Belangrijkste uitkomsten

Voor het boekjaar 2013 zijn 1.516 bedrijfsverslagen aan de Europese Commissie geleverd. Het streefgetal van 1.500 bedrijven is dus gehaald. Data van agrarische bedrijven zijn van groot belang bij de evaluatie van landbouwbeleid en het monitoren van de economische ontwikkeling in de agrarische sector.

In 2013 zijn er 67,481 land- en tuinbouwbedrijven actief in Nederland. Het Nederlandse FADN richt zich op bedrijven met een Standaard Output (SO) van 25.000 euro of meer. Deze populatie bestaat uit 49,636 bedrijven in 2013. Deze bedrijven vertegenwoordigen 99% van de nationale productie capaciteit, gemeten in SO.

Voor het boekjaar 2013 zijn 120 nieuwe bedrijven geworven. De gemiddelde respons voor bedrijven die gevraagd werden deel te nemen is 21%.

Tabel S.1 vergelijkt de gemiddelden in SO per bedrijf van de populatie en de steekproef. Voor de meeste variabelen zijn de verschillen niet significant, behalve voor melkvee en akkerbouwgewassen (de gemiddelde schatting van de steekproef is groter dan het gemiddelde van de populatie). Voor het verschil zou naast steekproeffouten non-respons bias een andere verklaring kunnen zijn. Hiervoor is meer aandacht nodig in het wervingsproces.

Tabel S.1

Vergelijking van de economische activiteiten per bedrijf in de landbouwtelling versus in de steekproef

Variabele	Economische activiteiten per bedrijf (SO in 1000 euro) in 2013		Significant (5%)
	Landbouwtelling (Bedrijven waarvan SO ≥ 25.000 euro)	Steekproef	
Totaal	423.541	441.550	*
Akkerbouw	45.121	48.833	*
Grasland	15.962	15.606	
Opengrondsgroenten	49.061	52.239	
Glasgroenten	101.676	96.650	
Melkvee	90.061	97.033	*
Kalveren	13.955	14.823	
Vleesvarkens	28.507	30.718	
Fokzeugen	22.047	21.390	
Vleeskuiken	11.676	11.387	
Leghennen	12.752	12.568	

Om inzicht te geven in de betrouwbaarheid van de steekproef zijn de standaardfouten van de geschatte gemiddelde van een aantal doelvariabelen geschat. Er zijn duidelijke verschillen in de betrouwbaarheid van de geschatte gemiddelden van de verschillende bedrijfstypen. Dankzij het grootste aantal (niet-biologische) melkveebedrijven in de steekproef zijn de geschatte gemiddelden van melkvee de meest betrouwbaar.

S.2 Achtergrond

Lidstaten zijn verplicht om een netwerk voor het verzamelen van de boekhoudkundige gegevens van landbouwbedrijven te hebben. Deze taak wordt in Nederland uitgevoerd door LEI Wageningen UR en het Centrum voor Economische Informatievoorziening (CEI). De doelen van het netwerk zijn om jaarlijks de inkomens van landbouwbedrijven vast te stellen en bedrijfsanalyses uit te voeren. De Europese Commissie vereist dat jaarlijks een selectieplan wordt opgesteld. Dit selectieplan draagt bij aan de harmonisatie van informatienetten in verschillende EU-landen.

De Landbouwtelling vormt het uitgangspunt voor het vaststellen van de steekproef voor het Bedrijveninformatienet. Op basis van de meest recente Landbouwtelling worden bedrijven ingedeeld in strata, die zijn gevormd op basis van het bedrijfstype en de economische omvang. Alleen bedrijven groter dan 25.000 euro SO vallen binnen het steekproefkader.

Voor elk stratum wordt vastgesteld hoeveel bedrijven in de steekproef moeten worden opgenomen. Dit aantal is afhankelijk van onder andere de economische betekenis van de sector, het aantal bedrijven in de groep, de beleidsrelevantie en de heterogeniteit van de bedrijven.

1 Introduction

1.1 Background

In 1965 the European Commission adopted a regulation (nr. 79/65/EEG) in which member states were obliged to set up a network for the collection of accountancy data on the incomes and business operation of agricultural holdings in the European Economic Community. The purpose of the data network is defined as the annual determination of incomes on agricultural holdings and a business analysis of agricultural holdings. The Netherlands were required to provide financial economic information on 1,500 farms to Brussels.

For the management of the system, the EU requires information on the selection of farms that are included in the national FADN system. In particular the regulation prescribes the provision of data on the establishment of a selection plan and the recruitment of farms. With respect to the selection plan, in article 6 the regulation EEG 1859/82 prescribes:

'Each Member State shall appoint a liaison agency whose duties shall be: ...to draw up and submit to the National Committee for its approval, and thereafter to forward to the Commission: the plan for the selection of returning holdings, which plan shall be drawn up on the basis of the most recent statistical data, presented in accordance with the Community typology of agricultural holdings.'

1.2 Objective and structure of the report

The objective of this report is to provide background information on the population, the selection plan, implementation of the selection plan and the quality of the sample of data that is to be provided to Brussels for the year 2013. The data forms the basis for a wide range of national and international research projects.

Chapter 2 gives a description of the background of the Dutch FADN system. Chapter 3 describes the agricultural population. This chapter will also consider the demarcation of the population as used in the Dutch FADN. Also the design of the sample of the Dutch FADN system is described. Chapter 4 gives a detailed account of the selection plan. Chapter 5 provides information on the implementation of the selection plan and the recruitment of new farms. Chapter 6 provides a qualitative and quantitative evaluation of the sample.

2 Statistical background of the Dutch FADN sample

2.1 Introduction

In the Dutch FADN detailed records on around 1,500 agricultural and horticultural farms are kept. Besides financial information, a broad set of technical, socio-economic, and environmental data are collected. One of the reasons for the Dutch FADN system is the legal obligation to provide information on the financial economic situation of farms to Brussels. However, an even more important use of the data can be found at the national level. Data from the FADN system are used for many national policy evaluations and research projects.

Based on a sample of farms, estimations are made for the whole population. This might raise the question how conclusions can be drawn for the whole population if only a limited number of farms are observed. The answer to this question can be found in proper sampling techniques such as stratified random sampling (Cochran, 1977). The same is true for the FADN sample. Farms that are included in the FADN should be representative of the whole population. In this way a sample can provide even better information than a census (in which all units are observed). With a fixed budget it is much easier to collect good data on a limited number of farms instead of collecting information on all farms. With a limited number of farms and thus a limited number of data collectors, it is easier to ensure good procedures and good training to collect reliable data.

An important issue is how to ensure that the farms in the FADN sample are representative of the whole population. To this end, the Dutch FADN makes use of a disproportional stratified random sample. A *stratified* sample implies that the population is divided into a number of groups (strata). Subsequently farms are selected from each of the groups. The variables that define these groups should be chosen such that the farms within one group are similar (at least with respect to the important aspects). The FADN sample distinguishes groups based on farms' economic size and type of farming. Sampling farms from each group ensures that the sample includes farms from all groups and consequently with different characteristics.

Disproportional means that not all farms have the same chance of being included in the sample. Groups which are relatively homogeneous, i.e. having farms that show a high degree of similarity, will have a lower chance of being included in the sample. After all, if all the farms are very similar, a limited number of observations would be sufficient to draw reliable conclusions (in the extreme case that all farms are exactly identical, it would be enough to have only one observation). In case of less homogeneous groups it is important to have a larger number of observations to make reliable estimates. The choice of the stratification variables has therefore an important impact on the quality of the sample.

This way of sampling enables unbiased estimates to be made for the whole population of farms. Stratification assures that all groups are properly represented, thereby allowing separate estimations for all groups. All groups together make up the whole population. In the FADN this is achieved by assigning a weight to each sample farm. The weight is calculated by dividing the number of farms in a group in the population by the number of sample farms in the same group.

Stratification also improves the representativeness of the sample in case of non-response. If a farm which is asked to join the FADN system refuses, another farm in the same size class and of the same type of farming can be selected. If there is a difference between the selection plan and the actual implementation, stratification helps to improve the representativeness by taking into account the real sampling fraction.

Finally, stratification makes maintenance of the sample easier. Due to attrition and changes in the population it is sometimes necessary to supplement certain groups. Stratification makes a more focused replacement possible.

