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Analyzing farm structural change using the Norwegian Direct Payment Register: Data overview and preliminary analyses

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Abstract
The Norwegian Direct Payment Register (PTR) is a database covering all units that claim direct payments on the basis of eligible animals and acreage. As almost all farms apply for payments and as almost all animal and crop production activities are eligible for various kinds of direct payments, the database represents an unique tool to analyse farm structural change. This paper contains a detailed description of the database and presents some possible venues to conduct such research.

Keywords
Direct payments, farm register, database, structural change, Norway

1 Introduction

The aim of this paper is to present the Norwegian Direct Payment Register (abbreviated PTR in Norwegian) and to indicate how it may be used to analyse farm structural change.

2 Construction of data set

The analysis is based on data from the Norwegian Direct Payment Register PTR (*Produksjonstilskuddsregister*). The register contains agricultural area by crop and number of animals by type of animal for every farm that applies for the large variety of direct payments covered by Norwegian agricultural policies. As almost all traditional agricultural activities are eligible for at least one type of direct payments and as almost all active farms apply for direct payments, the data base basically contains total agricultural area and total animal numbers for virtually any significant activity in Norwegian agriculture. A few exceptions apply. Eligibility for direct payments is subject to certain conditions, one of which is a minimum economic size of the farm (measured by turn-over) in order to prevent “hobby-farms” from receiving subsidies. As a consequence, the total numbers of acreage and/or animals may be somewhat underestimated when compared with other official sources such as slaughter statistics or the decennial total farm census.

A further important aspect is that the farm operator, and not the farm owner, of the land and/or animals applies for the payments. Based on the database, we are not able to distinguish between managed land that is owned and managed land that is rented.

This analysis utilizes data for the years 1999, 2003 and 2009. Data for all years in between are available, but yet unused. Individuals and legal entities managing agricultural area or keeping animals eligible for direct payments may apply for subsidies by filling in data in the register. The register links the amount of acreage and animals with three applicants’ characteristics: business identification number (*foretaksnummer*), producer number (*produsentnummer*), and property number (*kommune-, bruks- og gårdsnummer*). The business identification number is a measure of the business units occupied in agriculture. Usually, a farm constitutes one business unit, but it is not unusual that a farm consists of several units. That is increasingly the case in dairy where several farms join to invest in a large dairy operation. The joint dairy farm may have its own business identification number, while the remaining activities on the participating farms are covered by the original business identification number. The producer number is personal. Farm intergenerational transfer could thus be measured, but for the purpose of our analysis we do not regard intergenerational transfer in which the farm continues to apply for direct payments as structural change.

We rely on the property number as the unit of analysis. Property units present in 1999, but not in 2003 and 2009 as well as property units present in 2003 but not in 2009 are assumed to have left the sector.[1] A couple of aspects follow from this choice. As mentioned already, we disregard if farms split their activities in different business units. We also disregard shifts in ownership. We do, however, keep the two identification numbers in the dataset so as to open for the possibility of investigating some of these issues. Also, the property number contains the municipality to which the property belongs to.

As mentioned above, the register covers almost all of Norwegian agriculture due to the comprehensive and complex system of agricultural policies. The register contains 126 different crop and animal activities. Although the vast number of direct payments facilitates a comprehensive database, the back side of the medal is that changes in the regulations imply changes in the database, and hence breaks, making comparisons before and after the change challenging. Also, the register of a certain activity will cease if the associated payment is ceased. Fortunate enough, Norway still has enough oil money minimizing the number of direct payments that are eliminated. Rather, the list of activities recorded in the database is steadily increasing with honey bees as the latest addition. In this case, of course, no historical records (from the time bee farmers had to manage without subsidies) are available.

Table 1 shows the number of farms covered in the database using the three measures mentioned above and compared to the number of farms recorded in other statistics.

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[1] In very rare occasions, it might be the case that properties have been split up causing the emergence of new property units. This cannot be checked in our dataset.

Table 1. Number of farms for various accounting measures

	1999	2003	2009
Property number (NAA 2011)	66,892	54,752	45,460
Business number (NAA 2011)	66,832	53,465	45,420
Producer number (NAA 2011)	n.a.	54,752	45,458
Number of farms (Statistics Norway 2011)	70,740	58,231	47,688

Source: NAA (2011) and Statistics Norway (2011)

Table 1 reveals that there are small differences between the three measures to identify farms. For all practical purposes regarding the analysis, the number of properties, the number of businesses and the number of producers appears to be the same. Further, the numbers are somewhat lower than the number of farms provided by the Statistical Office (Statistics Norway). The reason is probably certain size limits regarding the eligibility of direct payments.

Table 2 shows the development of farms covered by the PTR for the years 1999, 2003 and 2009. Active farms are farms that apply for direct payments in a given year. Exiting farms are farms that apply a given year, but not in the following year. Entering farms are farms that apply in a given year, but not in the preceding year. Note that the terms "following year" and "preceding year" refer to the three years covered, 1999, 2003, and 2009, and not to the calendar year. For example, 1999 is the preceding year of 2003. By matching property numbers, we are able to track the development of each farm with respect to the three years covered. Almost 67,000 farms applied for direct payments in 1999, but almost 14,000 exited within the next four years as they did not apply for direct payments in 2003. As about 1,400 farms entered after 1999 and before 2003, the number of active farms was about 54,000 that year.

Table 2. Development of farms between 1999, 2003 and 2009

	1999	2003	2009
Active farms in preceding year	n.a.	52,435	41,804
Entry	n.a.	1,405	3,656
Active farms in current year	66,892	53,840	45,460
Exit	14,457	12,036	n.a.

Source: Own calculations

The number of farm entries in 2009 was considerably higher than in 2003, even if one accounts for the longer time period between 2003 and 2009 compared to the period from 1999 to 2003. There were also about 4,000 farms that applied for direct payments in

2009, but not in 1999. Moreover, about 1,000 farms applied for direct payments in 1999 and 2009, but not in 2003. There may be several explanations for these observations. In general, there may be a latent number of farms that operate near the limits of what is considered a farm in terms of direct payment eligibility, and it may be kind of accidental whether they fall inside or outside. For those farms, an additional reason not to apply for direct payments may be the paperwork involved. It may also be the case, that land owned by those farms was rented out some years so that another farmer applied for direct payments that year, and that the farm took back its land and applied for payments on its own. In some occasions, farming might actually have started up on those properties. Without any additional information, we treat farm entries and farm exists as they appear in the database. This may potentially overstate the number of farm exists in the sense of permanent farm exists, and may overstate the number of farm entries in the sense of farm entry where no farming activities where ever recorded in the past.

3 Data overview

Table 3 shows some descriptive statistics (i.e., number of farms applying, mean, variance, maximum, minimum, and total number) for selected types of area and animals for farms with at least one unit of that type in the respective year. The codes in parenthesis refer to the codes used in the PTR.

The table illustrates structural change that has taken place in the period covering ten years. For most crops and animals, the number of farms has decreased while the men as well as the variance and the maximum have increased. The only exception, possibly due to data error due to a change in the calculation of poultry, is chicken where the mean and the maximum have decreased. For both hens and chicken that legal (and binding) regulation limiting the numbers of poultry to be held on a farm becomes clearly visible. A similar regulation is in place for pigs.

Table 3. Descriptive statistics for selected farm variables in 1999, 2003 and 2009 [1)]

Variable	Year	N	Mean	Variance	Min	Max	Total
Other livestock (119, 124, 125, 126, 127, 128, 129)	1999	29,127	22.9	316.57	1.0	443.0	668,150
	2003	23,624	25.9	496.78	0.5	855.0	612,767
	2009	16,923	33.0	1,095.23	1.0	812.0	559,275
Dairy cows (120)	1999	22,277	14.3	47.38	1.0	147.0	317,560
	2003	17,419	15.9	70.32	0.5	165.5	277,082
	2009	11,517	21.2	179.72	1.0	169.0	244,614
Suckler cows (121)	1999	5,108	6.6	56.35	1.0	99.0	33,921
	2003	6,001	8.2	77.28	0.5	132.5	49,057
	2009	4,952	12.3	143.30	1.0	218.0	61,045
Sheep (134)	1999	21,862	41.9	1,308.11	1.0	460.0	915,278
	2003	18,052	50.8	1,754.30	1.0	462.0	917,558
	2009	14,440	57.7	2,548.26	1.0	629.0	832,668
Lambs (136)	1999	21,726	62.5	3,385.39	1.0	785.0	1,358,335
	2003	17,995	80.0	5,117.80	1.0	897.0	1,439,046
	2009	14,393	95.8	8,189.32	1.0	1,207.0	1,378,834
Goats (140, 142)	1999	723	73.0	935.69	2.0	340.0	52,762
	2003	584	76.9	950.32	3.0	182.0	44,932
	2009	409	90.2	1,857.07	5.0	336.0	36,894
Goat kid (143, 144)	1999	319	14.9	261.52	1.0	130.0	4,753
	2003	1,286	14.1	241.51	0.5	164.5	18,155
	2009	1,144	15.5	705.13	1.0	468.0	17,722
Sows (155)	1999	3,274	18.2	298.88	1.0	266.0	59,730
	2003	2,315	24.7	600.87	0.3	388.0	57,076
	2009	1,491	38.2	2,024.20	1.0	631.0	56,886
Slaugther pigs (157)	1999	3,785	86.0	8,878.73	1.0	1,328.0	325,437
	2003	3,824	102.1	13,992.32	0.5	1,920.0	390,469
	2009	2,121	208.5	36,222.47	1.0	1,470.0	442,244
Laying hens (160)	1999	3,768	0.9	4.04	0.0	36.0	3,227
	2003	3,134	1.0	5.42	0.0	36.6	3,147
	2009	1,992	2.0	11.40	0.0	36.0	3,973
Chicken (186)	1999	394	22.7	580.50	0.0	200.0	8,935
	2003	368	19.8	479.20	0.0	225.0	7,298
	2009	365	28.7	910.51	0.0	125.0	10,471
Potatoes (230)	1999	9,858	15.0	1,312.52	1.0	675.0	148,047
	2003	6,255	22.9	2,603.73	1.0	841.0	143,428
	2009	3,097	44.4	7,366.54	1.0	1,417.0	137,384
Oilseeds (237, 244)	1999	1,019	62.4	2,447.71	1.0	550.0	63,608
	2003	1,089	68.5	2,479.79	1.0	500.0	74,634
	2009	496	87.1	4,942.27	1.0	700.0	43,206

