Exploring the reasons for differences in structural change between organic and conventional agriculture in Norway

Introduction and motivation

Globally, agriculture provides food and a large variety of ecosystem services such as agrobiodiversity and cultural landscape, as well as greenhouse gas emissions. In Norway, agriculture is particularly important also for maintaining decentralized settlements and viable rural areas. The four strategic goals for agricultural policy in Norway are food security, maintaining agriculture across the country, increased value creation, and sustainable agriculture with lower emissions of greenhouse gases (Ministry of Agriculture and Food, 2016). With these goals, the government focuses on increasing organic production and consumption due to perceived beneficial effects for the environment, health, taste, and animal welfare (Ministry of Agriculture and Food, 2009). Yet the ambition for organic farming was downscaled in 2018 by replacing a target of 15 percent of overall production and consumption to stimulate organic farming to the level demanded by consumers (Ministry of Agriculture and Food, 2018). This can be seen as a response to the continuous low share of organic products produced and consumed in Norway (Agriculture Directorate, 2021).

The policy goals are supported by comprehensive subsidies, including payments to organic farming. Total support accounted for about 50 percent of gross farm receipts between 2020-2022, while the share of organic payments in budget support was below 1 per cent (OECD, 2023). The reduction in the number of active farms, so-called farm structural change, is a potential threat to sustainable development in rural areas. Generally, there are fewer alternative ways to earn income in rural areas, and they often require longer commuting. Also, from a geopolitical point of view I Norway, the continuous settlement of Northern Norway is a national security concern (NOU, 2023: 17). In this respect, the share of organic farms in all farms is increasing and farm exit rates are lower for organic compared to conventional (or non-organic) farms (Norway Digitalization Agency, 2023).

There is limited research on the comparison of the development of conventional and organic farming. Instead, there is a comprehensive literature that explain the failure of increasing

production and demand of organic food in Norway by studying organic farming only. Potential reasons for that failure include consumer reluctance (Vittersø & Tangeland, 2015; Kvakkestad et al., 2018), professional challenges of organic adoption (Flaten et al., 2005a), neighborhood effects (Marton & Storm, 2021), risk perceptions (Flaten et al., 2005b) and profitability and regulations (Flaten et al. 2010). In this paper, we explore the possible reasons for the observed differences in structural change between organic and conventional agriculture in Norway.

The descriptive analysis indicates higher exit rates for conventional farms than organic farms. However, it is unclear whether this difference is significant and what explains why organic farming is relatively more "robust" to structural change. Based on previous studies, we hypothesize that organic payments, management practices, farm size, location, and neighborhood effects may be important drivers for this observation. In addition, there might be more long-term investments in organic farming, or a higher willingness to put in effort for more environmental measures as part of a farm family lifestyle. The overall ambition is to explore whether organic farming supported by policies could imply a more stable sector and production over time. In other words, could organic farming "work against" structural change?

Data

Data on farm structure and its change over time is scarce in Europe. However, the Norwegian Freedom of Information Act (2009) ensures the publication of governmental aid payments to legal entities and private persons. This includes agricultural holdings, which are eligible for many subsidies, price premiums, and compensation payments. The respective payments, alongside the agricultural land, kept animals, grown crops, and harvest for which farmers receive payments, are published annually in the national data catalog (Norway Digitalization Agency, 2023). Almost any grown crop and farm animal receives funding. There are specific payments for organic produce in terms of acreage and animals (Norway Digitalization Agency, 2023). Together with the high share of governmental aid in farm income (about 50 percent according to OECD 2023), does the database cover most of the Norwegian farm population. Each legal entity that receives payments has a unique identification number which can be used to track farms over time, even in the case of farm succession or changes in administrative units like municipalities. In this context, we define a farm in a particular year as organic if that farm has received organic payments for at least one eligible

activity (i.e., crop and animal). This implies that farms that combine conventional and organic farming are defined as organic farms. Farms that do not receive any organic subsidies are defined as conventional (or non-organic) farms.

To identify farms over time, we use the farm's VAT number registered on the farmer. The VAT number may change if a successor takes over the farm or the farm is sold. Therefore, we also include spatial identifiers to avoid a change in the VAT number that erroneously considered farm structural change. We will also amend the data by providing information on the inherited land and infrastructures offered by the cadastral office. Information on prices of main agricultural inputs and outputs may be obtained from the Norwegian agricultural accounts (Budget Committee for Agriculture, 2023). Finally, we extend the observed period from 2010 to 2021. This will enable a more comprehensive examination of agricultural trends and structural change over an extended period.