The relationship between the agricultural population and the FADN sample is presented in Figure 2.1. The agricultural census provides an almost complete description of the agricultural population. Part of this census or part of this population is defined as the field of observation in the FADN.

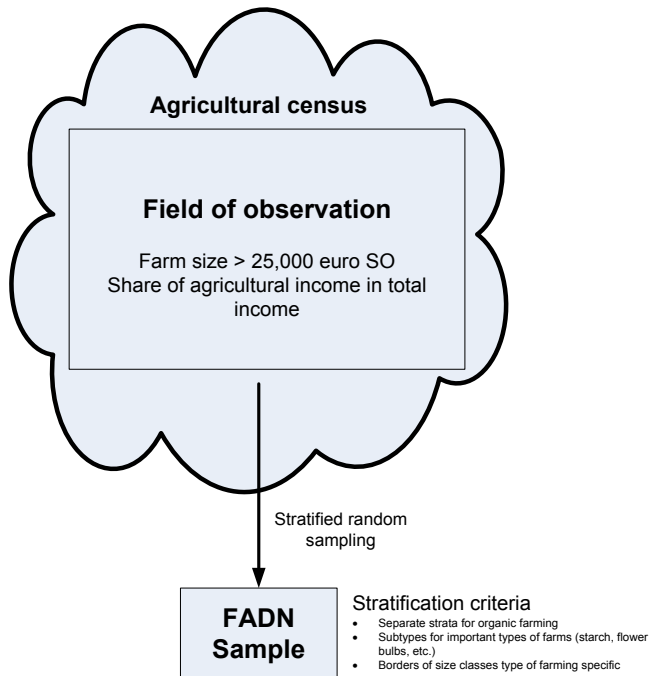


Figure 2.1 Agricultural population and the FADN sample

Source: Vrolijk et al. (2009).

Output measure

In 2010, the Standard Output measure was introduced in FADN as the basis for determining the farm economic size, replacing the previously used Standard Gross Margin (SGM) and accompanying European Size Unit (ESU). Standard Output refers to the standard value of gross production. The Standard Output of an agricultural product (crop or livestock), abbreviated as SO, is the average monetary value of the agricultural output at farmgate price, in euros per hectare or per head of livestock. There is a regional SO coefficient for each product, as the average value over a reference period (5 years). The Netherlands consists of one region. The sum of all the SO per hectare of crop and per head of livestock in a farm is a measure of its overall economic size, expressed in euros.

Lower threshold

A lower threshold of 25,000 euros of SO is applied. This threshold has been specified in the legislation underlying the FADN. The historical background was to distinguish small farms which were only held as a hobby or as side activity from real commercial farms producing for the market. Although the number of farms excluded from the field of survey is quite substantial, the percentage of production value which is not covered due to this threshold is very limited.

Other income sources

For practical and methodological reasons a limitation on 'other income of the holding' is used. Clear rules have been specified whether a firm belongs to the field of observation or not. A firm should have at least 25,000 euros of SO from primary agricultural activities, at least 25% of the turnover should come from primary agricultural activities and agricultural activities - in the broadest sense, so as to include other gainful activities - should be the largest share of turnover of the holding.

Stratification criteria

Given the abovementioned criteria, the field of observation of the FADN system is defined. Within this field of observation a stratification scheme is used. The stratification of the Dutch FADN is based on the economic size of the farm and type of farming. Although these criteria are similar to those used by the Commission, a more detailed look reveals substantial differences with the EU stratification. Differences are for example the use of separate strata for organic farming, and in several types of farming more detailed subtypes of farming are specified which are relevant for Dutch Agriculture (for example starch potato farms, flower bulb farms, horticultural farms by type of production).

The Dutch situation is somewhat more complicated compared to many other Member States due to the fact that the size classes vary across types of farming. The size distribution of, for example, horticultural farms is completely different from the size distribution of arable farms. For 2013 this is illustrated in Figure 2.2. This figure shows that 99% of all arable farms are smaller than 1,000,000 euros of SO, while almost 80% of the tomato firms are larger than 1,000,000 euros of SO (the dashed line marks the 1,000,000 euros of SO level). To take these differences into account the borders of the size classes have been established for each type of farming separately. Despite this complication the strata are still a cross section between types of farming and size classes. In total 122 strata have been defined.

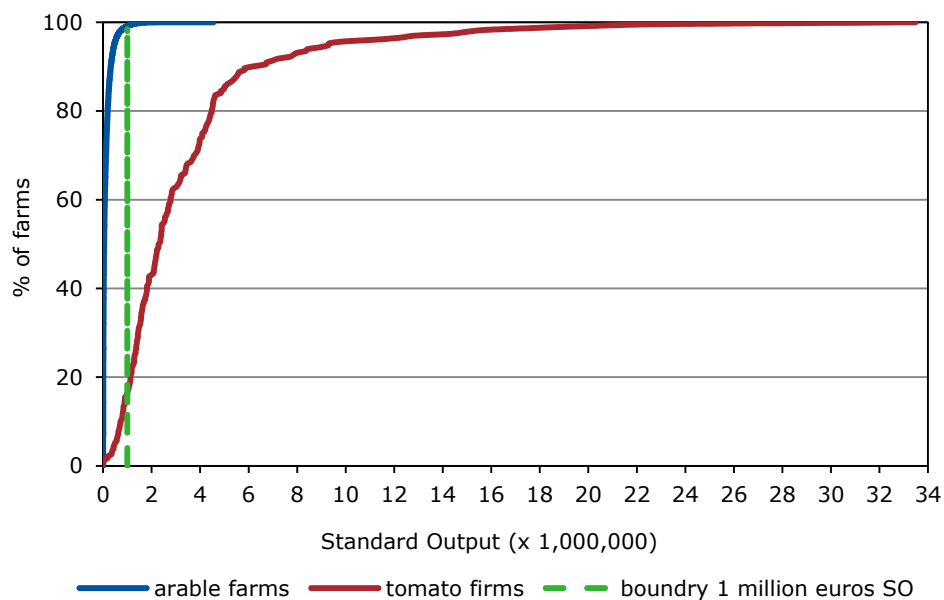


Figure 2.2 Distribution of arable farms and tomato firms in 2013

Source: Agricultural Census, Statistics Netherlands, calculations LEI Wageningen UR.

2.2 Sampling and recruitment processes

Figure 2.3 presents an overview of the sampling and recruitment processes. The agricultural census from Statistics Netherlands (CBS) is the starting point for the random sampling of farms. The random sampling takes place based on the selection plan as submitted to the European Commission. The selection plan will be further described in Chapter 4. Based on the selection plan, farms from the agricultural census are randomly drawn. This census (as available to researchers) does not contain addresses but only farm identifiers. The farm addresses from the selected farms are received from the ministry of Economic Affairs. Farm identifiers are coupled to their addresses and forwarded to the regional offices that are responsible for contacting farmers to request their participation. The farmers may refuse or accept the request to participate and the authorisations are collected and forwarded the central office in The Hague. These authorisations are used to receive electronically available

information from banks, suppliers, governmental institutions and others. The information on the acceptance and refusal of farmers is also used to verify the quality of the sample (see Chapter 6).

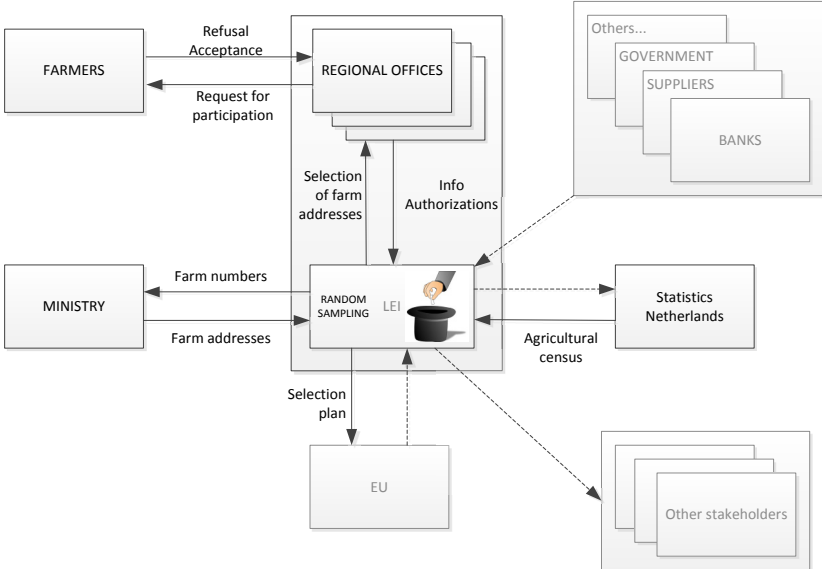


Figure 2.3 Sampling and recruitment processes
Source: Vrolijk et al. (2009).