Variable	Year	N	Mean	Variance	Min	Max	Total
Peas (245)	1999	165	57.2	1,508.87	1.0	250.0	9,445
	2003	178	56.4	1,866.13	1.0	360.0	10,042
	2009	204	72.9	3,740.00	2.0	612.0	14,864
Greenhouse (250)	1999	957	0.1	0.06	0.0	5.0	118
	2003	741	0.1	0.05	0.0	2.8	100
	2009	501	0.2	0.16	0.0	4.8	104
Vegetables (260, 263, 264)	1999	1,874	27.2	2,448.99	1.0	745.0	50,960
	2003	1,485	36.1	4,718.71	1.0	1,215.0	53,609
	2009	969	59.0	16,379.91	1.0	1,647.0	57,213
Apples and other tree fruits (271, 272, 273, 274)	1999	1,693	16.1	373.81	1.0	275.0	27,186
	2003	1,265	18.4	451.30	1.0	275.0	23,292
	2009	1,005	21.4	547.18	1.0	275.0	21,502
Other fruits (280, 281)	1999	1,969	10.7	385.96	1.0	295.0	21,027
	2003	1,415	16.6	1,130.81	1.0	487.0	23,530
	2009	955	21.1	2,003.85	1.0	819.0	20,152
Cereals (237, 238, 240, 242, 243, 245)	1999	20,642	161.4	23,809.63	1.0	2,811.0	3,332,351
	2003	17,198	190.9	35,376.59	1.0	3,080.0	3,282,324
	2009	13,786	225.0	53,686.59	1.0	5,234.0	3,101,548
Fodder (210, 211, 212, 213)	1999	53,763	123.8	8,653.99	1.0	2,161.0	6,653,556
	2003	42,469	154.9	12,752.62	1.0	2,152.0	6,580,471
	2009	35,700	186.4	23,250.05	1.0	2,030.0	6,654,615
Fruits and vegetables (271, 272, 273, 274, 280, 281)	1999	3,223	15.0	458.01	1.0	296.0	48,213
	2003	2,370	19.8	945.98	1.0	487.0	46,822
	2009	1,733	24.0	1,443.51	1.0	819.0	41,654
Total agricultural area	1999	66,319	154.3	17,717.70	0.0	3,411.0	10,233,245
	2003	53,173	190.1	26,075.74	0.0	3,826.0	10,106,753
	2009	44,492	224.6	42,686.97	0.0	5,413.0	9,992,518
Agricultural labour (man-years)	1999	66,461	1.2	0.19	0.6	21.6	81,597
	2003	53,411	1.3	0.25	0.6	16.0	72,102
	2009	44,887	1.3	0.32	0.6	27.0	57,299
Direct payments (1,000 nominal kr)	1999	66,638	168.4	1,7735.47	0.0	1,259.5	11,221,327
	2003	53,505	212.2	2,6658.54	0.0	1,866.7	11,351,306
	2009	45,044	270.8	5,1053.85	0.0	3,006.4	12,197,621
Total agricultural support 1,000 (nominal kr)	1999	66,423	322.9	11,1526.47	0.3	7,753.5	21,450,793
	2003	53,501	450.3	25,5817.03	0.2	18,849.6	24,090,535
	2009	45,027	514.1	48,8189.89	0.2	25,821.3	23,149,821
Economic output (1,000 nominal kr)	1999	66,638	294.0	8,0873.74	0.1	7,541.6	19,591,400
	2003	53,505	373.1	13,4171.17	0.1	9,090.3	19,965,031
	2009	45,044	438.5	21,5107.82	0.1	7,879.1	19,749,846

1) Acreage in ha (10 daa), animals in heads (poultry in 1,000 heads)
Source: Own calculations

Besides crops and animals, the table includes a variable for agricultural labour measured in man-years. Labour is calculated on an activity basis using data provided by the agricultural sector model Jordmod (Mittenzwei and Gaasland 2008). Labour per farm is composed of (1) a coefficient for each activity multiplied with the activity level and (2) a farm-specific constant. While the (marginal) coefficient is held constant over the entire period, the farm-specific constant accounts for technology induced growth in labour productivity with an annual reduction of about 5 hours. Moreover, per farm labour is calibrated to fit the official numbers for man-years in agriculture. The correction coefficients vary between 25 and 35 per cent indicating that, amongst possible data misspecification, the PTR only covers farms that apply for direct payments, while the official numbers correct for agricultural activity on farms too small to be eligible for those payments.

There are two variables measuring support to agriculture. While the first variable ('direct payments') covers direct payments and other subsidies financed by taxpayers, the second variable ('total agricultural support') also includes border protection financed by consumers. Table 4 indicates that support to agriculture amounts to roughly two-thirds of the sector's production value (including direct payments).

Table 4. Decomposition of production value including subsidies for Norwegian agriculture in 1999, 2003 and 2009

	1999	**2003**	**2009**
Support financed by taxpayers	11 176	11 256	12 234
Support financed by consumers	9 211	10 133	8 939
Market income at world market prices	8 251	8 681	13 583
%-PSE	71	71	61

Source: OECD (2011)

Direct payments per farm are calculated for each of the three years using the actual payment rates and eligibility rules for the most important support measures. According to table 5, these cover between 70 and 80 per cent of all direct payments. Most of these payments are based on current levels for almost all animals and crops that are produced in the country. Payment rates are commonly differentiated by region and farm size so as to counter natural handicaps and economies of scale. The remaining payments are grouped together and distributed per unit of acreage and animal using a key related to environmental cross-compliance. Income tax deduction and agro-environmental support stand out as the two single most important measures in that group. Without further knowledge, it seems impossible to allocate these payments to agricultural activities in a meaningful way.

Table 5. Treatment of direct payments in the analysis

Type of direct payment	1999	2003	2009
Specified payments	83.5	77.3	69.2
Income tax deduction	0.0	5.3	7.2
Investment support	1.9	1.9	3.0
Agro-environmental support (incl. organic farming)	1.9	3.5	8.6
Fuel tax concession	3.6	3.2	3.7
Transport subsidies for various commodities	2.1	3.2	2.9
Price support wool	1.5	1.5	1.1
Rest	5.4	4.2	4.2

Source: Own calculation.

Border protection (or market price support) is measured by the OECD on a commodity basis. It is calculated for the most important commodities only, and extended to the remaining commodities on a production value basis. In the analysis border protection is calculated per unit of crops and animals. That is straightforward for products like pig, sheep and poultry, but somewhat complicated to beef and milk because of joint production. Therefore, border protection for milk has been allocated to dairy cows, while border protection for beef has been allocated to livestock other than cows. For products not specified by the OECD (mostly fruit and vegetables), border protection has been calculated based on official import prices. While national yields have been assumed for animal production, while regional yields were assumed in crop production due to large regional differences in climatic and natural conditions.

The variable 'Economic output' measures basically market income and its calculation method is consistent with the principles used by Eurostat. The mean of economic output is lower than the mean of total agricultural support for all three years (see table 3). This underlines the importance of agricultural support for market returns and, finally, farm incomes.

3.1 Farms with agricultural area

Figure 1 shows the distribution of all farms with agricultural area in 1999 and 2009.

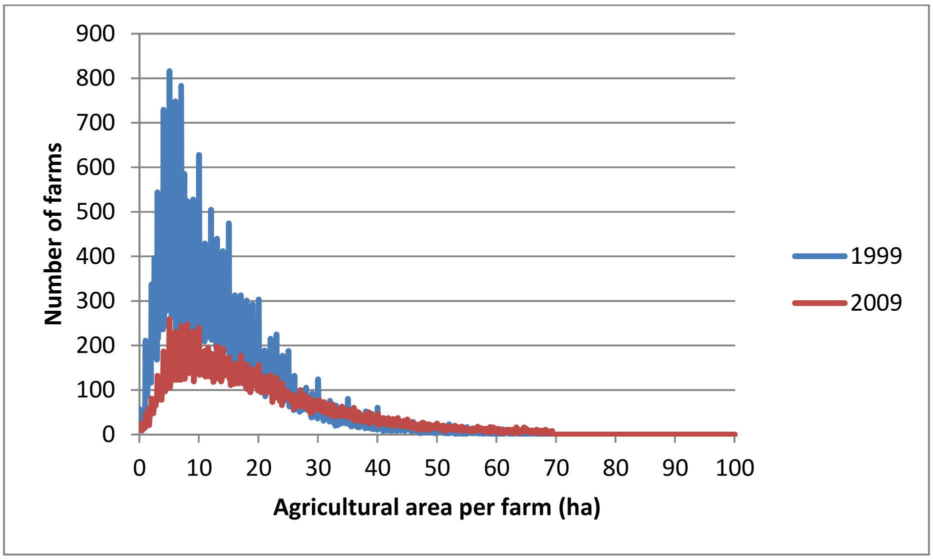

Figure 1. Distribution of farms with agricultural area

The distribution is skewed to the right as there are some very large farms. In fact, the largest farm (327.5 ha in 1999, and 541.3 ha in 2009) is not even shown in figure 1 that "stops" at 100 ha. The reduction of the number of farms is quite visible as well is the slight increase in the mean from 14 ha to 21 ha.

Figure 2 depicts the development of farms with agricultural area for the two periods 1999 – 2003 and 2003 – 2009. As the length of the two periods differs, growth rates are calculated on an annual basis. A growth rate of 1.0 indicates no change, while a growth rate of > 1 (< 1) compares to an increase (a reduction) in agricultural area. All farms with agricultural area in 1999 and 2003 are depicted. If farms quit the sector between 2003 and 2009, the second period growth rate is set to '0' (horizontal axis in figure 2). It turns out that farms behave very differently. Farms that expand their agricultural area in the first period may reduce their area in the second period (south-east area in figure) as well as expand their area further (north-east area in figure). There are also farms that shrink in the first period, but expand in the second period (north-west area in figure). It appears that the number of farms that shrink throughout the two periods (south-west area in figure) is smallest, but one should have in mind that there is a considerable number of farms that left the sector during the second period. In fact, there are farms that left the sector although they expanded their agricultural area during the first period.

