How to measure farm income in the era of complex farms

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Abstract

Farm income is a central objective in the Common Agricultural Policy (CAP). Due to an increasing complexity of farming, measuring farm income has been become less straightforward. This paper analyses farm complexity and its' impact on income indicators with data from the Dutch FADN. It uses the recent report from the US National Academy of Science on data collection of complex farms to discuss conceptual issues. The traditional situation of a farm with one entrepreneur and one household is in the Netherlands a minority. Linking the FADN with the farm census identification numbers shows that situations where a farm business has several establishments registered in the census, is not an exception. The complexity in farm organisation has consequences for financial indicators. Income data per farm, entrepreneur and per household differ as a result of the complexity and it depends very much on the research question which one is the most appropriate. The proposal of the European Commission for the new CAP to separate direct payments for income support from payments in eco-schemes as well as the interest in capping payments and in financial means of young farmers make these issues policy-relevant.

Keywords: Farm definition, Farm Income, Farm Business, Establishment, CAP

1. Introduction, research question and approach

Farm income is a central objective in the Common Agricultural Policy (CAP). Farm family income has been an important indicator in the CAP and in its farm monitoring system FADN (Farm Accountancy Data Network). However, due to an increasing complexity of farming, measuring farm income has been become less straightforward. This has not only consequences for monitoring farm income as one of the objectives of the CAP, but also for policy proposals such as the capping of CAP payments for large farms.

Policy makers and researchers became more aware of this complexity with the EU accession of 10 member states in 2004. In these new member states the traditional family farm was less dominant and other legal and ownership structures (like farm cooperatives and limited companies that succeeded legal forms that were dominant in the socialist era) led to a rethinking of the indicators for farm income. During the last decade many other factors increased the complexity of farming. To illustrate just one of these complexities, an example[1]: the farmer who buys out his neighbour, adds the land to his own property and rents out the bought farm building (or uses them for his contract work operations or an agri-tourism business) is enlarging his establishment and has one farm (in addition he might have some other income sources or could own some other establishments like an agri-tourism business). However, if a similar farm buys out his neighbour, uses the farm buildings for another farm activity (e.g. pig breeding on his original farm and hog finishing on the recently acquired farm[2]), proper categorization starts to depend on the way he organizes his business. If the two farms are or can be separated in a technical and economic sense (e.g. by having different management accounts with a profit- and loss account and balance sheet) then there are two establishments, in line with the day-to-day language: he

[1] Taken from chapter 4 of US NAS (2019), page 95.

[2] The pig industry as an example is no coincidence. In the Netherlands there are several holdings operating several farms. For instance the Van Sleuwen Group, where the Van Sleuwen family controls a foundation that owns several limited companies in the South of the Netherlands which are large pig farms. In addition it owns a feed company and a firm that deals with pig housing design. It also operates large pig farms, of which the assets are owned by others (based on Brabants Dagblad: https://www.bd.nl/meierij/bezette-boerderij-is-van-van-sleuwen-een-van-de-grootste-varkensbedrijven-van-het-land~aadb5d64/?referrer=https://www.google.com/). Another example is the Van Asten Group, an international family firm of two brothers and a sister with 4 establishments in the Netherlands and 5 in Eastern Germany where they also cultivate crops. They employ 220 persons according to their own website https://www.vanastenfokvarkens.nl/van-asten-fokvarkens/historie/. The – by marriage related – Van Gennip family has a similar international firm. However such firms are not unique to the pig and poultry sector. Farm management journals also report them for horticulture, arable farming and even some dairy farms have more than one location.

owns two farms. As we will discuss below that is in line with Eurostat's statistical instructions, but can confuse users of statistics on the number of farms and on farm income.

Increasing farm complexity is a global development. Developments in farm complexity have been described in Australia (Kingwell (2011) and Tually (2003)), USA (Ahearn et al. 2011; Ahearn, 2012; US NAS 2019), Canada (Freshwater, 2012) and Europe (Poppe et al. 2006 and Offermann et al. 2013). Meulenkamp et al (2006) coined the term 'semigration' for farmers that operate farms in several countries, with a business model that outsources low-value operations or keeps using the Dutch tax and banking facilities. The studies identify factors such as an increasing farm size, the increasing geographic dispersion of farms, the prevalence of multiple business operations, non-farm output, off farm employment and the increasing complexity of legal relations between the farm, its' farm owners and the management relationships. Other studies have described the problems that increasing farm complexity cause for farm level data collection (Ahearn, 2012; Vrolijk and Poppe,2016; Offerman et al. 2013).

This paper analyses farm complexity and its impact on income indicators. The objective of this paper is to analyse how this increasing complexity of farms affects the definition of the farm and the measurement of farm income. Furthermore we will discuss some solutions to solve these problems.

The US National Academy of Sciences (US NAS, 2019) recently released a report with recommendations on how to deal with farm complexity in collecting data on farm structure and farm income. Although aimed at the situation in the USA, the recommendations of the panel of the Academy (of which the first author of this paper was a member) are based on theoretical guidelines from international organisations, including Eurostat's NACE. Section 2 section summarizes the definitions recommended by the Academy.

In this paper we use Dutch data sets, especially the Agricultural Census and the Farm Accountancy Data Network (FADN) to investigate aspects of the problem of complex holdings in the Dutch agricultural sector. We present some updated analysis from Poppe et al. (2004) and Poppe et al. (2007). Section 3 presents the results and shows how indicators on the number of farms and farm size are influenced by the applied definitions.

In section 4 we analyse the effects of the complexity of farm organisation on financial indicators. We focus on the complexity of farming and the different income concepts that relate to well-being. The paper ends with conclusions and some reflections on related issues in the CAP debate.