3 Population

3.1 Introduction

This chapter describes the population or, more precisely, the field of observation as covered by the FADN sample. Section 3.2 reports the lower threshold and the consequences of its application. Section 3.3 describes the strata which are used to divide the population and reports the number of farms in each of the strata in the population.

3.2 Field of observation

Collecting detailed information at farm level requires considerable time and money. To assure an efficient and effective allocation of the available budget, the sample design focuses on certain groups in the population. Given the limited capacity it is important to apply a sampling procedure that optimises the reliability of the sample estimates (through stratification).

In 2013, a lower threshold of 25,000 euros of SO implied that 17,845 farms were not covered by the FADN sample. Although the number of these farms is large, they are only responsible for about 0.96% of the total production capacity expressed in SO. The 2013 population (field of observation) of the Dutch contribution to the EU FADN system is presented in Table 3.1.

Table 3.1

Number of farms and their relative economic importance (measured in Standard Output - SO) in the 2013 Agricultural Census

	Number of farms	Percentage of farms (%)	Percentage of SO (%)
All farms in the agricultural census (a)	67,481	100.00	100.00
Farms less than 25,000 euros of SO (b)	17,845	26.44	0.96
Total of covered farms (a) - (b)	49,636	73.56	99.04

Source: Agricultural Census, Statistics Netherlands and FADN, calculations by LEI Wageningen UR.

3.3 Stratification scheme in 2013

Farms are allocated to strata according to two stratification variables: 1) type of farming, 2) Size class. As shown in Table 3.2, in total 25 types of farming are distinguished. The number of size classes within a type of farming in 2013 ranges from 4 to 6.

The Dutch FADN typology differs in its degree of details from the European FADN (FADN, 2012): some farm types are not present in Dutch agriculture (e.g. olives, citrus fruits are not listed) and some types are further detailed (like vegetables within horticulture). For a number of types of farming a distinction is made between organic farming and non-organic farming. A compromise was found to fulfil the increasing demand for research on organic farms. Random selection of organic farms from the total population would result in a very low number of observations because of the low proportion of organic farms. The definition of separate farm types for organic farms would result in many practical problems. The number of strata would double. The problem of empty or nearly empty strata would increase seriously. In line with the existing stratification, a number of types of farming were selected where organic farming is especially relevant. The types that were originally selected were: dairy farms, field crop farms, field vegetables and combined crop farms (Vrolijk and Lodder, 2002).

The growth in the organic sector however was lower than expected and aimed for by policy makers. This resulted in practical problems in the recruitment of organic farms, for example due to the fact that the number of farms according to the selection plan was close to or even higher than the actual number of farms in the population. To deal with this problem a number of organic strata have been combined. 'Organic field crops farms', 'field vegetables' and 'combined crop farms' have been integrated in one farm type 'organic crop farms' (Vrolijk, 2006).

The breakdown in subtypes is as follows: 'field crop farms' have been itemised in 'starch potato farms', 'organic crops' and all 'other field crop farms'. The 'vegetables under glass' farms have been broken down in 'sweet pepper', 'cucumber', 'tomato' and 'other'. The dairy farms are split into organic and non-organic dairy farms. Within 'field vegetables' and the combined crop farms' the organic farms have been separated. These are subsequently combined with the organic field crop farms.

Table 3.2 presents the number of farms in the 2013 population according to size class and type of farming. The table shows that 49,636 (compared to 48,817 in 2012¹) farms fall within the field of observation. Dairy farms are clearly the largest group of farms. About one in every three farms is classified as a dairy farm.

Table 3.2

Stratification of the Dutch FADN sample 2013, including the number of farms per stratum according to the 2013 agricultural census

Lower boundary (k€ SO)	25	50	100	250	500	1,000	1,500	3,000	Total
Upper boundary (k€ SO)	50	100	250	500	1,000	1,500	3,000	infinity	
Type of farming									
<i>Field crop farms</i>									
- Starch potatoes	284		333	117		28			762
- Organic crops	85		89	67		26			267
- Other field crop farms	3,037		1,989	1,047		481			6,554
<i>Horticulture</i>									
Vegetables indoor	86		263		227	139	206	142	1,063
Plants	53		199		143	109	159	155	818
Cut flowers under glass	67		419		271	153	192	93	1,195
Field vegetables	260		394		121		80		855
Fruit	404		437	403		153			1,397
Tree nursery	685		1,066		264		197		2,212
Flower bulbs	94		259		123		119		595
Other horticulture	423		836		270		223		1,752
<i>Grazing livestock</i>									
<i>Dairy</i>									
- Organic	17		160	131		40			348
- Non-organic	724		5,121	8,463		2,191			16,499
Calf fattening	181		581		362		182		1,306
Other grazing livestock	3,133	1,704	707	274		100			5,918
<i>Intensive livestock</i>									
Breeding pigs	24		105	294	340		205		968
Fattening pigs	359		602	386	344		243		1,934
Integrated pig farms	4		49	135	282		273		743
Consumption eggs	36		237		222		198		693
Broilers	6		62		132		227		427
Other intensive livestock	34		184		225		163		606
Combined	799		663	658	455		149		2,724
Total									49,636

¹ From the accounting year 2013 on, new SO norms are implied, which means that especially for dairy farming, more farms are larger than the threshold of 25,000 SO.

4 Selection plan

4.1 Introduction

For the Dutch FADN, the allocation of the total capacity of sample farms is based on the relative importance and the heterogeneity of the different types of farming (see Dijk *et al.*, 1995a and Vrolijk and Lodder, 2002). To ensure that the FADN sample adequately reflects the heterogeneity of farms in the field of observation, the field of observation is stratified before the sample of farms is selected. The stratification is based on the type of farming and economic size classes described in the Commission's FADN methodology.² Stratification allows the field of observation to be represented as a matrix of cells, where each cell corresponds to a specific category of farms.

The EU selection plan guidelines³ specify the clustering rules, i.e. the aggregations of cells per type of farming when they contain very few or no farms in the field of observation. Following the guidelines, several adjacent economic size classes have been combined for an optimal stratification. Optimal allocation (distribution of sample capacity over the different strata based on heterogeneity) has been applied (Levy and Lemeshow, 1991).

4.2 Selection plan

The design principles of the sample of the FADN system facilitate an efficient alignment with the goals of the system (see Chapter 2). A summary of the 2013 selection plan is provided in Table 4.1. Given the goals of the FADN system the numbers provided in the table are the required number of observations per type of farming.

² http://ec.europa.eu/agriculture/rica/methodology2_en.cfm#ssffo

³ http://ec.europa.eu/agriculture/rica/annex004_en.cfm#clustering

Table 4.1

Desired sample size per type of farming (selection plan), 2013

Type of farming	Code	Number of farms		
		Main type	Type	Sub type
<i>Field crop farms</i>	1	210		
- Starch potatoes			30	
- Organic crops			30	
- Other field crop farms			150	
<i>Horticulture</i>		543		
Vegetables under glass	2111		130	
- Sweet pepper				32
- Cucumber				29
- Tomato				30
- Other				39
Cut flowers under glass	2121		118	
- Rose				
- Chrysanthemum				
- Other				118
Plants	2122		65	
Field vegetables	2210		50	
Fruit	3610		38	
Tree nursery	2320		60	
Flower bulbs	2221		37	
Other horticulture	2131, 2310, 2331, 3500, 3699		45	
<i>Grazing livestock</i>		433		
Dairy	4500		330	
- Non-organic				300
- Organic				30
Calf fattening	4611		40	
Other grazing livestock	4612, 4810, 4830, 4841, 4842, 4843		63	
<i>Intensive livestock</i>		224		
Breeding pigs	5111		48	
Fattening pigs	5121		48	
Integrated pig farms	5131		38	
Consumption eggs	5211		30	
Broilers	5221		30	
Other intensive livestock	5231, 5301		30	
<i>Combined</i>	6, 7, 8	90		
Total		1,500		

5 Recruitment of farms

5.1 Basic principles

In October 2012, an assessment was made of the farms available for the FADN system for 2013 (considering farms dropping out of the system). The recruitment of new farms for the year 2013 took place from October 2012 to February 2013.