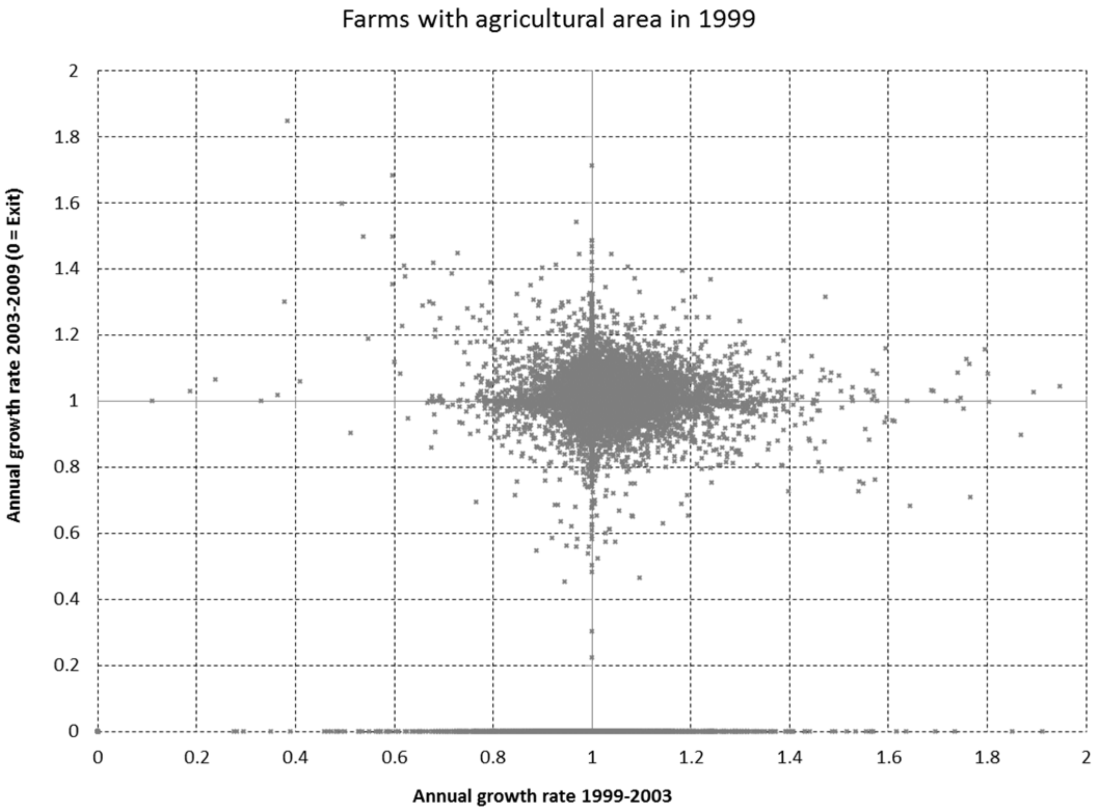

Figure 2. Development of farms with agricultural area

Figure 2 indicates that the commonly hold belief of "growth or exit" (i.e., that farms either grow or decrease and eventually exit) may be insufficient for a large number of farms. The picture seems to be much more non-linear. However, in order to support non-linearity, it would be necessary to study more than two periods. Note also, that there are farms that experience, partly substantial, growth in the first period, but exit in the second period (observations on the horizontal axis to the right of value '1'). However, the figure gives no indication on the number of such farms.

Table 3 shows the development of farms with agricultural area in 1999 between 1999 and 2009. The group sizes are chosen such that each of the three groups contains about one-third of all eligible farms in 1999.

Table 6. Development of farms with agricultural area between 1999 and 2009 1), 2)

	# in 1999	Exit by 2009	Small by 2009	Medium by 2009	Large by 2009
Small in 1999	21 827	13 615	5 459	2 121	632
	0.329	0.624	0.250	0.097	0.029
Medium in 1999	21 907	7 608	1 469	8 075	4 755
	0.331	0.347	0.067	0.369	0.217
Large in 1999	22 536	4 511	338	1 781	15 906
	0.340	0.200	0.015	0.079	0.706
Total for group	66 270	25 734	7 266	11 977	21 293
		0.388	0.110	0.181	0.321

1) For each cell, absolute number of farms and Markov-probability are provided above and below, respectively.
2) Small: < 8.1 ha , medium: 8.1 – 17.0 ha large: > 17.0 ha
Source: Own calculations

There were about 66,000 farms with agricultural area in 1999.[2] The size classes have been chosen such that the farms are about evenly split for 1999. Almost one out of four farms quit farming by 2009. Although there is a higher probability for small farms to quit, farm exit is an option chosen by large farms, too. Farms seldom reduce size, they rather exit. The probability that a large farm in 1999 ends up as a medium farm or small farm in 2009 is about 10 per cent. Similarly, the probability that a medium farm in 1999 becomes a small farm in 2009 is less than 10 per cent. Moreover, farm growth does not seem to occur rapidly. Less than 3 per cent of small farms in 1999 made it to large farms in 2009. While about one-third of all farms or 21,827 farms in 1999 were contained in the smallest size group, by 2009 this group was almost extinct with just 632 farms remaining.

3.2 Farms with dairy cows

Figure 2 shows the distribution of farms with dairy cows in 1999 and 2009. The number of dairy farms has decreased over the years, while the mean has slightly increased, partly as a result of tradable milk quotas and the merger of dairy activities on single farms to larger separate dairy firms.

[2] Note the difference to the total number of farms in 1999 which was 66,892. There are about 700 farms that have applied for direct payments in 199, but not for payments based on land.

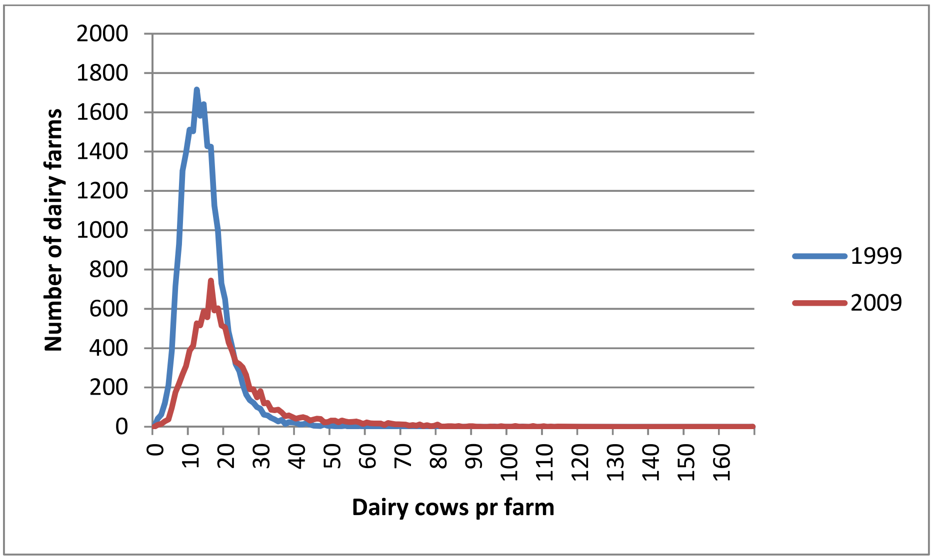

Figure 3. Distribution of farms with dairy cows

Compared to figure 2, figure 4 indicates that "growth or exit" is more relevant for dairy farms. It seems that the share of dairy farms that reduce in both periods is smaller than the respective share of all farms.

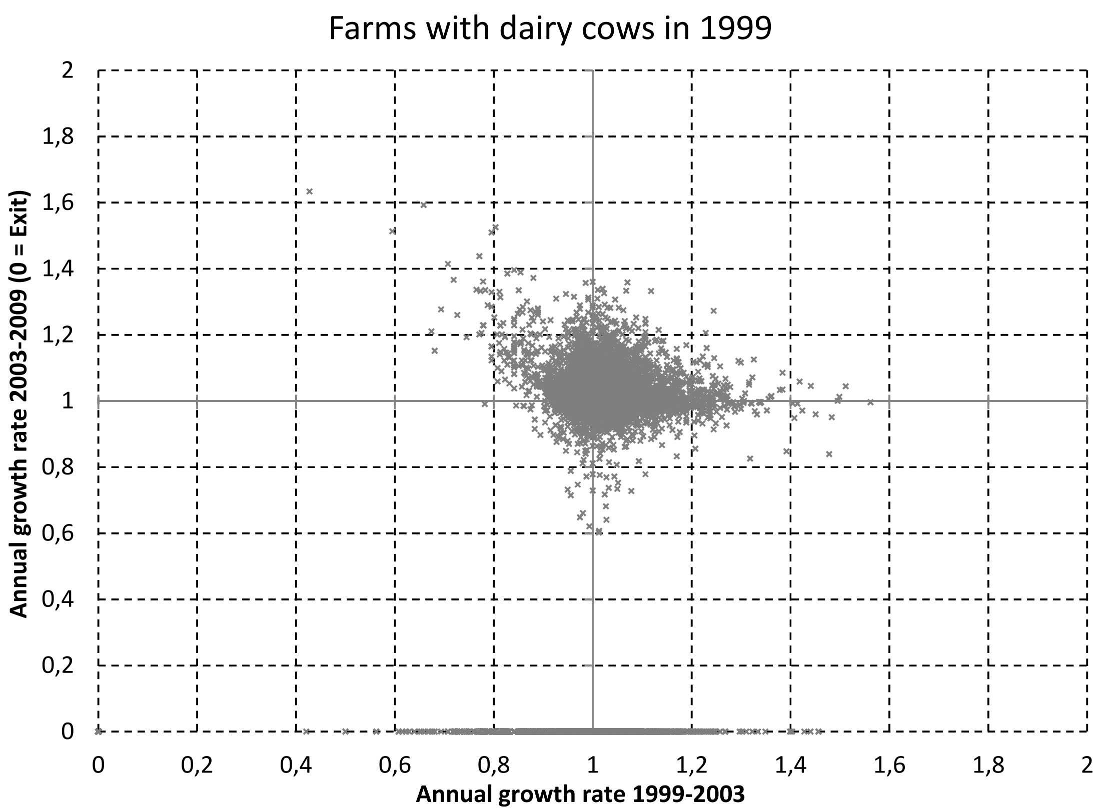

Figure 4. Development of farms with dairy cows

This would indicate that there is a relative stronger incentive and/or pressure to grow for dairy farms. This picture is supported by the numbers in table 7. There seems to have been more structural changes in dairy farms compared to all farms as more than one-half of all dairy farms disappeared within the 10 years period. In addition, there is a slight larger probability for medium-size farms to expand into the large farm group than to stay in their group. There are even smaller probabilities that dairy cow farms reduce their size. It is very uncommon to maintain dairy farming with a lower number of dairy cows.