2. Theoretical approach[3]

An investigation into the complexity of farm holdings starts with the definition of farming. Accountants define agricultural activity as *"the management by an entity of the biological transformation and harvest of biological assets for sale or for conversion into agricultural produce or into additional biological assets"* (IFRS, 2017). The essence of this definition is of a business activity that manages a biological process that leads to products (milk, potatoes, oranges, etc.) or into biological means of production (animals, seeds, etc.). The Statistical Classification of Economic Activities in the European Community takes agriculture (also as a synonym of farming) together with fisheries and forestry in one category for the national accounts. The category is defined as: "*the exploitation of vegetal and animal natural resources, comprising the activities of growing of crops, raising and breeding of animals, harvesting of timber and other plants, animals or animal products from a farm or their natural habitats*." Where the addition of natural habitats leads to the inclusion of fisheries, hunting and forestry . The statistical category not only includes agricultural production as a basic activity, but also agricultural support

[3] The text of this section is directly based on chapter 4 in US Academy of National Sciences (2019) to which the first author of this paper contributed.

activities (like contract work and veterinary services). These definitions learn that agriculture is not defined on the purpose of the production (food, feed, energy etc.). Nor that it is based on a product classification (that exists too) – it is defined by activities that an economist would describe with a production function of inputs and outputs. In the end a list is needed to rule activities in (e.g. farming fish, algae, tree farming) or out (forestry (although forests are pruned), cheese and wine making (both a biological process) or offering yoga with goats).

The question of what a farm is, is not solved by separating farming activities from agricultural support activities, energy production (e.g. turning the biogas into electricity) or service activities; in some cases it adds to the complexity as holdings have several activities, some farming, some not. Statisticians often have to classify holdings, not activities. The farmer that occasionally sells some apples at the roadside is still a farm and not a retailer, but conceptually we enter a fuzzy area in which, at the opposite end of the spectrum, there might be a shopkeeper that also supplies a few percent of its sales in autumn from self-grown apple trees (a farming activity). This shows the need for a criterion and a threshold to classify holdings by sector – which is provided by NACE in the statistical framework as follows[4]: *in such cases the principal activity of a statistical unit is the activity which contributes most to the total value added of that unit. The principle activity is identified according a top-down method and does not necessarily account for 50% or more of the unit's total value added. A secondary activity is any other activity of the unit, whose outputs are goods or services which are suitable for delivery to third parties. The value added of a secondary activity must be less than that of the principal activity*. In line with statistics for other parts of the economy, the US National Academy of Sciences (2019) recommends to apply clear rules based on the nature of its principal productive activities for classifying an entity as a farm or as a firm operating in a non-farming sector with secondary activities in farming. However, all businesses engaged in farm activities, even if it is a minority activity should be monitored for policy purposes.

Next issue is then the definition of an entity: is a supermarket chain as Carrefour counted as one or as hundreds of entities? In economic statistics, the answer is the difference between firms and establishments. A firm is "an organization conducting a business . . . . A firm may operate in one place of business or more." An establishment is "a single physical location where a firm's business is conducted" (Haltiwanger, Lynch and Mackie, 2007). For our example, this means that Carrefour is a firm, with many establishments, Eurostat follows this definition of a farm as an establishment, stating that: *A farm is a single unit, both technically and economically, which has single management and which produces agricultural products ... either as its primary or secondary activity* (Eurostat 2017). The US Academy of Science (2019) recommends to define a farm as "an establishment (single unit with a legal or informal management structure) that (1) has its principal or secondary activity in farming with the production of agricultural products and biological assets as seeds and animals; and (2) for which full economic data on key business variables, such as costs and revenues, can be collected and made available".

An establishment can differ from its legal structures. If the farm (establishment) is a partnership of father and son, it can very well be that for economic, fiscal or other reasons some assets are owned by the father in a personal firm or partnership with his wife and rented out to the farm. If this is not a single unit, technically and economically, but only a fiscal or risk-management construct, it is not an establishment (that is labelled as an investment fund).

In addition the US Academy of Science (2019) recommends to introduce the term Farm Business for the level of the firm. This means that a Farm Business describes situations with entities that have several establishments (some of them in farming but potentially others in non-agricultural activities) and situations where the firm and the establishment are equivalent (the classical farm that is one

[4] https://www.oecd.org/sdd/39974599.pdf, p. 67

establishment). The number of farm businesses is therefore lower than the number of farms (farm establishments).

The definition of a farm as an establishment and the farm business as a firm offers a solution to some of the complexity, but not all. The CAP is interested in family farms and farmer's decisions and income. This raises additional complexity, as a farm has sometimes more than one farmer and more than one household attached to it, in the same way as a farm business can consist of several farms.

Not everybody who works on a farm is a farmer. But what classifies a person as a farmer? Is it ownership (which means that absentee landlords or co-owning spouses count), or is it management (that includes paid farm managers), or should both criteria be met? And what do we mean with management: strategic and investment management or day-to-day operational management (which is important for policy makers due to its' environmental impacts). The US National Academy of Science recommends to collect the data per farmer / producer on ownership and hours worked and who is involved in which decisions, while recognizing that such questions are potentially time consuming and thus costly for even a special survey. It is not unthinkable that a farmer is even involved in more than one farm business, but if in a survey the farm establishment is the entry point, the farm business and its farmers can be identified and recorded.

Next complexity is the identification which farms (or farm businesses) are family farms – as politicians seem to have a special interest in such farms. Reinhardt and Barlett (1989) pointed out that the concept of the family farm has been adapted over time: it was originally used in the USA for the homesteading farms that had no outside labour and capital nor used contractors, and was over time broadened to keep up with changes in the organization of farming. A family can be defined as a group of two or more people related by birth, marriage, or adoption and residing together. A household consists of all the people who occupy a housing unit that is a house, an apartment or other group of rooms, or a single room, occupied or intended for occupancy as separate living quarters. These definitions help, although there are many cases in which a farmer lives alone, and such farms are also called family farms.