5.2 Elaboration of selection plan

Table 5.1 gives a more detailed description of the 2013 selection plan as presented in Table 4.1.

Table 5.1

Detailed selection plan 2013 per stratum.

Lower boundary (K€ SO)	25	50	100	250	500	750	1,000	1,500	3,000	Total
Upper boundary (K€ SO)	50	100	250	500	750	1,000	1,500	3,000	infinity	
Type of farming										
<i>Field crop farms</i>										
- Starch potatoes	7		11	7			5			30
- Organic crops	5		12	10			3			30
- Other field crops	32		36	51			31			150
<i>Horticulture</i>										
Vegetables indoor	4		36		33		18	22	17	130
Plants indoor	4		14		12		8	15	12	65
Flower indoor	3		32		35		16	23	9	118
Vegetables in the open air	5		31		8			6		50
Specialised fruits	3		10	13			12			38
Specialised nurseries	5		25		14			16		60
Bulbs	6		11		8			12		37
Other horticulture	5		15		8			17		45
<i>Grazing livestock</i>										
<i>Dairy</i>										
- Organic	1		16	10			3			30
- Non-organic	14		103	127			56			300
Calf fattening	7		12		11			10		40
Other grazing livestock	14	12	18	10			9			63
<i>Intensive livestock</i>										
Specialised pig rearing	3		5	16	13			11		48
Specialised pig fattening	2		12	10	10			14		48
Pig rearing and fattening combined	1		5	9	12			11		38
Consumption eggs	3		11		7			9		30
Broilers	1		5		8			16		30
Other intensive livestock	1		10		13			6		30
Combined	6		13	20	22			29		90
Total										1,500

5.3 Recruitment of farms

Based on the available number of farms in the FADN sample and the expected number of farms ending their participation before or during the period of data collection an estimate was made of the number of farms to be recruited. Furthermore, the variant of bookkeeping has been explicitly considered. Poppe (2004) describes that the introduction of a new bookkeeping system and budget cuts resulted in a large pressure on available capacity. To deal with this pressure, a flexible data collection system has been introduced with two main variants in the data collection: the EU variant and the Corporate Social Performance (CSP) variant. In the EU farm-income variant the most essential financial economic information is collected. This is the information that each member state is obliged to provide to Brussels. The information covered in this variant mainly focuses on family farm income, the balance sheet, a limited number of technical data (cropping pattern, livestock) and information on the EU subsidies. In the second variant, the CSP variant, a wide range of data is collected for EU and national purposes. It covers all the topics that are nowadays considered relevant in a report on the sustainability of a company or a farm. Therefore, besides the financial economic information as collected in the EU variant, a wide range of data is collected such as environmental data, other farm incomes, off-farm income, animal welfare, animal health and the level of innovation of firms.

An evaluation has been made of the policy and research relevance of sectors and based on this importance a decision has been made whether a type of farming is assigned to the EU variant, the CSP variant or a combination of both.

Based on the number of farms to be recruited in the CSP variant, the 2013 farms were randomly selected from the 2012 agricultural census. The random draw of farms took place per stratum. The number of farms drawn per stratum was 10 times higher than the required number of farms to ensure enough addresses, even with a high non-response rate in specific types of farming. Using these addresses farms were contacted and asked to participate in the FADN.

For the accounting year 2013, 120 new farms were recruited. The average response rate is 21%. No enquiry was made of the reason for non-response. As shown in Table 5.2, 115 farms (17% of farms drawn) were considered unsuitable for various reasons. The response rates vary significantly per farm types, ranging from zero response from the pot plants farms to 47% from dairy farms.

Table 5.2

Response rate in different types of farming, recruitment for CSP variant, 2013

Farming types a)	Number of refusals	Recruited farms	Unsuitable farms	Total farms	Unsuitable %	Response %
<i>Field crop farms</i>						
- Starch potatoes	13	2	5	20	25	13
- Organic crops	5	2	0	7	0	29
- Other field crop farms	78	14	9	101	9	15
<i>Horticulture</i>						
<i>Vegetables under glass</i>						
- Tomato	14	2	8	24	33	13
- Cucumber	3	1	0	4	0	25
- Sweet pepper	14	5	2	21	10	26
- Other	8	3	7	18	39	27
Cut flowers under glass	34	15	18	67	27	31
Plants	15	0	4	19	21	0
Fruit	11	1	3	15	20	8
Tree nursery	45	9	15	69	22	17
Flower bulbs	18	2	11	31	35	10
Field crops	62	5	18	85	21	7
<i>Grazing livestock</i>						
Dairy	10	9	0	19	0	47
Calf fattening	45	16	4	65	6	26
Other grazing livestock	29	21	4	54	7	42
<i>Intensive livestock</i>						
Fattening pigs	9	2	2	13	15	18
Integrated pig farms	19	4	3	26	12	17
Consumption eggs	8	4	1	13	8	33
Broilers	7	3	1	11	9	30
Total	447	120	115	682	17	21

a) Only farming types with recruiting activities are displayed

Table 5.3 describes the number of farms where accounts were completed for the first time for the bookkeeping year 2013. Due to several factors this is not exactly the same as the number of newly recruited farms. First, farms can drop out during the first year of participation or even right after recruitment. On second thought farms who were recruited, withdraw their participation. Or the quality of their bookkeeping is too poor to process. Second, this table includes the farms in the EU variant as well. And third, the farm type and size can be different in the year of bookkeeping compared to the year of selection.

Table 5.3

Number of farms with 2013 as first year of completion of bookkeeping, recruited for EU or CSP variant

Lower boundary (k€ SO)	25	50	100	250	500	1,000	1,500	3,000	Total
Upper boundary (k€ SO)	50	100	250	500	1,000	1,500	3,000	infinity	
Type of farming									
<i>Field crop farms</i>									
- Starch potatoes	0		1	0		1			2
- Organic crops	0		1	1		1			3
- Other field crop farms	3		3	4		5			15
<i>Horticulture</i>									
Vegetables under glass									
- Sweet pepper	0		0	0	0	4	0		4
- Tomato	0		0	0	0	0	1		1
- Other vegetables under glass	0		1	0	0	0	0		1
Cut flowers under glass	0		0	2	3	3	1		9
Plants ⁴	0		0	0	1	0	2		3
Field vegetables	1		2	2		0			5
Fruit	0	0	0		1				1
Tree nursery	1		1	3		2			7
Flower bulbs	0		2	1		2			5
Other horticulture	1		0	0		2			3
<i>Grazing livestock</i>									
Dairy, non-organic	0		0	3		6			9
Calf fattening	1		3	3		1			8
Goats	0	2	2	5		3			12
Other grazing livestock	0	0	0	3		0			3
<i>Intensive livestock</i>									
Breeding pigs	0		0	0	0	2			2
Fattening pigs	0		1	0	1	0			2
Integrated pig farms	0		0	0	1	1			2
Consumption eggs	3		0	1		0			4
Broilers	0		0	0		1			1
Other intensive livestock	0		1	2		3			6
Combined	0		0	4	3	3			10
Total									118

a) Only farming types with farms with first year of completion of bookkeeping are displayed.

A comparison of the field of observation (population) and the sample available for research purposes in 2013 is presented in Table 5.4. In 2013 the total number of farms which are available for research providing standard list of variables is 1,531. More detailed data available for research can be drawn from a sample of 1,249 farms (CSP variant).

⁴ These farms had been recruited from the previous year.