Method

To investigate the probability of organic and conventional farms exiting the agricultural sector, we will analyze annual individual farm data by using an econometric model. We follow an approach taken by two previous studies of particular importance. Marton and Storm (2021) study the neighborhood effects on conventional and organic farms, they divide the population into two groups: dairy farms that remain conventional in time *t*, and farms that convert to organic in time *t*. The authors use a probit panel model to estimate the probability of conversion, conditional on farm characteristics and neighborhood affiliations. Storm, Mittenzwei, and Heckelei (2014) also use a probit model when they investigate the effects of direct payments to a farm and its neighbors on the farm's survival. Their dependent variable is whether a farm is still active, looking at farms between 1999 and 2009. Both studies explore the structural change of farms over time.

For our analysis, we will extend these two studies. For instance, contrary to the two studies, we also have data about production quantities, which are relevant for comparing organic and conventional agriculture, as organic farms have lower yields than conventional farms due to lower input use. However, we are still interested in the probability of farm exit for organic and conventional farms and the potential differences between the groups.

Results of the descriptive analysis

Table 1 shows a decrease in total farms that have applied for organic payments from 1747 farms in 2017 to 1709 in 2021. A similar trend applies to conventional farms. This aligns with the overall trend in Norway of a decreasing number of total farms (Statistisk sentralbyrå, 2023). However, within existing farms, there is a slight increase in the share of organic farms from 4.35 percent in 2017 to 4.47 percent in 2021.

Table 1. Number of farms applied for subsidy.

Year	Organic farms	Conventional farms	Total farms	Share of organic farms	Share of conventional farms
2017	1747	38450	40197	4.35 %	95.65 %
2018	1769	37883	39652	4.46 %	95.54 %
2019	1752	37256	39008	4.49 %	95.51 %
2020	1742	36880	38622	4.51 %	95.49 %
2021	1709	36483	38192	4.47 %	95.52 %

This increasing share of organic farms may support our hypothesis that organic farms are more robust to structural change. Table 2 shows the percentage change in the number of organic and conventional farms from year to year. We observe a smaller percentage change over five years for organic farms compared to conventional farms. While the exit rate for conventional farms is -5.12 percent from 2017 to 2021, the corresponding rate for organic farms is less than half at -2.18 percent. At the time of writing, we have no information on whether the farms that no longer apply for organic payments convert back to conventional farms or whether they exit the agricultural sector. The same is true for the conventional farms. Some of these farms might become organic farms instead of leaving the sector. This information will become available in due time before conducting the analysis.

Table 2. Percentage change in number of farms from previous year by type of farm (%).

Change from year to year	Organic	Conventional	Total
2017-2018	1.26%	-1.48%	-1.36%
2018-2019	-0.96%	-1.66%	-1.62%
2019-2020	-0.57%	-1.01%	-0.99%
2020-2021	-1.89%	-1.08%	-1.11%
2017-2021	-2.18%	-5.12%	-4.99%

The annual exit rate is more stable for conventional farms with 1-1.5 percent annual change from 2017-2021. The corresponding numbers for organic farms vary between -1.9 and 1.3 percent annual change during the same period. However, since the absolute number of conventional farms is much higher than that of organic farms, it is reasonable to observe smoother exit rates for the former farms.

In Table 3, we follow up on the previous research by Marton and Storm (2021), who looked at the neighborhood effects of organic conversion or exit of dairy farms to explore whether neighboring farms had an impact on each other. Dairy farming is one of Norway's most significant agricultural production forms (Statistisk sentralbyrå, 2023). Numbers of both organic and conventional dairy farms have declined over five-years, yet the share of farms with organic cows has experienced a small increase.

Table 3. Numbers of organic and conventional dairy farms.

Year	Farms with organic cows	Farms with conventional cows	Share of organic farms	Share of conventional farms
2017	264	8093	3,16 %	96,84 %
2018	262	7793	3,25 %	96,75 %
2019	256	7451	3,32 %	96,68 %
2020	245	7059	3,35 %	96,65 %
2021	234	6796	3,33 %	96,67 %

In Figure 1, we look at the average size of conventional and organic farms. Conventional farms are slightly larger than organic farms, whereas the organic average size does not change as much.