Complexity in the calculation of family farm income arises from the fact that in many farms, including those that are part of complex farm businesses, farms are owned and operated by one (or two related) persons in which some of them have their own household, others (like spouses or unmarried children that are a farmer) live in the same household. The farm business (being a complex holding or a single establishment) generates farm income for the farmer(s) including from non-farming activities that might be part of the business[5]. The farmer or other members of the farmer's household might also earn off-farm income (and have off-farm wealth) that is relevant in a discussion on the need for income support via agricultural policy. Be aware that off-farm income might be earned in a separate establishment at the same location as the farm (e.g. an agri-tourism business or a company for contract work). Data collection on those owner-households, e.g. regarding non-farm income, can be restricted to those persons who are farmer/owner and their spouses, assuming that the non-farm income of children who (still) live at home is used for their own personal expenses and savings, and not in financing the farm, nor reducing the need to use the farm income for household expenditure. However, this can be a questionable assumption if that child is the potential successor on the family farm.

This theoretical framework of definitions (see Annex 1 for a data model) for farming, the farm (as establishment), the farm business, a farmer and farm household was put forward by the US National Academy of Science (US NAS, 2019) to shed light on the issues of monitoring complex farms in the USA. Based on international literature, it is relevant for Europe too. A first question is then: do we have complex farm issues over here – that is the topic we investigate in the next section with Dutch data. And

[5] Other gainful activities, that are income sources in which the production means of the farm activities are used.

the second question is: does it matter and distort our results in monitoring farm income – the topic of section 4.

3. Results: complex holdings in the Netherlands

A first indication (besides reports on individual cases in the farm press) that the issue of complex holdings is relevant in the Netherlands comes from comparing the farms in the Dutch FADN with their registration in the register of the Agricultural Census. The Census uses Eurostat's definition of the farm as an establishment, the FADN uses a definition that is closer to the one of a farm business[6]. We observe that 67 farming business as defined in the FADN have more than one registration number (establishment) in the Agricultural Census – that is 4% of the (unweighted) farms (Table 1). Most of these have two establishments, but 10 have three ones, and one even five. Since 2005 there is a clear increase in the complexity of farms, measured in the number of farm businesses with more than 1 establishment, although 2015 shows a temporary dip.

Table 1. Farm businesses in the Dutch FADN classified to the number of establishments that are associated with these farm businesses in the yearly farm census based on the register of the Agricultural Census , 2005, 2010, 2015, 20178.

Number of id's in agricultural census per FADN Farm	2005	2010	2015	2017
0	9	20	52	70
1	1424	1413	1413	1380
2	21	65	47	48
3	3	6	4	10
5	0	0	1	1

At the same time we observe that 70 farms in the FADN cannot be traced to establishments in the agricultural census. This is partly due to non-response (although it is obligatory to respond) to the Farm Census (especially in horticulture and permanent crops where farms do not receive CAP payments based on the census). But it could also be due to the fact that these establishments do not record agriculture as main or secondary or third activity or reported their agricultural activity under another number (either farm business or establishment)[7]. Also this phenomena is increasing over time (Table 1).

[6] A farm business is defined as an agricultural economic unit: the in the FADN defined unit, that is a composition of farms with their households, institutions and persons, that have agreed to (have) deliver data for the description of the unit.

[7] In the Netherlands only the firms registered in the Register of the Chamber of Commerce that indicated agriculture as a principle, second or tertiary activity are asked to take part in the farm census.

Table 2 Farm businesses in the Dutch FADN classified to the number of entrepreneurs per farm business, 2005, 2010, 2015, 2017 (unweighted)

	Number of farms				Percentage of farms			
Number of entrepreneurs	**2005**	**2010**	**2015**	**2017**	**2005**	**2010**	**2015**	**2017**
1	376	451	473	481	38%	39%	38%	38%
2	485	516	562	541	49%	45%	45%	43%
3	103	136	141	172	10%	12%	11%	14%
4	30	44	59	60	3%	4%	5%	5%
5	4	7	9	9	0%	1%	1%	1%
6	0	2	2	4	0%	0%	0%	0%
7	0	0	1	0	0%	0%	0%	0%
8	0	0	1	1	0%	0%	0%	0%

Increased complexity in Dutch agriculture is also shown with data on the number of entrepreneurs per farm business (Table 2). Farms with only one entrepreneur are a stable minority (38%). The number of farm businesses with 3, 4 or even 5 entrepreneurs is clearly increasing.

Most of these entrepreneurs live together in one household, but also here complexity is a reality: in some cases there are even 3 to 5 households associated with one farm business in the FADN (Table 3).

Table 3 Farm businesses in the Dutch FADN classified to the number of households per farm business, 2005, 2010, 2015, 2017 (unweighted)

	Number of farms				Percentage of farms			
Number of households	**2005**	**2010**	**2015**	**2017**	**2005**	**2010**	**2015**	**2017**
1	844	967	1066	1085	85%	84%	85%	86%
2	129	154	152	154	13%	13%	12%	12%
3	19	25	23	23	2%	2%	2%	2%
4	5	7	5	4	1%	1%	0%	0%
5	0	1	2	1	0%	0%	0%	0%
6	0	0	0	1	0%	0%	0%	0%

Farms are nowadays organised in different juridical forms (Table 4). The classic one-man-business is a legal form used by only one quarter of the farm businesses , and the number is declining. Most popular is the (fiscal) partnership in which two, three or more entrepreneurs are working together. Dutch fiscal law favours this form as a way to hand over a farm to the next generation and to (fiscally) reward spouses for their contribution in farm work. Forms that legally limit the liability of owners like the limited company or the limited partnership are gaining quickly in importance – another sign of increased complexity.

Table 4 Farm businesses in the Dutch FADN classified to their juridical form, 2005, 2010, 2015, 2017 (unweighted)

	Number of farms				Percentage of farms			
Juridical form	**2005**	**2010**	**2015**	**2017**	**2005**	**2010**	**2015**	**2017**
One man business	296	352	330	317	30%	30%	26%	25%
Partnership	479	483	469	466	48%	42%	37%	37%
Limited partnership *)	162	225	299	307	16%	19%	24%	24%
Limited company	61	96	153	181	6%	8%	12%	14%

*) in Dutch: V.o.F. and C.V.