Table 5.4

Number of farms in the population and sample according to the EU and CSP variant, 2013

Type of farming	Code	Number of farms		
		Population	Total sample (EU+CSP)	CSP
<i>Field crop farms</i>	<i>1</i>			
- Starch potatoes		762	26	26
- Organic crops		267	28	27
- Other field crop farms		6,554	151	149
<i>Horticulture</i>	<i>2+3</i>			
Vegetables under glass	2111			
- Sweet pepper		202	28	28
- Cucumber		171	29	29
- Tomato		229	25	25
- Other vegetables under glass		461	39	39
Cut flowers under glass	2121	1,195	99	97
Plants	2122	818	62	60
Field vegetables	2210	855	43	29
Fruit	3610	1,397	46	37
Tree nursery	2320	2,212	56	30
Bulbs	2221	595	44	36
Other horticulture		1,752	67	27
<i>Grazing livestock</i>	<i>4</i>			
Dairy	4500			
- Organic		348	34	34
- Non-organic		16,499	309	257
Calf fattening	4611	1,306	52	37
Other grazing livestock	4843	5,918	71	51
<i>Intensive livestock</i>	<i>5</i>			
Breeding pigs	5111	968	52	51
Fattening pigs	5121	1,934	50	46
Integrated pig farms	5131	743	34	30
Consumption eggs	5211	693	36	34
Broilers	5022	427	32	32
Other intensive livestock	<i>other 5</i>	606	28	2
<i>Combined</i>	<i>6-8</i>	2,724	90	36
Total		49,636	1,531	1,249

5.4 Supply of farm results to the European Commission

The final delivery of 2013 data to the EU has taken place in December 2014. Data of 1,516 farms of the bookkeeping year 2013 have been provided to and accepted by Brussels (Table 5.5). The target number of 1,500 farms has been reached.

Table 5.5*Number of farms provided to the European Commission*

Bookkeeping year	Provided to the European Commission
2001	1,330
2002	1,358
2003	1,435
2004	1,418
2005	1,458
2006	1,506
2007	1,511
2008	1,501
2009	1,565
2010	1,501
2011	1,478
2012	1,521
2013	1,516

6 Evaluation of the sample

6.1 Introduction

In this chapter the FADN sample for the year 2013 is evaluated both qualitatively and quantitatively. Section 6.2 provides an evaluation of the methodology of stratification and weighting. A crucial element is the calculation of weights. Section 6.3 provides the quantitative evaluation. This section focuses on the quality of the estimations based on the sample. This chapter is based on the standard approach of making estimations based on weights assigned to farms.

6.2 Evaluation of stratification and weighting

6.2.1 Introduction

This section deals with some practical problems related to the estimation process. Weights of individual farms are used to make estimations of frequencies, totals and averages of groups of farms (aggregated results) based on the data from the agricultural census and the FADN data.

The method to calculate the weights of individual farms is crucial. The goal is to achieve unbiased estimates with a minimal variance. This enables the estimation of the confidence interval of the real population value and the minimisation of the total error. This is true for direct estimators. In the case of a ratio estimator this is not necessarily true, but ratio estimators are outside the scope of this publication (see Vrolijk *et al.*, 2002, for a more extensive description of ratio estimators and other estimators).

6.2.2 Method of calculation of weights

The objective of the Dutch FADN system is to give a representative view of the total population. The question is therefore how to draw conclusions on totals, averages and frequencies that are valid for the whole population based on individual farm data. For example, how much is the average family farm income of all farms in agriculture and horticulture? The practical solution is found in weighting: the individual farm data are raised to the population level (for some variables the estimated values can be compared to the data that are available for the whole population, i.e. data which are included in the yearly agricultural census). A weight is assigned to every observed farm in the FADN system. The weight is defined as the ratio between the number of farms in a stratum according to the agricultural census and the number of farms in the sample (in the FADN system). The population in a specific stratum is continuously changing. Therefore the sample and population farms that belong to a stratum in year 2013 are not exactly the same as the farms that belong to that stratum in year 2012. The stratification and post stratification of the farms in 2013 is based on the 2013 agricultural census. Due to these changes farms included in one stratum could have had different inclusion probabilities at the time of recruitment. In theory, to achieve unbiased estimators these differences in inclusion probabilities should be taken into account in the estimation process. However, the consequence of this would be a very complicated system with many different substrata with different inclusion probabilities. Therefore this complicated procedure is not applied. As a result, the theoretical assumption of a strictly random sample cannot be validated.

Although the calculation method applied in practice can lead to systematic distortions between estimated values and true values, the assumption of a random sample is made. This leads to several practical advantages. The method to calculate weights is relatively easy, involving a limited set of homogeneous strata and resulting in a more effective use of data. A detailed discussion on the

calculation of different weights and the resulted population estimates can be found in Appendix 1 of the 2012 report.

Because of the applied sampling procedure (see Section 2.1) the different strata have different sampling fractions. Strata with relatively homogeneous units have a lower sampling fraction than very heterogeneous strata. This also implies that farms have very diverging weights. Farms from a homogeneous cluster will have a larger weight (in principle the reciprocal of the sampling fraction) and therefore represent a larger number of farms. The differences in sampling fractions are shown in Table 6.1. These percentages are calculated by dividing the required number of farms in the selection plan (Table 5.1) by the number of population units (Table 3.2).

Table 6.1
Sampling fractions in different strata (2013 sample)

Lower boundary (K€ SO)	25	50	100	250	500	750	1,000	1,500	3,000	Total
Upper boundary (K€ SO)	50	100	250	500	750	1,000	1,500	3,000	infinity	
Type of farming										
<i>Field crop farms</i>										
- Starch potatoes	0.02	0.03	0.06				0.18			0.04
- Organic crops	0.06	0.13	0.15				0.12			0.11
- Other field crop farms	0.01	0.02	0.05				0.06			0.02
<i>Horticulture</i>										
Vegetables indoor	0.05	0.14		0.15		0.13	0.11	0.12		0.12
Plants indoor	0.08	0.07		0.08		0.07	0.09	0.08		0.08
Flower indoor	0.04	0.08		0.13		0.10	0.12	0.10		0.10
Vegetables in the open air	0.02	0.08		0.07			0.08			0.06
Specialised fruits	0.01	0.02	0.03				0.08			0.03
Specialised nurseries	0.01	0.02		0.05			0.08			0.03
Bulbs	0.06	0.04		0.07			0.10			0.06
Other horticulture	0.01	0.02		0.03			0.08			0.03
<i>Grazing livestock</i>										
<i>Dairy</i>										
- Organic	0.06	0.10	0.08				0.08			0.09
- Non-organic	0.02	0.02	0.02				0.03			0.02
Calf fattening	0.04	0.02		0.03			0.05			0.03
Other grazing livestock	0.004	0.01	0.03	0.04			0.09			0.01
<i>Intensive livestock</i>										
Specialised pig rearing	0.13	0.05	0.05	0.04			0.05			0.05
Specialised pig fattening	0.01	0.02	0.03	0.03			0.06			0.02
Pig rearing and fattening combined	0.25	0.10	0.07	0.04			0.04			0.05
Consumption eggs	0.08	0.05		0.03			0.05			0.04
Broilers	0.17	0.08		0.06			0.07			0.07
Other intensive livestock	0.03	0.05		0.06			0.04			0.05
Combined	0.01	0.02	0.03	0.05			0.19			0.03
Total										

6.2.3 Remarks on the weights

In the report on farm results for 2013 the research population is defined as all farms in the 2013 agricultural census (above the lower threshold). The weight per farm is calculated as the ratio between the number of farms in the census and the number of farms in the sample.

In the calculation of aggregate results (averages, frequencies and totals) for the year 2013, the 2013 agricultural census is the starting point. Because of the registration of farms in the population (almost all farms are registered in the agricultural census) the aggregate numbers of farms are exactly the same as the numbers of farms in the census. However, in using these numbers in the calculation of weights for estimations for 2013 two remarks should be made.

Every year all horticultural and agricultural farms are registered in the agricultural census, but this registration only represents the situation at a certain moment during the year. Therefore it is possible that farms are missing from this registration, although the statistical office tries to correct for that. Furthermore, the number of farms tends to decrease significantly (this trend is stronger for certain types of farms and less strong for others). As a consequence estimations might be overestimations of reality. Distortions in the number of farms in the census can therefore cause incorrect estimations of aggregates.

The typology of farms according to the agricultural census might differ from the typology according to the FADN data. The census reflects the situation at a certain point in time, while the FADN system describes the farm during a whole year. In order to take these differences into account two weighting methodologies are available in the Dutch FADN system. From a theoretical point of view weighting based on the characteristics of the farm in the census is more appropriate. The census is used as the sampling frame; the weights should reflect information from this sampling process. If there are substantial differences, then the variables type and size of farming in the agricultural census are different from the variables size and type of farming in the FADN. In a weighting procedure based on the population numbers in the census and the characteristics in the FADN these variables are considered to be the same.

