Resilience of European farms under different CAP scenarios

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Abstract

The upcoming reform of the Common Agricultural Policy will put pressure on agricultural incomes and will cause more price volatility and income risk for farms in the EU. This raises the question if and how farms will survive these disturbances. Farms are able to survive only if they respond appropriately to disturbances. This resilience of farms is explained in this research by analysing the number of strategies that farmers indicate that they will use in a situation where the current CAP will continue and in a situation where it will disappear. The outcomes show that under both scenarios large more specialised farms with young farm heads are most resilient, and small more diversified farms headed by old farmers are least resilient. Results also show that farms that indicate to exit are the ones that are most dependent on CAP support, have old farm heads, and are part-time and diversified farms.

Keywords: resilience, governance, CAP reform, count model

1. Introduction

The upcoming reform of the Common Agricultural Policy (CAP), e.g. as a result of the discussion on the new EU budget (see European Commission, 2010), will put pressure on agricultural incomes and will cause more price volatility and income risk for farms in the EU. This raises the question if and how farms will survive these changes.

According to evolutionary theory, firms are able to survive only if they change appropriately over time in response to changes (see FitzRoy et al., 1998: 8 and Ricketts, 2002: 412). The ability to change is especially relevant for farm survival in cases of disturbances which can be described as events that a farm disrupt (cf. Janssen and Osnas, 2005: 95). The ability of a complex system as a farm to maintain its structural and functional capacity after a disturbance of the system is defined as resilience (see Perrings, 1998). A reformed CAP can be interpreted as a regime in which disturbances like price shocks can be expected to be more frequent, more severe and longer in duration. However, also without this reform disturbances are expected to take place but then in another policy and market regime.

The modes of farm and market governance are important factors that determine the farms' ability to survive. Farm governance refers to the way the farm is organised. For example, a limited liability organisational form as mode of organisation has lower risk bearing costs than a family farm (see e.g. Ricketts, 2002: 110). For this reason it can survive easier in a situation with more volatile prices and income uncertainty. Market governance is the way a farm organised its input and output transactions. For example, long term contracts could prevent timely adjustment of farming practices because the contract terms do not allow changes (e.g. in price). Reneging such a contract would also imply costs to the contract partners increasing certainty for farms. Farm and market governance are expected to differ between farms depending on farm and farm household characteristics, but will also differ between regions given the differences in legal structures and social and cultural values.

Farm resilience, the ability to change to cope with disturbance, is difficult to analyse empirically because disturbances differ in nature and it is the survivors that populate the databases. A way to investigate resilience in the case of CAP reform is to ask farmers how they would react to the situation where the current CAP will continue and to the situation where it will disappear. The farmers could give two types of answers. First, they could indicate that they will exit. Second, if they continue they can indicate if and how many (and which) alternative strategies they would follow to survive. In this paper we are especially interested in what explains the number of strategies farmers mention. There could be dominant strategies so that only one strategy can explain the survival, but it could also be that more strategies are indicated. In the latter case it is relevant if farmers are able to adopt a larger number of strategies to increase the probability of survival. Differences between the situation with and without the CAP gives additional insight in how farms indicate they will deal with disturbances in both policy and market regimes. So in this study we use data on what farms indicate what they will do. By doing this we look at perceived instead of real resilience, and indicated instead of actually followed strategies. To the best of our knowledge there do not exist empirical studies on resilience in agriculture although there are studies that deal with certain aspects of it, e.g. studies on farm exit (e.g. Kimhi and Bollman, 1999; Glauben, et al., 2004).

The objective of this research is to explain the number of strategies that farmers indicate that they will use in a situation where the current CAP will continue and in a situation where it will disappear in order to obtain knowledge about the resilience of farms.