Complex farms are larger farm businesses (Table 5). Farm businesses with 2 households or more, or with one household but 3 entrepreneurs have nowadays a standard output of on average more than 1 million euro. Farm businesses with one household and one or two entrepreneurs (typically man-wife or father-son partnerships) have on average a standard output of less than 1 million euro. Complex farm businesses are responsible for a relatively large part of production.

Complex farms are more specialised (Table 6). The degree of specialization across juridical forms is calculated using the Herfindahl index (Poon and Weersink, 2011) which is based on gross revenue generated from each main component (general cropping, horticulture, permanent crops, grazing livestock and granivores); the index is the sum of squares of the revenue generated by each component divided by the square of the total. The lower the value of the Herfindahl index, the greater the diversification on the farm. Limited companies and limited partnerships show a high degree of specialisation in all observed years. It suggests that specialisation helps in running a larger farm that is more complex in its organisation – or that a complex organisation helps in managing the risks that are associated with specialisation. However specialisation is an important driver also for one man businesses and partnerships: they have increased their specialisation to levels close to the limited companies.

Table 5 Number of farm businesses in the Dutch FADN and their economic size measured in Standard Output (€) classified to the number of households and the number of entrepreneurs per farm business, 2005, 2010, 2015, 2017 (unweighted)

		2005		2010		2015		2017	
Number of households	**Number of entrepreneurs**	Standard Output	Number of farms	Standard Output	Number of farms	Standard Output	Number of farms	Standard Output	Number of farms
1	1	452.550	370	515.918	438	695.473	460	802.860	467
	2	561.574	399	701.090	422	822.518	456	924.384	444
	more than 3	647.960	75	1116.866	107	1296.510	148	1398.394	171
2	2	796.196	83	955.353	90	1305.036	101	1380.038	92
	more than 3	661.216	41	970.851	52	1083.068	40	1226.095	51
more than 3	more than 3	722.555	21	1316.336	30	1888.751	25	1915.620	24

Table 6 Degree of specialisation (Herfindahl index) of farm businesses in the Dutch FADN, classified to juridical form, 2005, 2010, 2015 and 2017 (unweighted)

Juridical form	**2005**	**2010**	**2015**	**2017**
One man business	0.94	0.94	0.95	0.96
Partnership	0.90	0.92	0.95	0.94
Limited partnership	0.95	0.95	0.95	0.95
Limited company	0.98	0.98	0.98	0.98

Concerning being active in multi-functional activities / other gainful activities there is not much difference across juridical forms (Table 7). The share of farm businesses that are active in activities like nature management, agri-tourism, care-farming, energy sales, on-farm sales (dairy), and contract work (in crops or handling agricultural products) is more or less the same in all categories, only limited companies show a higher percentage. In all categories there is a clear increase.

Table 7 Share of farm businesses (in % of total) in the Dutch FADN with other gainful activities, 2005, 2010, 2015 and 2017.

Juridical form	2005	2010	2015	2017
One man business	42%	51%	53%	61%
Partnership	45%	53%	59%	64%
Limited partnership	35%	53%	59%	63%
Limited company	30%	65%	67%	73%

From the data in the Dutch FADN we can conclude that the classical idea of a (family) farm as farming in one location, with one farmer owning and managing the farm and with one household, legally organised as a one man business is not representing the reality very well. Farms have become more specialised in their types of agricultural production (although with a majority of farms involved in multi-functional activities), but with a much more complex farm organisation. One in 25 (4%) farm businesses have more than 1 establishment as measured in the agricultural census. Most farms are organised as a partnership, only 1 in 4 (25%) is a classical one-man-business. A substantial number of farm businesses provide an income to more than 1 household. Complex farms are larger farms and responsible for a large part of our food production. In the next section we investigate what this means for important income indicators such as family farm income per farm or per entrepreneur or household. How are these indicators affected by the 1:n relationship between farms and households?

4. Results: effects on Dutch indicators

Table 8 gives some characteristics of farm businesses with more entrepreneurs, more establishments or more gainful activities. The results show that the percentage of farms with more entrepreneurs is the highest in the horticultural and intensive livestock sector and the lowest in the arable sector. The prevalence of Other gainful activities is the highest on arable farms and mixed farms. Farm businesses with several establishments can especially be found in the intensive livestock sector and to a lesser extent in horticulture. Complex farms, defined as farm businesses with more entrepreneurs, more establishments or more gainful activities in addition to farming, are on average larger in terms of standard output but also in hectares and have more more own capital. Complex farms have a slightly lower degree of specialisation (Herfindahl index).

The impact of complex farms on the result indicators is described in table 9 and further. In the classical situation with a farm business that is one farm, has one entrepreneur and one household, there is by definition no difference between the income indicators expressed per farm, per entrepreneur and per household. However, the values are totally different for complex farms: especially values per entrepreneur are much lower than those per farm. Table 9 shows this effect for several years. This supports the method in the FADN to express family farm income per unpaid agricultural work unit – especially if it is important to judge labour productivity. For judging the issue of income support, the total income at household level is probably more appropriate. Table 8 shows that a rather high family farm income at farm level (€ 109.642) can be the result of rather moderate income per entrepreneur (€

37.932) but is much more satisfactory at household level (€ 89.140,-). Although the farm level clearly overestimates the farm income at household level and underestimates the total family income at household level. We conclude that Family Farm Income and Total Family Income are indicators that are easily misunderstood in more complex farm businesses.