6.3 Quantitative evaluation of the 2013 sample

6.3.1 Introduction

This section focuses on the quality of the estimations based on the 2013 FADN sample. Figure 6.1 shows the same structure as displayed in Figure 2.1, but it adds the quality aspects: coverage, response rate, representativeness and reliability of estimates. The response rate and the accompanying non-response, has already been described in the previous chapter. Section 6.3.2 provides information on the coverage of the sample; the coverage compares the total population as described by the census and the field of observation of the FADN sample. Section 6.3.3 analyses the extent to which distortions might occur between the sample and the population due to over or under representation of farms with specific characteristics; it compares the characteristics of the field of observation and the actual FADN sample. Section 6.3.3 provides information on the reliability of estimates based on the FADN sample.

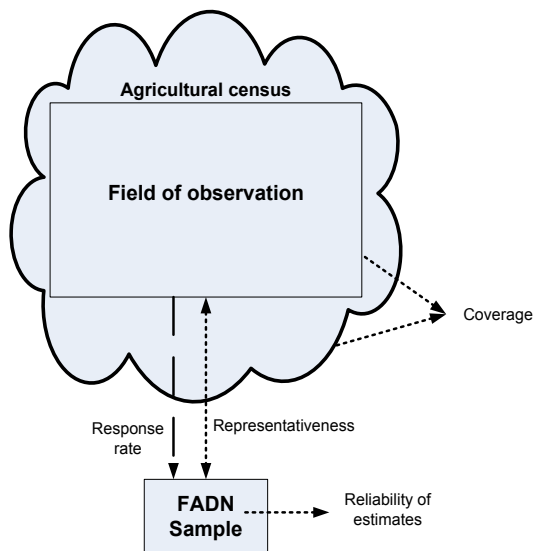


Figure 6.1 Quality aspects of the Dutch FADN
Source: Vrolijk et al. (2009).

6.3.2 Coverage

It is desirable to have a sample that represents the population as accurate as possible. A clear distinction should be made between the coverage and the representativeness. This section describes the coverage, Section 6.3.3 deals with the representativeness. To get an idea about the extent to which the total population is covered by the sample it is relevant to distinguish several aspects (Figure 6.2). Farms that are too small or are not registered in time are not part of the agricultural census (b). The sampling frame (c) is the basis for the choice of sample farms and consists of farms registered in the agricultural census that fulfil the size criteria: larger than 25,000 euros of SO. From this sampling frame the sample is drawn (d).

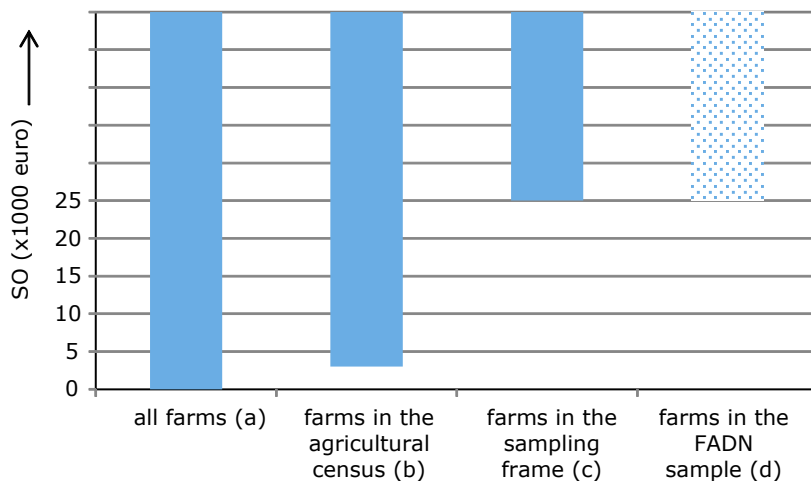


Figure 6.2 Relationship between all farms and FADN sample concerning lower threshold

Figure 6.2 gives an indication to what extent the FADN sample in 2013 covers the whole population. Table 6.2 presents some characteristics for the total sample for example: area of crops, number of animals and labour. A comparison is made between the farms in the sampling frame (all the farms that have a chance of being included in the FADN sample) (c) and the total population as described by the agricultural census (b). Direct comparison with all farms (a) would be better but the unregistered

farms are unknown, and the practical difference is very limited. The sampling frame covers the population to a large extent. For example with respect to size (calculated in euros of SO), the coverage is 99% (Table 3.1). The upper threshold, which used to exclude large horticulture firms from the sampling frame, has been abolished from 2010 on. However, the sample farms do not yet include many farms above the former upper threshold, although in recent years the recruitment of farms focuses on these very large firms. This implies that the average size of the farms in the sample may be smaller than the average size in the population (compare Table 6.4).

Table 6.2
Coverage of the sample compared to agricultural census, 2013

Selected characteristics of the sample a)	Number according to census	Covered by sampling frame \geq 25,000 euros of SO (%)
Farms	67,481	73.6
Standard output (million euro)	21,226	99.0
Total labour (AWU)	160,387	91.1
Family labour (AWU)	92,160	87.1
Paid labour (AWU)	68,228	96.6
Area (hectare)		
Agricultural area	1,847,612	94.5
Grassland	773,094	92.3
Green maize	229,739	91.9
Arable	979,655	95.8
Winter wheat	124,771	96.9
Sugar beet	73,194	98.3
Starch potatoes	44,031	99.4
Seed potatoes	40,223	99.9
Ware potatoes	71,568	99.1
Seed onion	21,984	99.8
Horticulture in the open air	85,046	99.6
Headed cabbage	2,755	99.5
Leek	2,682	99.8
Brussels sprouts	2,708	100.0
Asparagus	3,123	99.1
Cauliflower	2,108	99.6
Apple	7,906	99.5
Pear	8,509	99.5
Park trees	6,156	99.4
Hedges	2,596	99.5
Tulip bulbs	11,350	99.9
Horticulture under glass	9,818	100.0
Cucumber	615	100.0
Sweet pepper	1,244	100.0
Tomatoes	1,768	100.0
Chrysanthemum	479	100.0
Roses	384	100.0
Pot plant flower	868	100.0
Pot plant green	436	100.0
Number		
Dairy cows	1,552,919	100.0
Fattening calves	925,444	99.9
Breeding pigs	1,184,454	100.0
Fattening pigs	5,754,052	100.0
Broilers	44,242,044	100.0
Laying hens	44,815,842	100.0

a) Main crops and livestock are listed and not farming types

Source: Agricultural Census, Statistics Netherlands, processed by LEI Wageningen UR.

In policy analysis and research it is essential to distinguish between farming types (for example specialised pig fattening farms) and agricultural activities (pig fattening). In the report on the redesign of the FADN sample it was illustrated that types of farming should not be the only focus of research (Vrolijk and Lodder, 2002). Agricultural activities are important in many research projects.

To give a complete picture of a certain agricultural activity it is important to look at the activities on all farm types. For example, not only pig fattening farms will create added value from pig fattening, also other types of farms can be involved in this activity (although it is not their main business). Table 6.3 describes to which extent a certain activity can be found on certain types of farming in 2013. For example, 80.7% of the cattle activities can be found on the dairy farms and 14.7% on the farms that belong to 'other farms' category and 3.5% on combined farms. The intensive livestock sector pigs and poultry are highly specialised. Almost 90% of the activities can be found on the specialised farms. The activity 'vegetables in the open air' is more diverse. On the specialised farms 64.9% of the vegetables in the open air (in SO) can be found. The combined and other farms also have a large share of the production of vegetables in the open air.

Table 6.3

Relationship between types of farming and agricultural activities - share of SO 2013

Animals or crops	Cattle	Pigs	Poultry	Arable crops	Vegetables open air	Fruit	Tree Nursery	Flower bulbs	Vegetables glass	Ornamental plants
Type of farming										
Dairy	80.7	1.3	0.2	17.7	0.9	0.5	0.5	0.8	0.0	0.0
Pig	0.4	89.9	0.4	2.9	2.5	0.3	1.0	1.4	0.0	0.0
Poultry	0.3	0.3	91.4	1.5	0.5	0.4	0.2	0.1	0.0	0.0
Arable	0.1	0.1	0.1	60.3	2.3	0.7	0.1	1.2	0.0	0.0
Vegetables open air	0.1	0.0	0.0	0.7	64.9	1.2	0.2	0.1	0.6	0.0
Fruit	0.0	0.0	0.0	0.2	0.2	85.4	0.1	0.0	0.0	0.0
Tree nursery	0.1	0.1	0.0	0.4	0.6	0.4	89.4	0.6	0.0	0.1
Flower bulbs	0.0	0.0	0.0	0.7	0.7	0.2	0.0	69.5	0.0	0.1
Vegetables under glass	0.0	0.0	0.0	0.0	1.5	0.4	0.1	0.0	87.8	0.0
Ornamental plants a)	0.0	0.0	0.0	0.0	0.1	0.3	0.3	4.8	0.3	93.6
Combined	3.5	6.8	5.6	10.8	15.9	7.9	5.2	9.1	0.2	0.0
Other	14.7	1.4	2.2	4.7	9.9	2.3	2.9	12.4	11.2	6.2
Total agriculture	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

a) Consists of cut flowers under glass and pot plants

Source: Agricultural Census, Statistics Netherlands, calculations by LEI Wageningen UR.