Table 7. Development of farms with dairy cows between 1999 and 2009 1), 2)

	# in 1999	Exit by 2009	Small by 2009	Medium by 2009	Large by 2009
Small in 1999	6 592 0.296	4 475 0.679	1 131 0.172	656 0.100	330 0.050
Medium in 1999	7 830 0.352	3 958 0.505	279 0.036	1 509 0.193	2 084 0.266
Large in 1999	7 814 0.351	2 948 0.377	40 0.005	296 0.038	4 530 0.580
Total for group	22 236	11 381 0.512	1 450 0.065	2 461 0.111	6 944 0.312

1) For each cell, absolute number of farms and Markov-probability are provided above and below, respectively.
2) Small: < 11 cows, medium: 11 – 16 cows, large: > 16 cows

Source: Own calculations

3.3 Farms with cereals and oilseeds

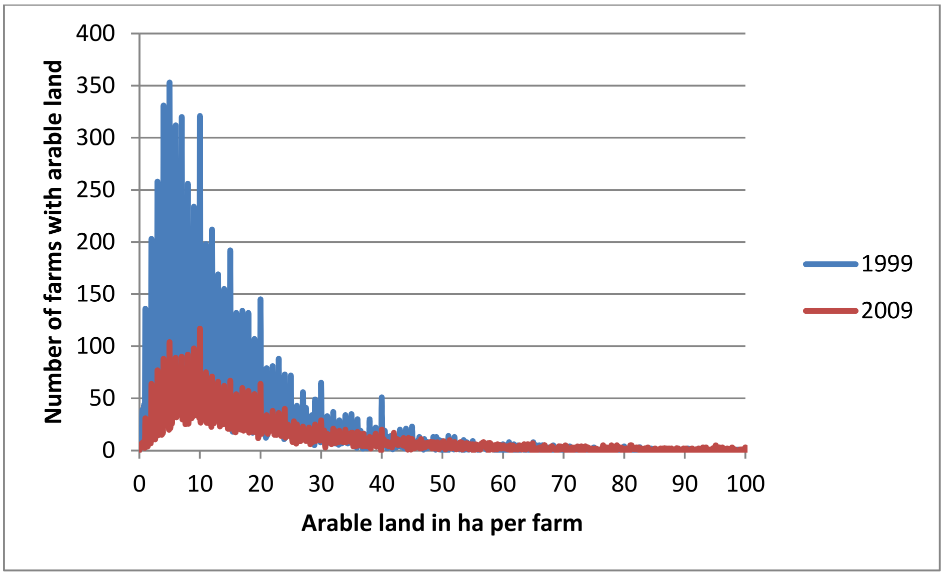

Figure 5. Distribution of farms with cereals and oilseeds

Figure 5 shows the distribution of farms with cereals and oilseeds, while the development of farms with cereals and oilseeds is shown in figure 6.

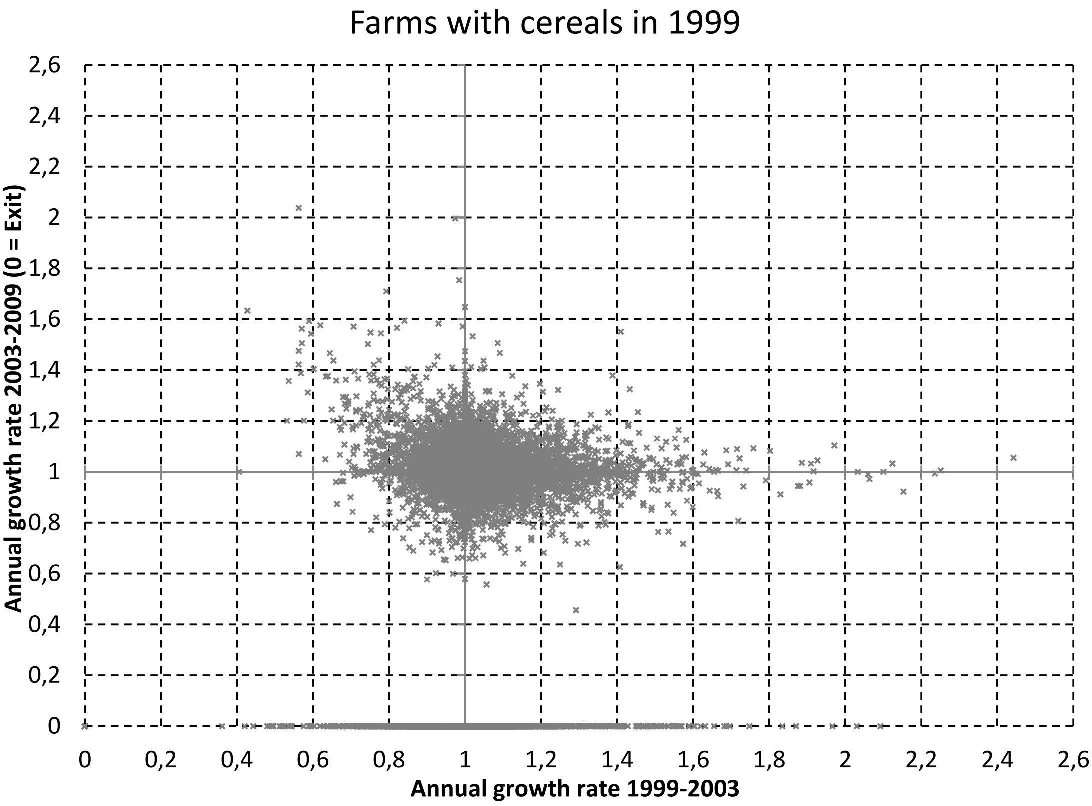

Figure 6. Development of farms with cereals and oilseeds

Table 8 shows the development of farms with arable crops in 1999 between 1999 and 2009. Similarly to the corresponding graphs for all farms and dairy farms, it is interesting to note that, for most farms, annual growth is limited. Also, there does not seem to be a clear pattern regarding the relationship in the development between the two periods.

Table 8. Development of farms with arable crops between 1999 and 2009 [1), 2)]

	# in 1999	Exit by 2009	Small by 2009	Medium by 2009	Large by 2009
Small in 1999	6 671	4 212	1 525	677	257
	0.324	0.631	0.229	0.101	0.039
Medium in 1999	6 935	2 791	531	2 578	1 035
	0.337	0.402	0.077	0.372	0.149
Large in 1999	6 971	1 623	87	589	4 672
	0.339	0.233	0.012	0.084	0.670
Total for group	20 577	8 626	2 143	3 844	5 964
		0.419	0.104	0.187	0.290

1) For each cell, absolute number of farms and Markov-probability are provided above and below, respectively.
2) Small: < 7.5 ha, medium: 7.5 – 16.8 ha large: > 16.8 ha
Source: Own calculations

There were about 20,000 farms with arable crops in 1999. Between one-third and one-half of these farms exit arable cropping by 2009, but they may still have applied for other crops or animals.

Farm exit occurred throughout size classes, with a higher probability for small farms going out of production. For the medium and large farms, there is a tendency to remain in the same size. Medium sized farms most often either stay or quit, while large farms most often stay.

3.4 Farms with labour

If one measures farm development by labour (paid or unpaid, own or hired), the picture becomes somewhat different (figure 7). The population looks more like a “cross” indicating that a period of growth or decline follows a period of stability and vice versa. Moreover, there seems to be a negative relationship of growth in the two periods: If farms grow in the first period, they seem to be stable or decline in the second period. Similarly, farms that decline in the first period seem to be stable or grow in the second period. Note, however, that there are also farms that exit in the second period.

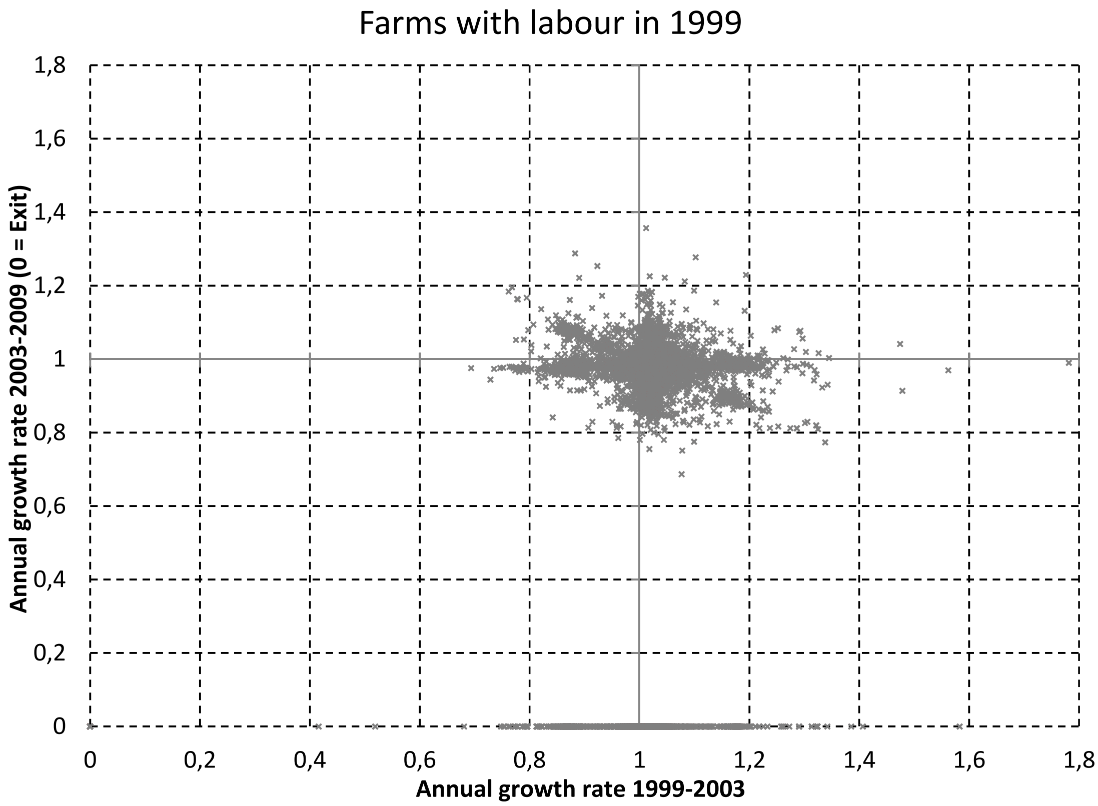

Figure 7. Development of farms with labour

The differences of measuring farm development using labour compared to acreage or animals are also evident from table 9. While about 60 to 70 percent of large farms remain large measured by acreage or animals, this is true only for about 50 per cent of respective farms measured by labour. While it is quite unlikely if that small farms in 1999 become medium sized farms in 2009 if measured by acreage or animals, this is the case for almost one out of three large farms if measured by labour. On the other hand, there is a smaller chance for small and medium-sized farms to grow.