To answer the research question about 1400 households were interviewed in 11 case-study areas in the Europe Union (EU) representing different farming types and regions. Farms differ in their location within the EU, specialization, size, business environment and institutional environment. Data have been used to estimate two zero-inflated negative binomial models (Long and Freese, 2001), for each scenario one. The estimation procedure consists of two distinct processes: the inflate equation that corresponds to the binary model predicting that the farm indicates to follow no strategies and an equation for the number of strategies adopted.

This paper is organized as follows. In Section 2 presents the data and empirical model. Results will be discussed in Section 3. The paper finishes with a general discussion and some conclusions.

2. Data and empirical model

Survey

In 2009, interviews were carried out as part of the EU project CAP-IRE in 11 case study regions in 9 countries of the EU: Emilia-Romagna (Italy), Macedonia and Thrace (Greece), Podlaski (Poland), North-East of Scotland (UK), Andalusio (Spain) South-East Planning Region (Bulgaria), Centre (France), Midi-Pyrénées (France), Lahn-Dill-District (Germany), Ostprignitz –Ruppin (Germany), North-Holland (the Netherlands). Results were used from a questionnaire carried out with a mix of phone, postal and face-to-face interviews depending on the possibilities in the case study

areas. The farm head or one of the farm heads was asked to fill in the pre-coded questions. The questionnaire contained questions about the farm and farm household, the business environment and the reaction to two scenarios.

Scenarios
One scenario was 'the CAP stays as it is' and the other one was 'the abolition of the CAP'. The scenarios will be labelled as 'present CAP' and 'no-CAP' respectively. Figure 1 describes the scenarios.

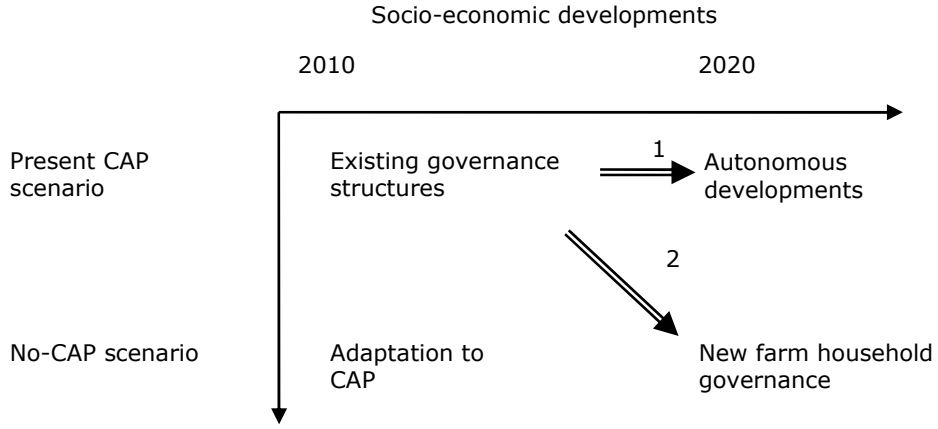

Figure 1: CAP scenarios and the farm development

Figure 1 shows that farm households were asked to give their judgment about future behaviour taking into account changes in their farm household that are expected to take place within the present CAP scenario (see arrow 1 in Figure 1). This brings us in the upper right quadrant. A second question was to react to the no-CAP scenario (see arrow 2 in Figure 1).

Data
In this paper, we will concentrate on about 1400 farm households who responded that they will continue under the present CAP scenario and who either continue or quit farming under the no-CAP scenario. If a farm exits anyway it does not make sense to ask for strategies how they will continue. From the questionnaire, several variables were derived. Table 1 gives an overview of the data used for the estimation.