6.3.3 Representativeness

Because of the stratification scheme, the sample will provide a good representation of the population on the main characteristics (stratification variables) at the beginning of a year. During the year farms might drop out of the sample and changes might occur in the population. Despite these changes the representativeness is maintained by applying post-stratification on the resulting sample and the changed population. Representativeness with respect to the stratification variables does not necessarily imply that the sample is representative for all variables. Such full representativeness is impossible unless the sample size approximates the whole population or all variables highly correlate with the stratification variables.

Table 6.4 shows to what extent the sample is representative for a number of variables in the agricultural census. These variables concern the sizes of different agricultural activities per farm measured in SO or physical units. The averages per farm of these variables calculated from the census are compared with the averages estimated from the FADN using the post-stratification weights. If the absolute difference between the calculated population average and the estimated average is greater than twice the standard error of the estimates, the difference is considered statistically significant and indicated by an asterisk next to the specific variable. When this occurs, i.e., the estimates significantly

differ from the population average, it is considered less likely that the difference can be explained by sampling errors alone with regard to these variables. Attention should then be paid to the assessment and control of non-sampling errors such as non-response bias and data-handling errors.

As shown in Table 6.4, the sample can be considered representative for most variables measured in SO except for arable crops and dairy (FADN larger than census). For arable crops, however, the absolute difference is rather small. The differences are nevertheless significant due to the small standard error of the estimate. This suggests the possibility of non-sampling error. Consider the relatively low responses in certain farm types and strata, the possibility and extent of non-response bias should be assessed using recruitment records.

Table 6.4 gives a description for the whole population. In case of research projects on specific types of farming, similar tables could be generated for only farms of that type of farming.

A comparison between the sample and the population as registered in the agricultural census does not fully answer the question whether estimations of financial, economic and technical characteristics are bias free. Quality of farm management for example is not recorded in the data and thus cannot be statistically tested. Thus it is possible that farms with relatively good or bad management skills and therefore performance are over represented in the sample.

Table 6.4

Comparison of farms in the agricultural census and farms in the Dutch FADN.

Variable	Average size per farm 2013		Significant (5%)
	Census (Farms with SO ≥ 25,000 Euros)	FADN	
Size (Standard Output)			
Total	423,541	441,550	*
Arable crops	45,121	48,833	*
Grassland	15,962	15,606	
Horticulture open air	49,061	52,239	
Horticulture under glass	101,676	96,650	
Dairy	90,061	97,033	*
Veal	13,955	14,823	
Fattening pigs	28,507	30,718	
Breeding pigs	22,047	21,390	
Broilers	11,676	11,387	
Laying hens	12,752	12,568	
Size (ha)			
Total	35.19	37.18	*
Arable crops	18.91	20.92	*
Cereals	4.02	4.67	*
Tuberous and root crops	4.58	5.15	*
Permanent grassland	13.41	13.11	
Horticulture open air	1.71	1.92	*
Pome and stone fruit	0.34	0.36	
Tree nursery	0.31	0.30	
Flower bulbs	0.47	0.64	*
Vegetables open air	0.46	0.52	
Horticulture under glass	0.20	0.19	
Vegetables under glass	0.10	0.09	
Tomatoes	0.04	0.03	*
Cucumber	0.01	0.01	
Sweet pepper	0.03	0.03	*
Cutflowers	0.05	0.04	
Roses	0.01	0.01	
Chrysanthemum	0.01	0.02	*
Pot plants	0.04	0.04	
Labour (AWU)			
Male	1.78	1.74	
Paid labour	1.33	1.15	*

Source: Agricultural Census, Statistics Netherlands and FADN, calculations by LEI Wageningen UR.

6.3.4 Reliability

The previous subsection provides some indicators whether there are systematic differences between the sample and the population (representativeness of sample). This section focuses on the reliability of the estimates.

The calculation of averages of groups based on sampling units implies that there can be differences between the estimated value and the true population value. These differences may occur due to the random selection of units to be included in the sample. Table 6.5 provides an indication of the level of precision of the estimates for a set of important goal variables in the 2013 sample.

This section provides the reliability of estimates for a number of important goal variables for different types of farming. This calculation is based on the available CSP observations (see Section 5.3). Table 6.5 and Table 6.6 present the standard errors of estimated goal variables as well as their relative standard error (coefficient of variation). The coefficient of variation is defined as the standard error divided by the group average. A higher coefficient of variation implies less reliable estimates, but the value is strongly affected by the absolute value of the average. If the average value approaches zero, the coefficient of variation can become very large. If the average value is negative, the coefficient of variation is negative as well. This is the case with for example savings.

The precision of estimates is determined by the standard error of the estimate of a variable. The standard error is used to calculate the confidence interval. This confidence interval describes the range in which the true population value will be given a certain level of certainty. The 95% confidence interval (with a critical t-value of 1.96) ranges from the calculated average minus 1.96 times the standard error to the calculated average plus 1.96 times the standard error. For example, the standard error 12,220 for starch potatoes farms signals that average farm income on such farms can vary within the confidence interval 97,500 +/- 1.96*12,220, i.e. (€73,549 - €121,451).

Table 6.5

Standard error of estimates and coefficient of variation (in italics) of important goal variables per type of farming (Based on CSP variant, 2013)