Note that 'growth' here is defined net growth in labour productivity as the labour coefficients take into account exogenous annual growth in labour productivity.

Table 9. Development of farms with labour between 1999 and 2009 [1), 2)]

	# in 1999	Exit by 2009	Small by 2009	Medium by 2009	Large by 2009
Small in 1999	22 400	11 861	9 483	568	488
	0.337	0.530	0.423	0.025	0.022
Medium in 1999	22 481	8 989	5 809	5 637	2 046
	0.338	0.400	0.258	0.251	0.091
Large in 1999	21 638	4 694	2 581	3 712	10 651
	0.325	0.217	0.119	0.172	0.492
Total for group	66 519	25 544	17 873	9 917	13 185
		0.384	0.269	0.149	0.198

) For each cell, absolute number of farms and Markov-probability are provided above and below, respectively.
2) Small: < 2.088 hours, medium: 2.088 – 2.396 hours, large: > 2.396 hours

Source: Own calculations

3.5 Farms with direct payments

Figure 8 shows the development of farms measured by the amount of direct payments (i.e, support financed by consumers) received.

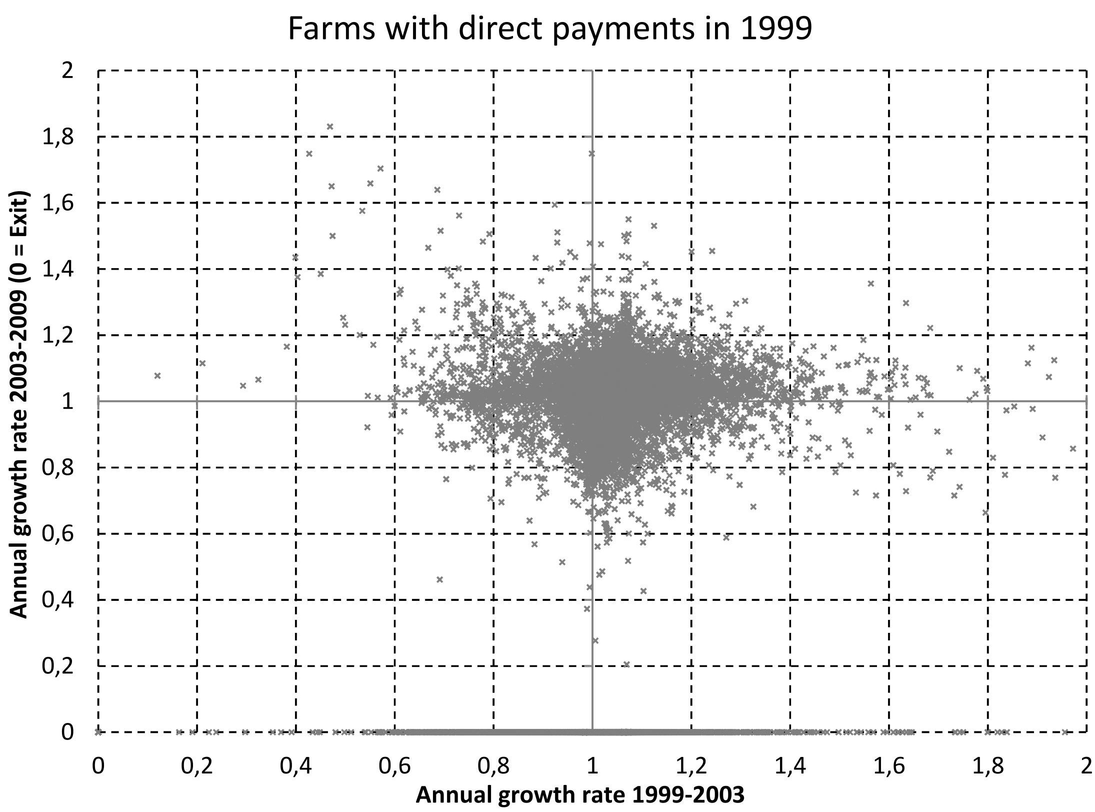

Figure 8. Development of farms with direct payments

It seems that most farms have enjoyed increased support in the first period, but many of those seem to have experienced a reduction in support in the second period (south-east area of figure 8). The distribution of farms in figure 8 appears to be similar to the distribution of farms measured by agricultural area in figure 2 indicating a, probably not surprising, positive relationship between direct payments and agricultural area.

3.6 Farms with total support

In figure 9, direct payments are extended with border protection (i.e., support financed by consumers) to give total support to agriculture. Compared to figure 8, the growth rates in the second period seem to be smaller. Lower world market prices in 2007 and 2008 that led to reduced border protection are a possible reason.

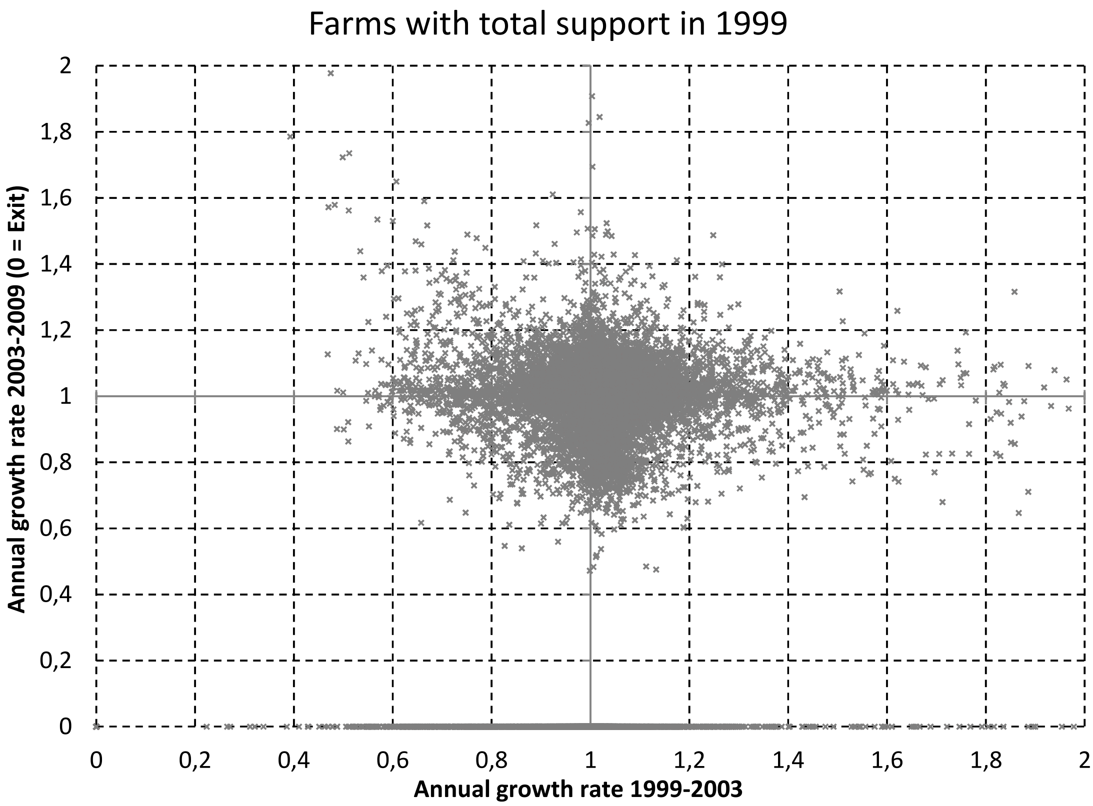

Figure 9. Development of farms with total support

3.7 Farms with economic output

Finally, farm growth is measured by economic output, i.e. market incomes. Economic output hence covers border protection, but not support financed by taxpayers. Figure 10 provides a picture for all farms, while figure 11 presents a sample. There is one farm that increased its economic size by factor 7 annually. This farm tells the success story of a Norwegian farm only comparable to Isak Sellanrå in Knut Hamsun's famous Nobel-prize awarded novel 'The growth of the soil'. The farm's economic output in 1999 was based on two laying hens. One of those must have laid a golden egg. Just four years later, the farm had grown to accommodate 263 sheep and 65 ha of arable land. These numbers remained stable until 2009, but the farm grew with additional 11 livestock.

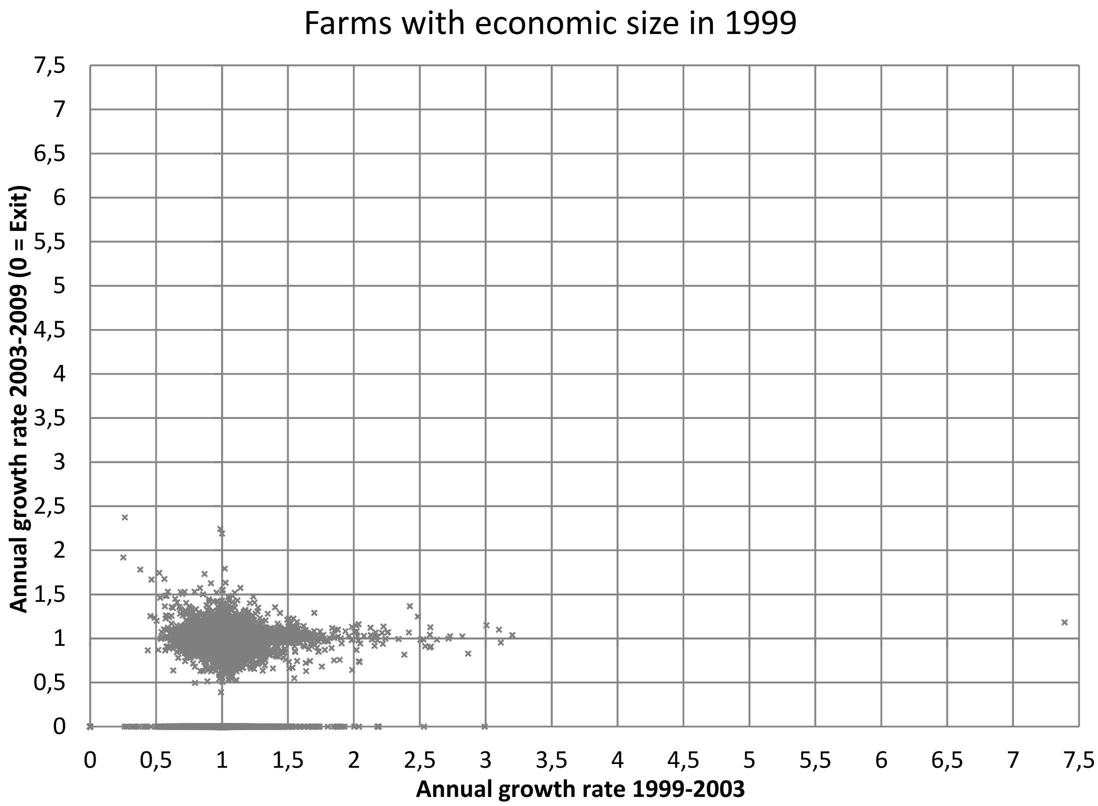

Figure 10. Development of farms with economic size

Figure 11 shows a 'tail' to the right, indicating numerous farms that grew measured by economic size in the first period, but remaining rather stable in the second period. It also seems that there was more growth in the first period than in the second period.