Table 1 – Data for the average farm

	Present CAP scenario (observations: 1368)		No-CAP scenario (observations. 894)	
Variable	Mean	Standard deviation	Mean	Standard deviation
Average number of adaptations	3.62	3.16	3.59	3.20
Percentage of farmland leased (%)	41.54	36.63	37.57	35.72
Percentage part-time labour (%)	27.44	32.48	23.99	29.84
Single farm payment per ha (€)	413.82	708.44	298.87	538.60
Income from farming > 50% (dummy)	0.69		0.76	
Household members (number)	3.73	1.40	3.75	1.43
Membership social organisation (dummy)	0.29		0.27	

Membership farmers union (dummy)	0.52		0.52	
Membership nature preservation organisation (dummy)	0.06		0.07	
Multifunctional non-farm activities (dummy)	0.19		0.19	
Area (ha)	98.77	258.96	99.81	276.71
Age (years)	46.45	12.47	45.33	13.00
Agricultural education (dummy)	0.61		0.65	
Higher education (dummy)	0.28		0.27	
Specialisation in livestock (dummy)	0.26		0.32	
Specialisation in crops (dummy)	0.35		0.35	
Regions:				
Emilia - Romagna, Italy (dummy)	0.11		0.14	
North-Holland, the Netherlands (dummy).	0.08		0.11	
Macedonia and Thrace, Greece (dummy)	0.19		0.10	
Podlaskie, Poland (dummy)	0.17		0.23	
North East of Scotland, UK (dummy)	0.06		0.07	
Southeast Planning Region, Bulgaria (dummy)	0.11		0.12	
Centre, France (dummy)	0.04		0.04	
Midi Pyrénées, France (dummy)	0.04		0.05	
Lahn-Dill-District, Germany (dummy)	0.04		0.02	
Ostprignitz-Ruppin, Germany (dummy)	0.07		0.04	
Andalucia, Spain (dummy)	0.10		0.07	

Source: CAP-IRE questionnaire

About 60% of the farmers responded that they will continue in both scenarios. This implies that the CAP abolition does not influence the decision of this group about exit or continuation. The other 40% of the farmers responds that they will continue in the present CAP scenario and that they will exit in the no-CAP scenario.

Empirical model

To explain whether or not strategies are adopted, and if yes how many, the variables described in Table 1 have been included in the empirical model.

Farm governance is represented by the percentage of land leased, and part-time versus full time labour. It is expected that farmers who own a large share of their land are more likely to continue farming under both scenarios as they do not have to pay land rents which makes them less susceptible to disturbances. With more part-time labour farmers have alternative sources of income making them less susceptible to disturbances.

The average single farm payment (SFP) payment per hectare is about 110 euro lower for farms who continue in the no-CAP scenario. This variable was included in order to determine the importance of the CAP payments for an individual farm. It is expected that the more important these payments are the more susceptible they are to disturbances, and therefore the more survival strategies they will adopt. If income from farming is relatively important we also expect these farms to be more susceptible to disturbances. Farms that are involved in multi-functional non-farm activities and large farms are expected to be less susceptible to disturbances.

Memberships of social organisations, farmers unions and nature preservation organisations are expected to represent social and human capital that enables farmers to adopt easier strategies, and therefore, makes them less susceptible to disturbances. Agricultural and higher education have the same effect.

Regional dummies represent regional differences in legal structures and social and cultural values that could affect the possibility to adopt certain strategies.

Age, type of specialisation and the number of household members could also influence the number of strategies adopted representing experience, past experiences with changes and possible strategies, and alternative sources of incomes respectively.

Adoption strategies

Figure 2 gives an overview of the adaptation strategies chosen as a reaction to the present CAP scenario. Adaptation strategies are plans of farmers to deal with disturbances. We listed 14 different adaptation strategies. About 55% of the households adopted between 1 and 5 strategies. About 20% did not choose any of the 14 strategies proposed. Adjusting the machinery park, adapting buildings, change in land ownership and land leasing, change in hiring employees and alter use of family labour on farm are mentioned most often. For the no-CAP scenario a similar figure can be constructed. However, farms who continued in the no-CAP scenario and the present CAP did not significantly indicate more strategies.