Table 8: Financial indicators and characteristics of farm businesses in Dutch FADN classified to situations with more entrepreneurs, with more id's (establishments) and farm businesses with other gainful activities (weighted, observations 2015 and 2017)

	More entrepreneurs		**More id's in census**		**Other gainful activities**	
Structure Variable	No	Yes	No	Yes	No	Yes
Standard output	366753	600517	479910	968060	426755	542407
Number of households	1.00	1.23	1.13	1.18	1.09	1.15
Number of entrepreneurs	1.00	2.35	1.72	1.89	1.66	1.78
Agricultural area	35.4	43.4	39.4	66.8	27.5	48.3
Revenues Other gainful activities	32891	63199	49627	67095	-4890	50296
Own capital	1637183	2280061	1957968	3394017	1498877	2326653
Herfindahl index	0.96	0.94	0.94	0.93	0.95	0.94
Arable	53.6%	46.4%	99.0%	1.0%	19.4%	80.6%
Grazing livestock	47.6%	52.4%	97.0%	3.0%	43.0%	57.0%
Horticulture	40.0%	60.0%	97.6%	2.4%	49.1%	50.9%
Permanent crops	42.1%	57.9%	97.6%	2.4%	45.9%	54.1%
Intensive livestock	38.0%	62.0%	94.4%	5.6%	59.6%	40.4%
Mixed	40.6%	59.4%	99.5%	0.5%	32.8%	67.2%
Income variable						
Total Family Farm income	52380	109642	79601	203527	53323	104420
- Per entrepreneur	52380	37932	40955	91260	29470	51011
- Per household	52380	89140	70443	172481	48920	90800
Total Family income	66265	120054	91747	214011	65761	116101
- Per entrepreneur	66265	51087	53341	113233	39615	65225
- Per household	66265	97605	81192	181365	60331	100957

Table 9: Family farm income of farm businesses in Dutch FADN expressed in Euro per farm business or per entrepreneur for simple and more complex farm businesses based on the number of entrepreneurs per farm business, several years.

Number of entrepreneurs	Income variable	**2005**	**2010**	**2015**	**2017**
One entrepreneur	Per farm	28026	40578	43558	61323
	Per entrepreneur	28026	40578	43558	61323
More than one entrepreneur	Per farm	59650	82357	88623	131761
	Per entrepreneur	26667	36312	37138	55743
All farms	Per farm	45843	61561	68149	99105
	Per entrepreneur	27261	38436	40055	58330

The analysis in table 9 assumed no difference between farm businesses and establishments (farms), where in reality this difference exists – as we showed in section 3. But if the user of the FADN would use the establishment concept as his/her definition of a farm, and follow the Eurostat definition of a farm, this has big consequences for the level of the reported income. In table 10 we show the family farm income per farm business and per farm by dividing the income by the number of establishments (identification numbers in the agricultural census) for complex farms[8]. The outcome of this analysis shows that this difference between farm business and farm (establishment) does not only have an effect on the income reported for those complex farms (which is to be expected), but that it also has an effect on the income reported for the average farm: family farm income at farm business level is 5% (2017) to 10% (2015) higher at farm business level, as reported in FADN, than at farm (establishment) level.

This difference also creates problems in aggregating the results from the FADN to sector and national level, or in comparisons between indicators per farm derived from sector data with FADN data. Currently the Dutch FADN does not take into account this problem of complex holdings with more than 1 establishment. The weighting factor for a farm is based on the sampling fraction based on 1 establishment (identifier in the census). This overestimates total income at sector level for farm types that have many complex farm businesses.

[8] Establishments within one farm business can of course be of different size and for statistics on distributions it would be better to allocate the incomes to the different establishment, or estimate the allocation with census data of the establishments. For averages as shown here that does not have an effect.

Table 10: Family farm income of farm businesses in Dutch FADN expressed in Euro per farm business or per establishment (identification numbers in the census) for simple and more complex farm businesses based on the number of establishments per farm business, several years.

Number of establishments (id's in agricultural census) per FADN Farm business	Family farm income per....	2005	2010	2015	2017
1	Farm (establishment)	45653	59089	61950	93804
	Farm business	45653	59089	61950	93804
2	Farm (establishment)	28488	42679	52205	97722
	Farm business	56975	85359	104409	195445
3	Farm (establishment)	97822	72741	46160	151383
	Farm business	293466	218222	138480	454150
5	Farm (establishment)			1141253	1209744
	Farm business			5706264	6048720
Total	Farm (establishment)	45496	58624	61895	94262
	Farm business	45843	61561	68022	99319

The importance of the number of entrepreneurs and households in complex farm business for indicators on farm income and total income as demonstrated above (table 8) is equally relevant for the level of savings that becomes available for the farm business and can be used for investments or repaying loans (table 11). Taking the composition of the household(s) into account influences the off-farm income, the paid taxes and household consumption and hence the savings that remain when these items are offset against the family farm income. Table 11 also recognises the fact that when it comes to investment capacity of farm businesses, savings should be judged in conjunction with the revaluation of assets due to price changes (mainly increase in land values) that determine the borrowing capacity. In all reported years the revaluation of assets is equal or higher than the reported levels of family farm income. In a total-income concept such changes in asset values should be taken into account.

Table 11: Income components and savings of farm businesses in Dutch FADN expressed in Euro per farm business, several years.

Variable	2005	2010	2015	2017
Family farm income	45843	61561	68022	99319
Off farm income	12354	14682	13034	10915
Total income	58196	76242	81056	110234
Paid (personal) taxes	6133	4129	9194	11054
Disposable income	52063	72113	71861	99180
Savings	8619	22306	23681	44589
Total revaluation	44557	124792	72409	102607

Having demonstrated how the complexity of farm organisation influences the reporting of income data in the form of averages, we now turn our attention to the distribution of income. Although a lot of the communication of farm incomes concentrates on averages, it is probably the distribution that matters if it comes to a safety net for farm incomes. And where the complexity of farm organisation influences average values, it probably also influences distributions.

Table 12 shows the distribution of farm family income per farm business and illustrates that statistics on a one year distribution strongly overestimate the distribution, and therefor the number of farms with a low income. Although there is a correlation in incomes of farmers between different years (large farms

with higher incomes stay large, good farmers keep their competences) farms are not every year in the same percentile of the distribution. There is a certain randomness with some (bad) luck to find your farm at one of the ends of the income distribution.