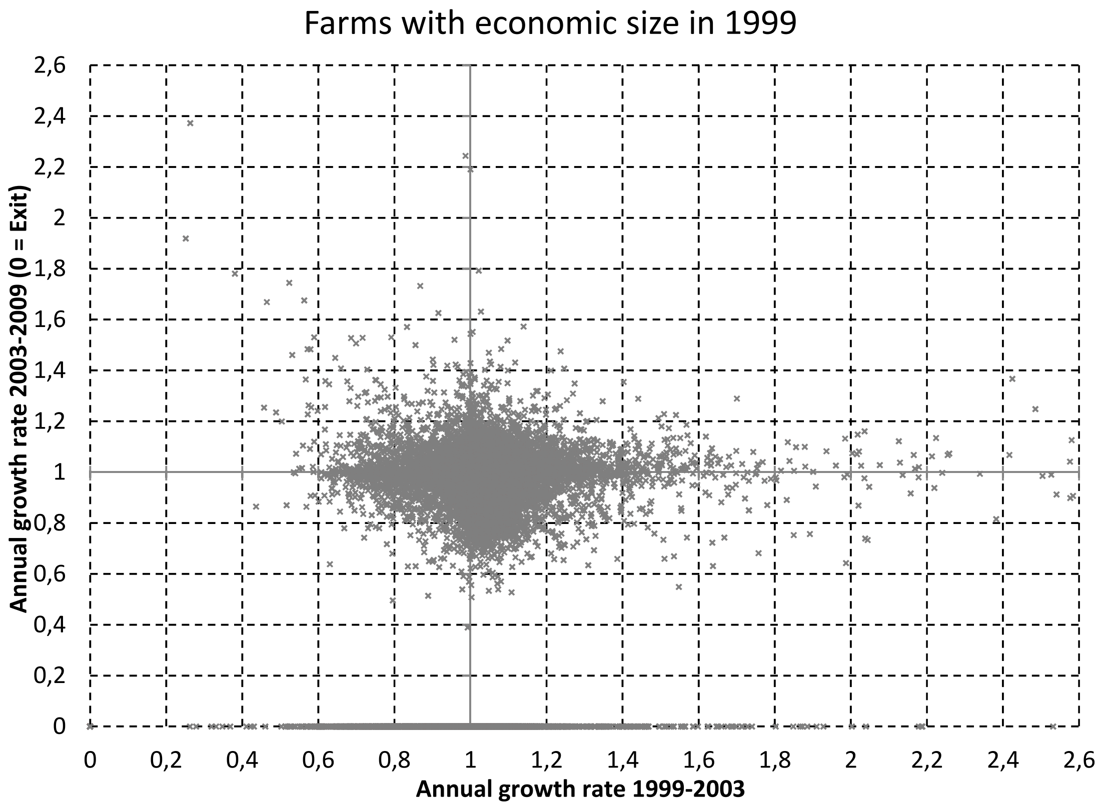

Figure 11. Development of farms with economic size

3.8 Farms with age

Table 9 and figure 12 show the decomposition of active farms, exit farms and entry farms by age. It is interesting to note that the age distribution of farmers that quit the sector between 1999 and 2009 is quite consistent with the age distribution of active farmers in 1999. That means, that there are relatively as many young as old farmers that leave the sector.

Table 9. Decomposition of exit, entry and active farmers by age group

Age group	Active farmers in 1999		Exit farmers by 2009		Entry farmers by 2009	
	absolute	%	absolute	%	absolute	%
20-30	2881	4.3	1232	4.6	1237	31.9
30-40	12468	18.7	4928	18.3	1246	32.1
40-50	19600	29.4	7230	26.8	883	22.8
50-60	18866	28.3	7030	26.1	462	11.9
60-70	10817	16.2	5246	19.5	43	1.1
70-80	1968	2.9	1140	4.2	9	0.2
>80	174	0.3	129	0.5	1	0.0

Source: Own calculations

The age distribution of entering farmers is more in line with the common life cycle hypothesis. Farmers are young when they occupy a farm.

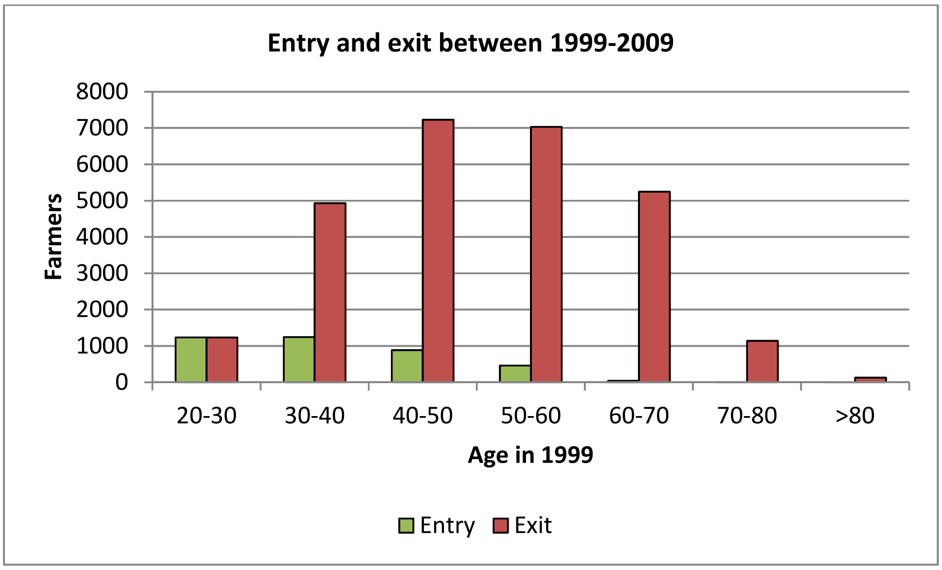

Figure 12. Entry and exit between 1999 and 2009 (by age in 1999)

4 Preliminary analysis

This section contains some preliminary analysis as a starting point for stimulating discussion.

4.1 Does acreage growth depend on acreage growth in the path?

This regression is performed only for farms that had acreage in 1999, 2003 and 2009. Farms that quit the sector are dropped. 'UAAR0309' (annual percentage growth in acreage between 2003 and 2009) is the dependent variable to be explained by 'UAAR9903' (annual percentage growth in acreage between 1999 and 2003), 'UAAR99' (acreage in 1999), 'TOTS99' (total support in 1999), 'TOTS9903' (arithmetic difference in total support 1999 and 2003), 'AGE' (farmer's age in 1999) and 'REGION' (46 labour market regions as a proxy for alternative job market opportunities with low numbers in the South and high numbers in the North, see Bhuller 2009 for reference).

The descriptive statistics and correlation matrix are presented below.

Variable	Obs	Mean	Std. Dev.	Min	Max
uaar9903	39160	1.028513	.0886733	.1115141	4.022082
uaar0309	39160	1.010147	.0721992	.223061	2.759908
uaar99	39160	186.0052	139.4141	.0147	3411
tots99	39160	365.436	288.0507	3.646018	6427.069
tots9903	39160	52.22542	202.0588	-6274.499	5685.251
age	39160	48.18917	10.91776	7	90
region	39160	39.29722	19.83663	11	83

	uaar9903	uaar0309	uaar99	tots99	tots9903	age	region
uaar9903	1.0000						
uaar0309	-0.0685	1.0000					
uaar99	-0.1175	-0.0471	1.0000				
tots99	-0.0441	0.0063	0.6289	1.0000			
tots9903	0.3135	0.0349	0.1927	0.1051	1.0000		
age	-0.0410	-0.0288	-0.0260	-0.0040	-0.0384	1.0000	
region	0.0382	0.0293	-0.1344	0.1011	0.0175	0.1854	1.0000

Support to agriculture is often related to acreage and animal numbers as can be seen from the high correlation between TOTS99 and UAAR99. The correlation coefficients of the other variables are probably rather small. Note that growth in acreage between 1999 and 2003 is negatively correlated to growth in acreage between 2003 and 2009. Farms appear to be larger in the south (negative correlation between UAAR99 and REGION), but grow faster.

The results of the regression analysis are shown below.

Source	SS	df	MS
Model	3.56374279	6	.593957132
Residual	200.561209	39153	.005122499
Total	204.124952	39159	.005212721

Number of obs	= 39160
F(6, 39153)	= 115.95
Prob > F	= 0.0000
R-squared	= 0.0175
Adj R-squared	= 0.0173
Root MSE	= .07157

uaar0309	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
uaar9903	-.0870295	.004384	-19.85	0.000	-.0956222	-.0784369
uaar99	-.0000587	3.56e-06	-16.51	0.000	-.0000657	-.0000518
tots99	.0000157	1.67e-06	9.39	0.000	.0000124	.0000189
tots9903	.0000293	1.95e-06	15.06	0.000	.0000255	.0000331
age	-.0002373	.0000338	-7.02	0.000	-.0003035	-.0001711
region	.0000619	.0000193	3.20	0.001	.000024	.0000998
_cons	1.112333	.0049515	224.65	0.000	1.102628	1.122038

All independent variables seem significant, probably due to the very high number of observations. Still, the variation in the independent variables does not explain very much of the variation of the dependent variable. Farm growth in the first period contributes negatively to farm growth in the second period. This is somewhat inconsistent with the "growth-or-exit" hypothesis, but maybe more consistent with a life cycle hypothesis assuming that farms grow after succession and remain rather stable thereafter. This view is supported by the negative sign of the age variable. The positive sign of the regional variable indicates that farms in the North grow faster than farms in the South. Total support and growth in total support contribute positively to growth in acreage in the second period.