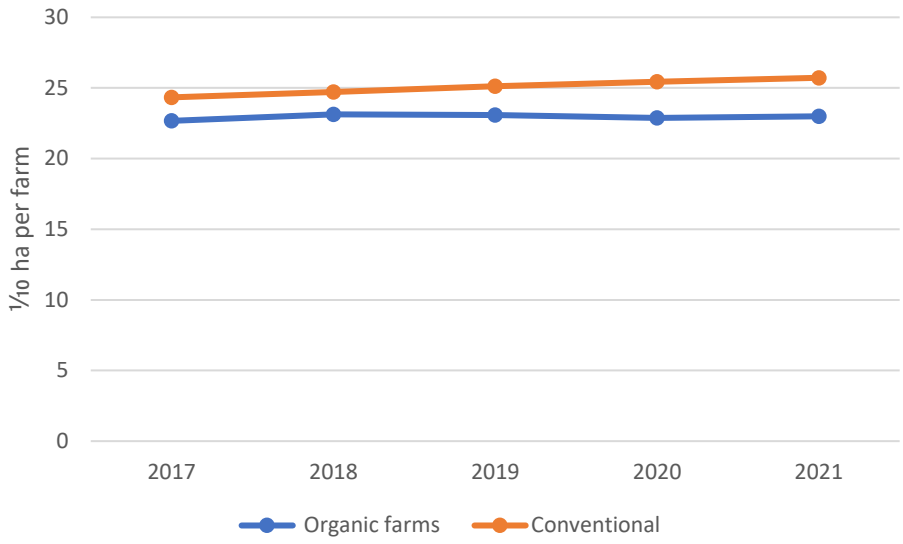

Figure 1. Average size of conventional and organic farms (ha per farm, 2017-2021)

Furthermore, Figure 2 shows that the total average subsidies are higher for organic farms compared to conventional farms. This is valid calculated both as total subsidies per farm (left panel) and total subsidies per ha (right panel). Notably, on average, organic farms receive higher subsidies per farm even if their farm size is smaller.

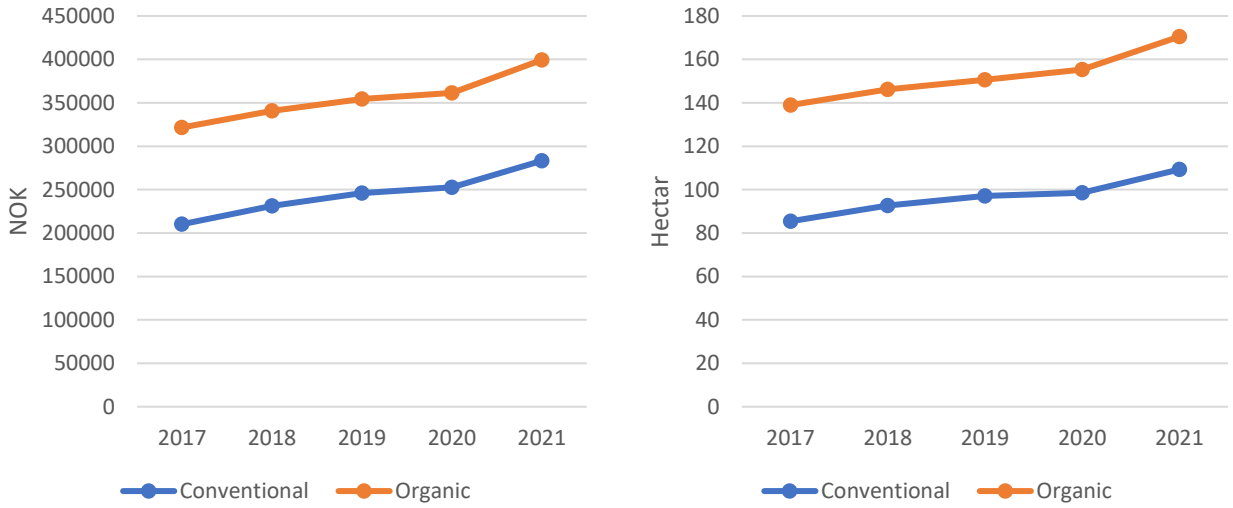

Figure 2. Average subsidies per farm (left panel) and average subsidies per ha (right panel) by type of farm

The descriptive analysis suggests that the observed data may support our hypothesis. However, we do not yet utilize information on the level of individual farms to see in which direction organic and

conventional farms change, i.e., whether they remain in the sector but convert to organic and conventional farming, respectively, or whether they quit farming altogether. Further analysis will decompose this development on the individual farm level.

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