Table 12: Family Farm Income in Euro (average, median, 25% and 75% percentile) per farm business in Dutch FADN, one year average and three year average (per farm business).

Year	One year average				Three year average			
	Mean	Percentile 25	Median	Percentile 75	Mean	Percentile 25	Median	Percentile 75
2005	45843	9687	34841	70094	46111	7504	34689	66804
2010	61561	4990	35874	81627	39092	649	26256	64466
2015	68022	-1206	26282	77164	68248	1398	30683	74923
2017	99319	8312	50367	122256	86368	5918	38982	97283

Farms with a high income tend to be rich farmers in terms of own capital, it is that capital that generates income and is an indicator for a large farm (with efficiency of scale). But this correlation is not perfect. That implies that for policy research into the safety net function of agricultural policy it makes sense to show this correlation. Farmers with a low income but a high level of own capital have more options to get out of poverty by selling part of or all their assets and find employment elsewhere. Table 13 shows that about 25% of the farm businesses in the Dutch FADN have a relatively low income averaged over three years (quintiles 1 and 2) and at the same time a relatively low net worth (quintiles 1 and 2 of own capital). Another 17% has a relatively low income (quintiles 1 and 2) but a more favourable net worth (median or highest quintiles).

Table 13: Farms (in % of total number of farms) classified to quintiles of three year average income and own capital per farm, Dutch FADN, 2017.

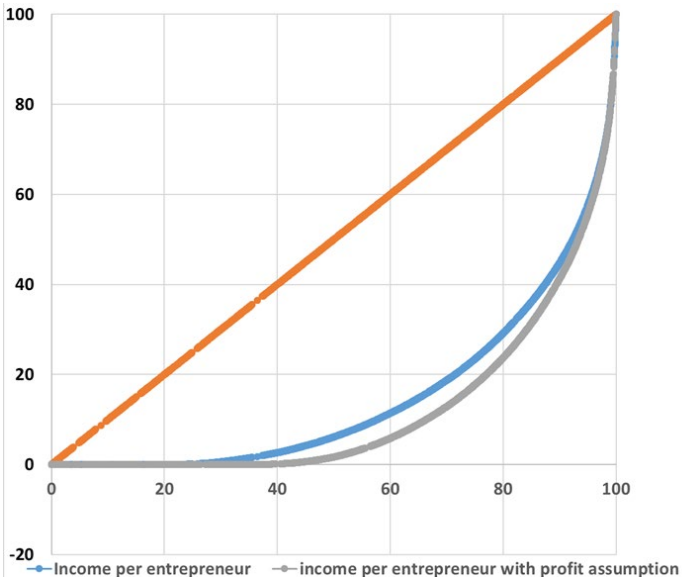
		Classes of own capital (quintiles of capital distribution)				
		1	2	3	4	5
Income classes of three year average family farm income (quintiles of income distribution)	1	6%	6%	4%	3%	1%
	2	4%	7%	4%	3%	2%
	3	5%	3%	6%	3%	3%
	4	3%	3%	3%	6%	5%
	5	1%	2%	3%	5%	9%

The final question is then if and how the complexity of farm business influences the statistics on the distribution of income. To investigate this issue, we first look to the distributions of income per entrepreneur. Due to a lack of data how entrepreneurs divide the income between each other, this distribution is often given by assuming an equal share for the entrepreneurs.

As we also lack data on the division of income to the different entrepreneurs in the Dutch FADN, we carried out a simulation based on some rules of thumb: in arrangements between entrepreneurs it is not uncommon to settle rules in which income is allocated according to the input into the partnership in terms of capital and labour. If for instance the father supplies most of the capital he will get a return on capital, and in addition father and son/daughter get both a reward from the income for their labour input. Also between man and wife (in cases of marital conditions that guarantees that the family assets of the farm stay with one of them) this situation is not unthinkable. To mimic this situation we assumed that the net worth would be owned by one entrepreneur and be rewarded by a 3% cost of capital. The remaining income would be equally shared by all entrepreneurs for their labour input. Figure 1 gives the results of this calculation, based on a three year average income, in the form of a Lorenz curve (cases with a three year average income that was negative have been omitted). It shows that the real distribution

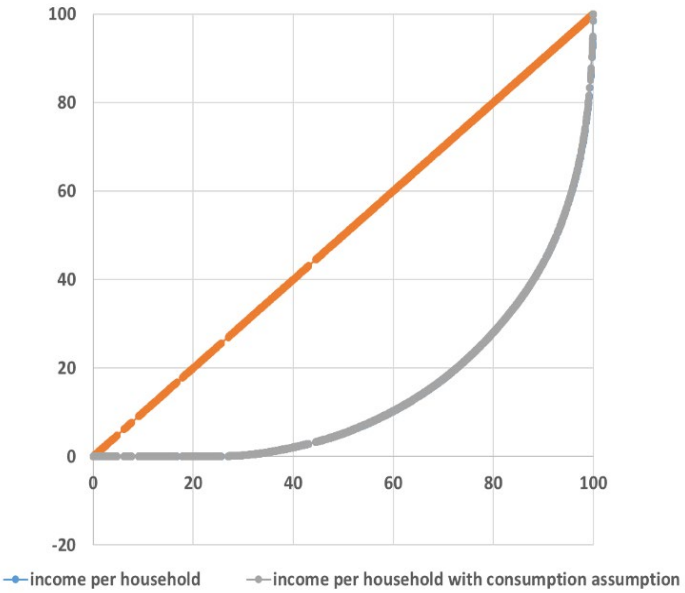
of income (the grey line), could easily be more skewed than the distribution that is normally shown (the blue line). A result of the complexity of having more entrepreneurs per farm.

Figure 1. Lorenz curves for the 3-year income per entrepreneur based on an equal sharing of the income (blue line) and on the assumption that the net worth is owned by one of the entrepreneurs that gets a 3% reward for this input (grey line).