Type of farming	Goal variable					
	Farm income, €	Total revenues, €	Return, a)	Savings, €	Total income, €	Net farm result, €
<i>Field crop farms</i>						
- Starch potatoes	12,220	75,228	3.2	12,580	15,727	9,599
	<i>0.13</i>	<i>0.17</i>	<i>0.03</i>	<i>0.22</i>	<i>0.13</i>	<i>0.24</i>
- Organic crops	10,136	59,545	2.8	16,814	14,245	11,884
	<i>0.09</i>	<i>0.13</i>	<i>0.03</i>	<i>0.24</i>	<i>0.12</i>	<i>0.25</i>
- Other field crop farms	6,015	14,742	2.5	15,893	7,304	5,072
	<i>0.09</i>	<i>0.05</i>	<i>0.03</i>	<i>1.52</i>	<i>0.09</i>	<i>1.86</i>
<i>Horticulture</i>						
<i>Vegetables under glass</i>						
- Sweet pepper	56,239	92,542	1.9	52,559	56,839	50,035
	<i>0.09</i>	<i>0.02</i>	<i>0.02</i>	<i>0.10</i>	<i>0.09</i>	<i>0.07</i>
- Cucumber	37,545	80,344	1.6	34,504	37,588	32,976
	<i>0.24</i>	<i>0.04</i>	<i>0.02</i>	<i>0.55</i>	<i>0.24</i>	<i>0.36</i>
- Tomato	91,166	1,047,336	1.8	76,064	92,001	79,960
	<i>-0.45</i>	<i>0.25</i>	<i>0.02</i>	<i>-0.23</i>	<i>-0.48</i>	<i>-0.45</i>
- Other	28,611	54,116	3.0	21,583	28,403	26,080
	<i>0.27</i>	<i>0.07</i>	<i>0.03</i>	<i>-0.98</i>	<i>0.25</i>	<i>0.79</i>
Cut flowers under glass	20,194	66,768	2.0	17,305	20,295	17,363
	<i>0.24</i>	<i>0.05</i>	<i>0.02</i>	<i>1.89</i>	<i>0.23</i>	<i>0.95</i>
Plants	34,553	242,104	2.2	28,849	34,223	31,394
	<i>0.24</i>	<i>0.12</i>	<i>0.02</i>	<i>0.72</i>	<i>0.23</i>	<i>0.63</i>
Field vegetables	13,358	47,149	4.6	10,066	12,479	12,273
	<i>0.45</i>	<i>0.09</i>	<i>0.05</i>	<i>-0.49</i>	<i>0.35</i>	<i>-0.28</i>
Fruit	17,212	43,453	5.2	15,809	18,993	15,750
	<i>0.32</i>	<i>0.12</i>	<i>0.06</i>	<i>-13.21</i>	<i>0.34</i>	<i>-0.95</i>
Nurseries	13,715	44,966	3.9	12,820	13,528	12,448
	<i>0.25</i>	<i>0.13</i>	<i>0.05</i>	<i>-0.93</i>	<i>0.24</i>	<i>-0.24</i>
Flower bulbs	23,733	153,226	3.1	19,879	24,128	22,965
	<i>0.16</i>	<i>0.12</i>	<i>0.03</i>	<i>0.29</i>	<i>0.15</i>	<i>0.39</i>
Other horticulture	28,284	348,195	4.6	34,813	31,746	24,579
	<i>0.33</i>	<i>0.32</i>	<i>0.05</i>	<i>5.17</i>	<i>0.34</i>	<i>-1.50</i>
<i>Grazing livestock</i>						
<i>Dairy</i>						
- Organic	6,727	14,754	2.0	6,620	6,104	6,830
	<i>0.20</i>	<i>0.05</i>	<i>0.02</i>	<i>-1.43</i>	<i>0.13</i>	<i>-0.15</i>
- Non-organic	3,893	8,004	0.8	4,023	4,044	3,514
	<i>0.06</i>	<i>0.02</i>	<i>0.01</i>	<i>0.15</i>	<i>0.05</i>	<i>-0.26</i>
Calf fattening	11,855	42,269	2.7	13,147	12,631	10,058
	<i>0.46</i>	<i>0.14</i>	<i>0.03</i>	<i>-2.27</i>	<i>0.31</i>	<i>-0.27</i>
Goats	15,419	36,942	3.3	24,415	15,664	15,698
	<i>0.13</i>	<i>0.07</i>	<i>0.03</i>	<i>0.38</i>	<i>0.12</i>	<i>0.85</i>
Other grazing livestock	30,299	57,014	6.3	35,419	30,122	15,975
	<i>-3.10</i>	<i>0.36</i>	<i>0.10</i>	<i>-1.06</i>	<i>1.70</i>	<i>-0.29</i>
<i>Intensive livestock</i>						
Breeding pigs	18,754	51,059	2.3	15,800	18,248	11,844
	<i>0.33</i>	<i>0.06</i>	<i>0.02</i>	<i>1.01</i>	<i>0.27</i>	<i>12.56</i>
Fattening pigs	6,103	29,716	2.7	21,978	15,244	4,106
	<i>0.18</i>	<i>0.05</i>	<i>0.03</i>	<i>2.81</i>	<i>0.24</i>	<i>-0.55</i>
Integrated pig farms	15,477	108,405	1.1	18,617	15,769	16,389
	<i>0.21</i>	<i>0.08</i>	<i>0.01</i>	<i>0.92</i>	<i>0.19</i>	<i>2.27</i>
Consumption eggs	19,630	62,259	3.1	20,203	19,943	19,490
	<i>-0.38</i>	<i>0.08</i>	<i>0.04</i>	<i>-0.24</i>	<i>-0.50</i>	<i>-0.16</i>
Broilers	8,861	126,431	1.0	10,128	8,956	9,397
	<i>0.21</i>	<i>0.09</i>	<i>0.01</i>	<i>-9.80</i>	<i>0.17</i>	<i>-0.76</i>
Other intensive livestock	*	*	*	*	*	*
	*	*	*	*	*	*
Combined	14,582	42,991	4.0	14,576	14,874	13,977
	<i>0.29</i>	<i>0.10</i>	<i>0.05</i>	<i>0.66</i>	<i>0.24</i>	<i>-0.78</i>

a) Revenues per 100 euros costs.

Table 6.6

Reliability of estimates (coefficient of variation in italics) of important goal variables per main type of farming, based on CSP variant (2013)

Type of farming	Goal variable					
	Farm income, €	Total revenues, €	Returns a)	Savings, €	Total income, €	Net farm result, €
Field crops	7,013	16,005	2.6	9,036	8,589	6,381
	<i>0.06</i>	<i>0.04</i>	<i>0.02</i>	<i>0.12</i>	<i>0.06</i>	<i>0.12</i>
Vegetables under glass	45,979	219,632	1.4	43,200	47,201	45,396
	<i>0.39</i>	<i>0.11</i>	<i>0.01</i>	<i>1.47</i>	<i>0.39</i>	<i>0.60</i>
Cut flowers under glass	19,919	88,159	1.8	17,317	19,703	18,443
	<i>0.21</i>	<i>0.06</i>	<i>0.02</i>	<i>0.69</i>	<i>0.19</i>	<i>0.67</i>
Pigs	5,997	29,201	0.6	7,058	6,039	5,291
	<i>0.11</i>	<i>0.04</i>	<i>0.01</i>	<i>0.25</i>	<i>0.08</i>	<i>1.41</i>
Poultry	14,207	57,127	1.5	14,647	13,937	12,373
	<i>0.14</i>	<i>0.05</i>	<i>0.02</i>	<i>0.34</i>	<i>0.12</i>	<i>0.29</i>
Grazing livestock	3,580	7,061	1.3	3,114	3,707	3,095
	<i>0.13</i>	<i>0.02</i>	<i>0.02</i>	<i>-0.51</i>	<i>0.09</i>	<i>-0.07</i>
All farms	3,589	12,305	0.9	3,557	3,798	2,981
	<i>0.09</i>	<i>0.03</i>	<i>0.01</i>	<i>-1.02</i>	<i>0.07</i>	<i>-0.09</i>

a) Revenues per 100 euros costs.

There are clear differences in the significance of estimates between different types of farming. Following Table 6.5, the estimates for the dairy sector (non-organic) are the most reliable (the lowest coefficient of variation) because of the large number of farms included in the sample, which reflects the importance of the dairy sector in Dutch agriculture. The decision on the number of farms is described in Vrolijk and Lodder (2002).

The previous tables give an indication of the reliability of estimates for certain types of farming. These tables are used to evaluate the allocation of sampling capacity to the different types of farming. Also in research projects the tables give an indication of the reliability of estimates and should therefore be considered before drawing statistical conclusions.

The tables also give an indication of the dispersion (variability) of observations. A large dispersion makes it more difficult to make precise estimates of group characteristics. Dispersion is however also one of the main advantages of the FADN system. The micro economic information at farm level makes it possible to show and analyse differences between farms, for example research about sustainability performance (Dolman *et al.*, 2012) and the impact of Dutch and EU agricultural mineral policies (Goffau *et al.*, 2012). The European Commission has no requirements regarding the reliability. However, it is one of the factors that are taken into account by determining the distribution of farms over the farm-types and size classes.

References

Cochran, W.G. (1977). *Sampling Techniques*. New York: John Wiley & Sons.

Dijk, J., K. Lodder, J. Luyt en H.C. Pruis, Voorstel voor de indeling van de populatie land- en tuinbouwbedrijven in groepen en bijbehorend keuzeplan. Interne Nota 437. Landbouw-Economisch Instituut (LEI-DLO), Den Haag, 1995a.

Dolman, M.A., H.C.J. Vrolijk, I.J.M. de Boer, Exploring variation in economic, environmental and societal performance among Dutch fattening pig farms. *Livestock Science* 149 (2012) 1 – 2.

Goffau, A. de, T. C. van Leeuwen, A. van den Ham, G.J. Doornewaard and B. Fraters, Minerals Policy Monitoring Programme Report 2007-2010 : Methods and procedures, 2012.

Levy, P.S. en S. Lemeshow, *Sampling of populations: Methods and Applications*, Wiley, New York, 1991.

Poppe, K.J., *Het Bedrijven-Informatienet van A tot Z*. Rapport 1.03.06. LEI, Den Haag, 2004.

Vrolijk, H.C.J. en K. Lodder, *Voorstel tot vernieuwing van het steekproefplan voor het Bedrijven-Informatienet*. Rapport 1.02.02. LEI, Den Haag, 2002.

Vrolijk, H.C.J., H.B. van der Veen and J.P.M. van Dijk, *Sample of Dutch FADN 2007. Design principles and quality of the sample of agricultural and horticultural holdings*. Report 2009-067, LEI, The Hague, 2009.

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