4.2 Does labour growth depend on labour growth in the path?

This regression is performed only for farms that had labour in 1999, 2003 and 2009. Farms with labour that quit the sector between 1999 and 2009 are dropped. 'LABO0309' (annual percentage growth in labour between 2003 and 2009) is the dependent variable to be explained by 'LABO9903' (annual percentage growth in labour between 1999 and 2003), 'LABO99' (labour in 1999), 'TOTS99' (total support in 1999), 'TOTS9903' (arithmetic difference in total support between 1999 and 2003), 'AGE' (farmer's age in 1999) and 'REGION' (46 labour market regions as a proxy for alternative job market opportunities with low numbers in the South and high numbers in the North, see Bhuller 2009 for reference).

The descriptive statistics and correlation matrix are presented below.

Variable	Obs	Mean	Std. Dev.	Min	Max
labo9903	39603	1.018828	.0448089	.6934751	1.781489
labo0309	39603	.9782826	.0333476	.6687996	1.356753
labo99	39603	2347.56	814.0139	1050.121	18122.8
tots99	39603	367.0625	290.3587	.18945	6427.069
tots9903	39603	52.5192	205.5155	-6274.499	5685.251
age	39603	48.18034	10.93241	7	90
region	39603	39.30366	19.80828	11	83

	labo9903	labo0309	labo99	tots99	tots9903	age	region
labo9903	1.0000						
labo0309	-0.1713	1.0000					
labo99	-0.1619	-0.0523	1.0000				
tots99	-0.0249	0.0048	0.3664	1.0000			
tots9903	0.3407	0.0100	0.0847	0.0993	1.0000		
age	-0.0306	-0.0295	-0.0035	-0.0062	-0.0392	1.0000	
region	0.0116	-0.0011	0.2178	0.0968	0.0160	0.1855	1.0000

Support to agriculture is less related to labour than it was to acreage. The correlation coefficients of the other variables are rather small. Again we see that growth in labour between 1999 and 2003 is negatively correlated to growth in labour between 2003 and 2009 (which can also be inferred from figure 7). However, it's important to have in mind that the labour coefficients are adjusted for exogenous technical progress over time. Note that farms grew faster in the north between 1999 and 2003, but faster in the south between 2003 and 2009.

The results of the regression analysis are shown below.

Source	SS	df	MS
Model	2.01998951	6	.336664918
Residual	42.0199746	39596	.001061218
Total	44.0399641	39602	.001112064

Number of obs	=	39603
F(6, 39596)	=	317.24
Prob > F	=	0.0000
R-squared	=	0.0459
Adj R-squared	=	0.0457
Root MSE	=	.03258

labo0309	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
labo9903	-.164445	.0039765	-41.35	0.000	-.1722391	-.1566509
labo99	-4.61e-06	2.26e-07	-20.45	0.000	-5.06e-06	-4.17e-06
tots99	3.29e-06	6.08e-07	5.41	0.000	2.09e-06	4.48e-06
tots9903	.0000146	8.59e-07	17.00	0.000	.0000129	.0000163
age	-.0001169	.0000153	-7.65	0.000	-.0001468	-.0000869
region	.0000487	8.64e-06	5.64	0.000	.0000318	.0000656
_cons	1.158398	.0042354	273.51	0.000	1.150096	1.166699

All independent variables are significant. Although the variation in the independent variables does not explain very much of the dependent variable's variation, it seems to be higher for labour (0.0459) than for acreage (0.0175). Farm growth in the first period contributes negatively to farm growth in the second period. Consistent with the life cycle hypothesis? This view is supported by the negative sign of the age variable. The positive sign of the regional variable indicates that farms in the north grow faster than farms in the south. Total support and growth in total support contribute positively to growth in labour in the second period.

4.3 Does growth in economic output depend on growth in economic output in the path?

This regression is performed only for farms that had economic output in 1999, 2003 and 2009. Farms with economic output in 1999 that quit the sector between 1999 and 2009 are dropped. 'ESUV0309' (annual percentage growth in economic output between 2003 and 2009) is the dependent variable to be explained by 'ESUV9903' (annual percentage growth in economic output between 1999 and 2003), 'ESUV99' (economic output in 1999), 'TOTS99' (total support in 1999), 'TOTS9903' (arithmetic difference in total support between 1999 and 2003), 'AGE' (farmer's age in 1999) and 'REGION' (46 labour market regions as a proxy for alternative job market opportunities with low numbers in the South and high numbers in the North, see Bhuller 2009 for reference).

The descriptive statistics and correlation matrix are presented below.

Variable	Obs	Mean	Std. Dev.	Min	Max
esuv9903	39557	1.046492	.1426597	.2514626	7.391404
esuv0309	39557	.988395	.0988787	.3685125	2.481104
esuv99	39557	404.4576	347.9923	.326	6464.44
tots99	39557	367.402	290.3408	.18945	6427.069
tots9903	39557	52.50202	205.5949	-6274.499	5685.251
age	39557	48.18146	10.93176	7	90
region	39557	39.30606	19.80815	11	83

	esuv9903	esuv0309	esuv99	tots99	tots9903	age	region
esuv9903	1.0000						
esuv0309	-0.0379	1.0000					
esuv99	-0.0629	-0.0511	1.0000				
tots99	-0.0333	-0.0385	0.8942	1.0000			
tots9903	0.5364	-0.0228	0.1647	0.0994	1.0000		
age	-0.0530	-0.0292	-0.0077	-0.0063	-0.0392	1.0000	
region	0.0028	-0.0290	0.0788	0.0969	0.0160	0.1857	1.0000

Not surprisingly, support to agriculture is strongly related to economic output. Therefore, TOTS99 and TOTS9903 are omitted from the regression. The correlation coefficients of the other variables are rather small. Again we see that growth in economic output between 1999 and 2003 is negatively correlated to growth in economic output between 2003 and 2009.

The results of the regression analysis are shown below.

Source	SS	df	MS
Model	2.20113518	4	.550283796
Residual	384.53768	39552	.009722332
Total	386.738815	39556	.009776995

Number of obs	= 39557
F(4, 39552)	= 56.60
Prob > F	= 0.0000
R-squared	= 0.0057
Adj R-squared	= 0.0056
Root MSE	= .0986

esuv0309	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
esuv9903	-.0295659	.0034877	-8.48	0.000	-.0364018	-.02273
esuv99	-.0000149	1.43e-06	-10.41	0.000	-.0000177	-.0000121
age	-.000255	.0000462	-5.51	0.000	-.0003456	-.0001644
region	-.0000975	.0000256	-3.82	0.000	-.0001476	-.0000474
_cons	1.041488	.0044786	232.55	0.000	1.03271	1.050267

All independent variables are significant, but the variation in the independent variables explains almost nothing of the dependent variable's variation. Farm growth in the first period contributes negatively to farm growth in the second period. Also, the larger the farm in the first period, the lower is farm growth in the second period. Consistent with the life cycle hypothesis? This view is supported by the negative sign of the age variable. The negative sign of the regional variable indicates that farms in the north grow slower than farms in the south.

4.4 Does first period farm development have an impact on the decision of farm exit vs. continued farming in the second period?

This multinomial logistic regression is performed for all farms with **acreage** in 1999 and 2003. A binary variable 'EXIT0309' is generated with the value of '1' indicating continued farming between 2003 and 2009 (or 'success') and the value of '0' indicating farm exit between 2003 and 2009 (i.e., no acreage)[3] (or 'failure'). Other variables are 'UAAR9903' (arithmetic difference in acreage between 1999 and 2003'), 'UAAR99' (acreage in 1999), 'TOTS99' (total support in 1999), 'TOTS9903' (arithmetic difference in total support between 1999 and 2003), 'AGE' (farmer's age in 1999) and 'REGION' (46 labour market regions).

The descriptive statistics for the sample and the two sub-groups are shown below.

All farms

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	51200	.7648438	.4241006	0	1
uaar9903	51200	17.68534	75.17495	-1032	2672
uaar99	51200	171.7101	133.6598	.0147	3411
tots9903	51200	36.42778	197.4601	-7461.609	5685.251
tots99	51200	335.6278	283.4427	3.646018	7541.578
age	51200	48.43941	11.12558	7	90
region	51200	39.62572	19.77998	11	83

Failure: Exit0309 = 0 (farms that exit)

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	12040	0	0	0	0
uaar9903	12040	1.375252	58.85465	-739	997
uaar99	12040	125.2154	99.64293	.027	2080
tots9903	12040	-14.95388	171.9463	-7461.609	2969.955
tots99	12040	238.6772	243.9066	5.722062	7541.578
age	12040	49.25332	11.73981	13	88
region	12040	40.69419	19.55726	11	83

Success: Exit0309 = 1 (farms that continue)

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	39160	1	0	1	1
uaar9903	39160	22.69998	78.84778	-1032	2672
uaar99	39160	186.0052	139.4141	.0147	3411
tots9903	39160	52.22542	202.0588	-6274.499	5685.251
tots99	39160	365.436	288.0507	3.646018	6427.069
age	39160	48.18917	10.91776	7	90
region	39160	39.29722	19.83663	11	83

[3] In principal, there might be farms that have animals, but no acreage. These farms are considered as farms that have left the sector.

It appears that the two sub-groups are quite similar with respect to age and geographical location, but farms that exit are smaller, receive less total support and exhibit a reduction in total support in the first period, while farms that do not exit experience an increase.