We did a similar exercise for the farm income per household. We assumed that in for instance the case of a father and son/daughter or in the case of two brothers that farm together the firm has a strong growth strategy and entrepreneurs take out € 30.000 euro per household for living expenses (consumption) and allocate the rest to the entrepreneurs to reinvest in the farm business. Figure 2 gives the results. Here we do not see any difference between the two Lorenz curves. There are several reasons for this. First of all most of the FADN farms have more than one entrepreneur but these are often husband/spouse or father/son combinations (or both). Farms with two households and more than 2 entrepreneurs are a minority. Second reason is that the distribution per entrepreneur has a stronger impact (if we allocate the € 30.000 to one of the farmers as income before allocating the rest equally) than the distribution per household.

Figure 2 Lorenz curves for the 3-year income per household based on an equal sharing of the income between entrepreneurs (blue line) and on the assumption that one entrepreneur per household first takes € 30.000.- for household consumption (grey line).



5. Conclusions and recommendations

In line with anecdotal farm reports, this paper found that Dutch farms are becoming more complex in their organisational arrangements. This is also the case for very specialised farms, perhaps to reap the benefits of large scale production and manage risks. The traditional situation of a farm with one entrepreneur and one household is in the Netherlands a minority. Linking the FADN with the farm census identification numbers shows that situation where a farm business has several establishments registered in the census, is not an exception.

The complexity in farm organisation has consequences for financial indicators. Income data per farm, entrepreneur and per household differ as a result of the complexity and it depends very much on the research question which one is appropriate. Especially if users assume a classical situation of one-farm/one-farmer/one-household, data per farm can be interpreted wrongly: incomes per farmer or household are then lower than assumed with the farm-level statistic. A thinking exercise showed that due to the complexity of farms the distribution of income per entrepreneur could be more skewed that the current way of presenting suggests.

In the case of the Netherlands there seems to be an urgent need to look into the links between the Farm Business concept in the FADN and the Farm (establishment) concept in the agricultural census. If data at farm business level is interpreted as data per farm in the census there is an overestimation of income due to the complex farm organisation with farm businesses that have more than one establishment. This influences the averages of certain sectors (like horticulture and pigs and poultry) where complicated farm structures are more common. In the farm census farms could be asked “Is the farm or its owners (co-)owning other farms?”. And perhaps: “If yes, provide the identification numbers of those farms”. With this the farm businesses are identified and the census data could be reworked from a census of farms into a census of farm businesses, if needed with an specialised survey.

These conclusions show that the conceptual framework developed by the US National Academy of Science on complex holdings, is relevant for the Netherlands too. Farms are becoming more complex in their organisation, but a farm should also in the future be defined as an establishment. From now on researchers should be more explicit if they report on farm businesses or farms. The linkages between

farms that have the same owner(s) and the linkages between farms and farmers (owners / managers) and households should be explicitly modelled and data on these relations should be collected to understand the farm structure. The same understanding is crucial for a proper monitoring of farm incomes and micro-economic evaluations of policy measures (including the application of micro-economic models). Data on non-farm income and paid taxes should be collected for a fair view on income in farm families. The European Court of Officers as well as its Dutch equivalent have reported quite critically on the efficiency of the CAP payments to farmers, and the use of the current farm family income indicator instead of total household income.

This is even more the case as the future Common Agricultural Policy will differentiate in Pillar 1 between direct payments per ha for income support (with a conditionality based on environmental legislation and good agricultural practices) and eco-schemes as voluntary schemes with a payment per ha for additional environmental management (including nature management and climate change measures). Especially in the case of income support the household level is more important than data per farm or per entrepreneur. This is strengthened by the idea of capping: payments should then probably be maximised at household level, not at farm level. Capping applied to the establishment level in the current practice of the CAP, where the payments are linked to farms (establishments) and not to farm businesses or households, could also lead to splitting farms up into different establishments (Sahrbacher et al. 2012). That would make the concept of a farm business even more relevant for monitoring.

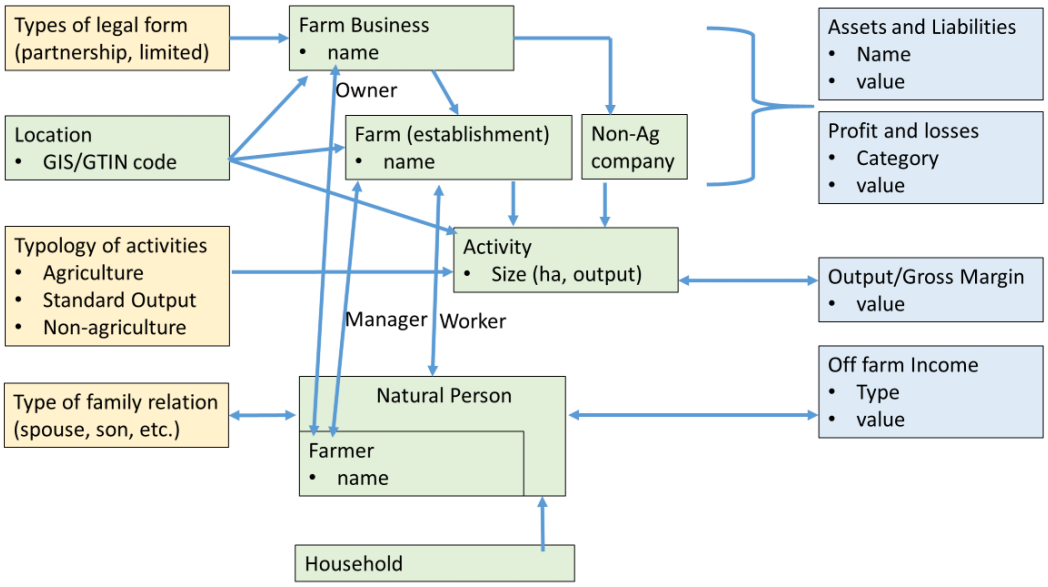
Politicians also have a special interest in young farmers. The current practice of looking to data of farms with the oldest entrepreneur being younger than 40 years old is not very satisfactory. It is more important to have a look to farm businesses where one of the entrepreneurs is younger than 40 and to look how income in complex farm businesses is allocated to the different entrepreneurs. This would make it possible to judge if young farmers have enough savings in their early career years (farming with their parents or partly earning an income outside farming) to be able to take over the farm from their parents. For the eco-schemes, data at farm level seems to be more important to understand farm performance than the data on entrepreneurs and households.

Concerning data collection these information needs could mean a closer collaboration between FADN systems and fiscal accounting offices, especially in countries where this collaboration is historically not developed. Fiscal accounts do have all the data on the allocation of (fiscal) profits to the different entrepreneurs and households. The differences between valuations in fiscal accounts (on historic values with short depreciation periods to optimize tax burdens) and management accounts (with actual values and economic depreciation) are less sharp than in the past as we are living for a long period with low inflation rates. On the other had the data needs for evaluating the sustainability performance of farming, with indicators on minerals, pesticides, greenhouse gasses, antibiotics, biodiversity and much more, needed to evaluate the eco-schemes (also in relation to state aid), cannot be served by fiscal accounts, and often not even by management accounting software of farms. Here data collection of basic data with up to date ICT is the way forward (Vrolijk et al, 2016). Using the flow of invoices and other documents to (and from) a farm with a form of digital data collection reinforces the point that farms can best be defined as establishments in line with how farmers organise their farms. For reporting income such establishments have to be consolidated in farm businesses to create a fair view of farm income on complex farms.

Annex 1 Data model

The figure below provides a simple data model for the conceptual terms used in the theoretical framework of section 2, and how they are related. Boxes show entity types (or objects), lines the most important relationships, with the arrows indicating a 1:many relation – a farm business has a location, a location can house zero, one or more farm businesses. A farm business can have one or more farms (farm establishments) and non-agricultural companies. In the simple case the farm business has one farm

and both are equivalent. Farms and non-agricultural companies have activities. Natural persons work in a farm, can manage a farm and can own a farm business. Some natural persons are called a farmer, based on rules for management and ownership. Persons live in a household. Typologies are used to classify activities and based on that rule if entity is a farm or a non-agricultural company. Typologies of legal forms and family relationships are also useful to describe a situation in a standard way. Financial indicators relate to the farm business and establishments in the case of balance sheets and profit and loss accounts. Activities have output and often gross margin indicators. Income (and wealth) indicators relate to natural persons.



References

Ahearn, M., Barnes, K., Culver, D., Jones, S., Smith, J., Boone, K., Bolliger, F., Iwig, B., Leduc, A., McCarthy, J., MacDonald, J., Parsons, J., Poppe, K. and Ravindra, D. (2011) Complex Agricultural Establishments. Prepared by the Planning Committee for an International Workshop on Enhancing Data for Complex Agricultural Establishments, Niagara-on-the-Lake, Ontario, Canada, June 26-28, 2011.

Ahearn (2012) Challenges in Collecting Data from Complex Farm Operations: Review of Perspectives from an International Conference; In: Pacioli 20 Complex farms and sustainability in farm level data collection, LEI Wageningen UR, The Hague, 2013.

Freshwater, D. (2012), Complexity and Obsolete Data Concepts: Canadian Farm Policy, and The Changing Structure of Agriculture, Agricultural Economics Staff Paper # 469.

Kingwell, R. (2011), Managing complexity in modern farming. Australian Journal of Agricultural and Resource Economics, 55: 12-34. doi:10.1111/j.1467-8489.2010.00528.x

Meulenkamp, W.J.H., Kranendonk R.P., Hermans C.M.L., and Rienks,W.A.(2006), Quickscan (S)emigratie van Nederlandse agrariërs, Alterra Wageningen.

Offermann, F., Forstner, B. and Weiss, M. (2013) Increasing importance of 'new forms' of agricultural holdings in Germany and its impact on collection of information for labour use in FADN. 21 PACIOLI Workshop, Sweden. September 22-25, 2013.

Pesce M., Kirova M., Soma K., Bogaardt M-J., Poppe K., Thurston C., Monfort Belles C, Wolfert S., Beers G., Urdu D., 2019, Research for AGRI Committee – Impacts of the digital economy on the food-chain and the CAP, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels

Poon K. and A. Weersink (2011) Factors affecting variability in farm and off-farm income. Agricultural Finance Review. 71. 379-397.

Poppe, K.J., H. van der Veen, K. van Bommel and W. van Everdingen (2004) Developments in the organisation of the farm and their policy implications. Paper for the SFER Conference 'Developments in farm families: policy implications', Paris, April 2004. Also published in: K.J. Poppe: Pacioli 12 – Income issues in farm households and the role of the FADN, LEI, Den Haag.

Poppe Krijn J., Hans Vrolijk, Karel van Bommel and Hennie van der Veen (2006) Observations on farm structure in Europe. Paper presented at the congress of the IAAE, Brisbane, Australia, August 2006.

Sahrbacher, C, A. Sahrbacher, A. Balmann, A. Ostermeyer and F. Schoenau: Capping direct payments in the CAP: another paper tiger? In: EuroChoices, December 2012

Tually, Geoffrey G., 2003. "The Farm Family and Their Farm Business: A Multidisciplinary, but Potentially Explosive Mix of Business, Legal Ownership and Family Aspects," 14th Congress, Perth, Western Australia, August 10-15, 2003 24369, International Farm Management Association.

US NAS – US National Academy of Sciences (2019), Improving data collection and measurement of complex farms, Washington DC: The National Academies Press.

Vrolijk, H.C.J. Poppe, K.J. and Keszthelyi, Sz. (2016): Collecting sustainability data in different organisational settings of FADN in Europe. Studies in Agricultural Economics 118 (3), 138-144.

Vrolijk, H.C.J. and K.J. Poppe (2016), Structural change in Dutch agriculture: the impact on farm-level statistics, ICAS VII, Rome 2016.