The coefficients of correlation for the whole sample are shown below.

```
             | exit0309 uaar9903   uaar99 tots9903   tots99      age   region
-------------+---------------------------------------------------------------
    exit0309 |   1.0000
    uaar9903 |   0.1203   1.0000
      uaar99 |   0.1929   0.0716   1.0000
    tots9903 |   0.1443   0.4712   0.1841   1.0000
      tots99 |   0.1897   0.1017   0.6345   0.0833   1.0000
         age |  -0.0406  -0.0416  -0.0319  -0.0432  -0.0174   1.0000
      region |  -0.0300  -0.0008  -0.1257   0.0033   0.0969   0.1538   1.0000
```

Total support and the change in support is somewhat correlated with acreage, but none of the independent variables is correlated with the binary exit variable. The results of the multinomial logistic regression are shown below.

```
Multinomial logistic regression                   Number of obs   =      51200
                                                  LR chi2(6)      =    4597.25
                                                  Prob > chi2     =     0.0000
Log likelihood = -25627.496                       Pseudo R2       =     0.0823

------------------------------------------------------------------------------
    exit0309 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
0            |
    uaar9903 |  -.0047599   .0002678   -17.77   0.000    -.0052848    -.004235
      uaar99 |  -.0033081   .0001668   -19.83   0.000     -.003635   -.0029812
    tots9903 |  -.0018943    .000093   -20.36   0.000    -.0020766    -.001712
      tots99 |   -.001369    .000071   -19.28   0.000    -.0015082   -.0012298
         age |   .0055372   .0009847     5.62   0.000     .0036073    .0074671
      region |   .0048197   .0005849     8.24   0.000     .0036734     .005966
       _cons |  -.6846176   .0550434   -12.44   0.000    -.7925007   -.5767345
-------------+----------------------------------------------------------------
1            |  (base outcome)
------------------------------------------------------------------------------
```

All variables are highly significant, but there is not much explanation. It is more likely that small farms, farms that grow slow, that receive less total support and that experience low growth in support exit. Moreover, it is more likely that farms with older farmers and farms in the northern regions exit.

4.5 Does first period farm development have an impact on the decision of farm exit vs. continued farming in the second period?

This multinomial logistic regression is performed for all farms with **labour** in 1999 and 2003. A binary variable 'EXIT0309' is generated with the value of '1' indicating continued farming between 2003 and 2009 (or 'success') and the value of '0' indicating farm exit between 2003 and 2009 (i.e., no labour) (or 'failure'). Other variables are

'LABO9903' (arithmetic difference in labour between 1999 and 2003'), 'LABO99' (labour in 1999), 'TOTS99' (total support in 1999), 'TOTS9903' (arithmetic difference in total support between 1999 and 2003), 'AGE' (farmer's age in 1999) and 'REGION' (46 labour market regions).

The descriptive statistics for the sample and the two sub-groups are shown below.

All farms

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	51578	.7678274	.4222226	0	1
labo9903	51578	165.0668	525.2258	-38323.6	13269.96
labo99	51578	2308.385	820.5824	1050.121	39507.05
tots9903	51577	36.15333	199.3694	-7461.609	5685.251
tots99	51578	335.8936	284.0197	.18945	7541.578
age	51578	48.43455	11.13564	7	90
region	51578	39.63345	19.76585	11	83

Failure: Exit0309 = 0 (farms that exit)

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	11975	0	0	0	0
labo9903	11975	90.52074	603.4725	-38323.6	11505.31
labo99	11975	2178.829	828.8908	1050.121	39507.05
tots9903	11974	-17.97541	166.4471	-7461.609	2758.636
tots99	11975	232.8137	234.0777	1.005392	7541.578
age	11975	49.27524	11.74418	13	88
region	11975	40.72409	19.5862	11	83

Success: Exit0309 = 1 (farms that continue)

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	39603	1	0	1	1
labo9903	39603	187.6078	496.968	-7038.811	13269.96
labo99	39603	2347.56	814.0139	1050.121	18122.8
tots9903	39603	52.5192	205.5155	-6274.499	5685.251
tots99	39603	367.0625	290.3587	.18945	6427.069
age	39603	48.18034	10.93241	7	90
region	39603	39.30366	19.80828	11	83

It appears that the two sub-groups are quite similar with respect to age, geographical location and labour in 1999, but farms that exit perform less growth with regard to labour, receive less total support and exhibit a reduction in total support in the first period, while farms that do not exit experience an increase.

The coefficients of correlation for the whole sample are shown below.

	exit0309	labo9903	labo99	tots9903	tots99	age	region
exit0309	1.0000						
labo9903	0.0780	1.0000					
labo99	0.0868	-0.0893	1.0000				
tots9903	0.1493	0.3952	0.0352	1.0000			
tots99	0.1996	-0.0059	0.3957	0.0757	1.0000		
age	-0.0415	-0.0267	-0.0084	-0.0422	-0.0185	1.0000	
region	-0.0304	0.0268	0.2228	0.0040	0.0947	0.1534	1.0000
	exit0309	uaar9903	uaar99	tots9903	tots99	age	region

Total support and the change in support is somewhat correlated with labour, but none of the independent variables is correlated with the binary exit variable. The results of the multinomial logistic regression are shown below.

```
Multinomial logistic regression                   Number of obs   =      51577
                                                  LR chi2(6)      =    4575.86
                                                  Prob > chi2     =     0.0000
Log likelihood =  -25660.12                       Pseudo R2       =     0.0819

------------------------------------------------------------------------------
    exit0309 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
0            |
    labo9903 |  -.0001428   .0000275    -5.19   0.000    -.0001967   -.0000889
      labo99 |  -.0000634   .0000174    -3.63   0.000    -.0000976   -.0000292
    tots9903 |  -.0030185   .0000898   -33.60   0.000    -.0031946   -.0028424
      tots99 |   -.002632    .000059   -44.58   0.000    -.0027478   -.0025163
         age |   .0053693   .0009829     5.46   0.000     .0034429    .0072958
      region |   .0085452   .0005879    14.54   0.000      .007393    .0096974
       _cons |  -.8558697   .0602125   -14.21   0.000     -.973884   -.7378554
-------------+----------------------------------------------------------------
1            |  (base outcome)
------------------------------------------------------------------------------
```

The picture is quite similar to the multinomial logistic regression measuring farm size by acreage. All variables are highly significant, but there is not much explanation. It is more likely that those farms exit that are small, that grow slowly, that receive less total support and that experience low growth in support. Moreover, it is more likely that farms with older farmers and farms in the northern regions exit.

4.6 Does first period farm development have an impact on the decision of farm exit vs. continued farming in the second period?

This multinomial logistic regression is performed for all farms with **economic output** in 1999 and 2003. A binary variable 'EXIT0309' is generated with the value of '1' indicating continued farming between 2003 and 2009 (or 'success') and the value of '0' indicating farm exit between 2003 and 2009 (i.e., no economic output) (or 'failure'). Other variables are 'ESUV9903' (arithmetic difference in economic output between 1999 and 2003'), 'ESUV99' (economic output in 1999), 'TOTS99' (total support in 1999), 'TOTS9903' (arithmetic difference in total support between 1999 and 2003), 'AGE' (farmer's age in 1999) and 'REGION' (46 labour market regions).

The descriptive statistics for the sample and the two sub-groups are shown below.

All farms

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	51508	.7679778	.4221272	0	1
esuv9903	51508	80.07759	302.9598	-5883.863	18526.32
esuv99	51508	368.0795	335.0834	.326	7230.675
tots9903	51508	36.11966	199.4392	-7461.609	5685.251
tots99	51508	336.256	284.0254	.18945	7541.578
age	51508	48.43729	11.13511	7	90
region	51508	39.64289	19.76469	11	83

Failure: Exit0309 = 0 (farms that exit)

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	11951	0	0	0	0
esuv9903	11951	3.294177	204.0468	-3791.795	4171.607
esuv99	11951	247.6703	253.4208	1.428395	7230.675
tots9903	11951	-18.10485	166.4251	-7461.609	2758.636
tots99	11951	233.1649	234.1587	1.005392	7541.578
age	11951	49.28408	11.74398	13	88
region	11951	40.75776	19.57966	11	83

Success: Exit0309 = 1 (farms that continue)

Variable	Obs	Mean	Std. Dev.	Min	Max
exit0309	39557	1	0	1	1
esuv9903	39557	103.2755	323.4469	-5883.863	18526.32
esuv99	39557	404.4576	347.9923	.326	6464.44
tots9903	39557	52.50202	205.5949	-6274.499	5685.251
tots99	39557	367.402	290.3408	.18945	6427.069
age	39557	48.18146	10.93176	7	90
region	39557	39.30606	19.80815	11	83

It appears that the two sub-groups are quite similar with respect to age and geographical location, but farms that exit are smaller with regard to economic output, perform less output growth, receive less total support and exhibit a reduction in total support in the first period, while farms that do not exit experience an increase.

The coefficients of correlation for the whole sample are shown below.

	exit0309	esuv9903	esuv99	tots9903	tots99	age	region
exit0309	1.0000						
esuv9903	0.1393	1.0000					
esuv99	0.1975	0.1943	1.0000				
tots9903	0.1494	0.6398	0.1504	1.0000			
tots99	0.1995	0.2075	0.8995	0.0759	1.0000		
age	-0.0418	-0.0419	-0.0206	-0.0422	-0.0188	1.0000	
region	-0.0310	0.0013	0.0798	0.0039	0.0944	0.1533	1.0000
	exit0309	labo9903	labo99	tots9903	tots99	age	region

As earlier experienced, total support and economic output are correlated. Therefore, total support in 1999 and its change from 1999 to 2003 is omitted.

The results of the multinomial logistic regression are shown below.

```
Multinomial logistic regression                   Number of obs   =      51508
                                                  LR chi2(4)      =    4474.86
                                                  Prob > chi2     =     0.0000
Log likelihood = -25664.882                       Pseudo R2       =     0.0802

------------------------------------------------------------------------------
    exit0309 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
0            |
    esuv9903 |  -3.424465   .0902638   -37.94   0.000    -3.601378   -3.247551
      esuv99 |  -.0023319   .0000489   -47.67   0.000    -.0024278   -.0022361
         age |   .0049396   .0009859     5.01   0.000     .0030072     .006872
      region |   .0076939   .0005614    13.70   0.000     .0065935    .0087942
       _cons |    2.47157    .106903    23.12   0.000     2.262044    2.681096
-------------+----------------------------------------------------------------
1            |  (base outcome)
------------------------------------------------------------------------------
```

The picture is quite similar to the multinomial logistic regressions measuring farm size by acreage and labour. All variables are highly significant, but there is not much explanation. It is more likely that those farms exit that are small and that grow slowly. Moreover, it is more likely that farms with older farmers and farms in the northern regions exit.

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