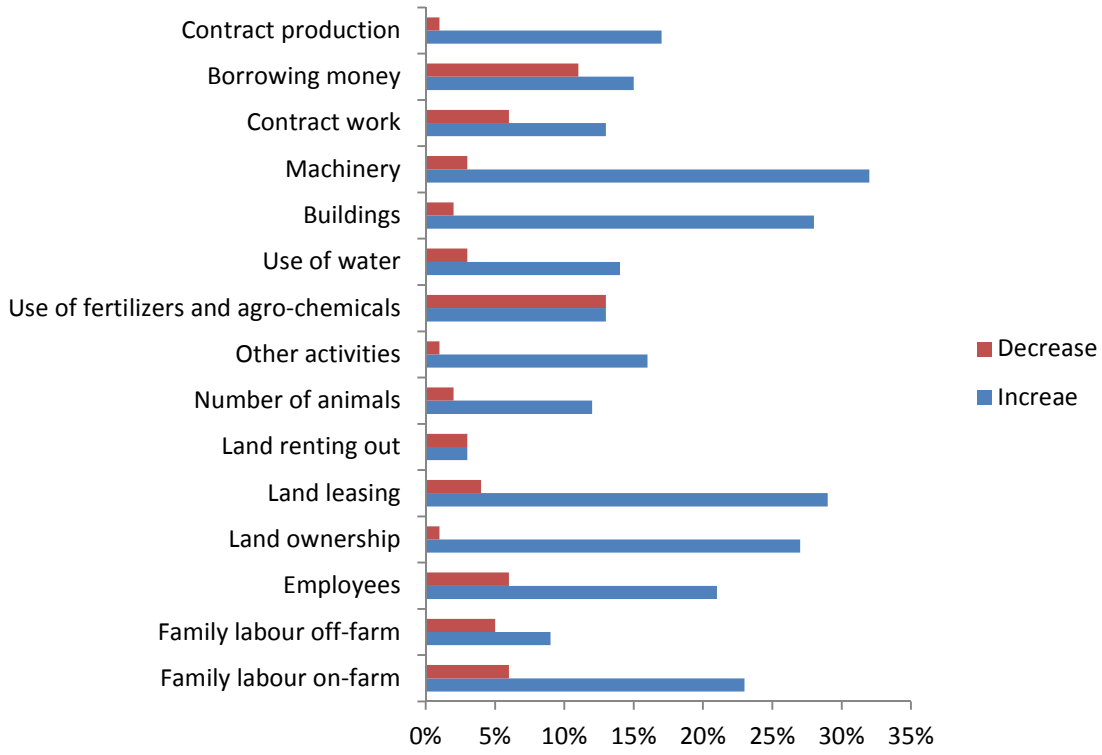

Figure 2: Adaptation strategies in the CAP scenario. The horizontal bars represent the percentage of farmers that plan to decrease (red) or increase (blue) the variables included.

Estimation procedure

To analyse the number of strategies farms indicate to adopt a Poisson model was estimated which uses the number of strategies as count variable. However, the Poisson model is rejected because of signs of overdispersion (see Verbeek, 2004: 212), that is, a greater variance than might be expected in a Poisson distribution. The large value for chi-square in the Poisson goodness-of-fit is another indicator that the Poisson distribution is not a good choice. A negative binomial regression is often appropriate in cases of overdispersion (see Verbeek, 2004: 213). Therefore a negative binomial model was tested. The overdispersion parameter alpha within the negative binomial distribution is significantly different from zero and thus confirms that the Poisson distribution is not appropriate. The dataset contains a relative large number of zero observations (no strategies are adopted) which led to the rejection of the standard model in favour of a zero-inflated negative binomial model. A reason could be that these farms consider themselves to be robust or they have difficulties to imagine how they change, and therefore, give a zero answer. The zero-inflated count model merges a binary logit with a negative binomial model (Long and Freese, 2001). The estimation procedure consists of two distinct processes: the inflate equation that corresponds to the binary model predicting that the farm indicates to follow no strategies and an equation for the number of strategies farms indicate to adopt (count equation). The Vunong test (Long and Freese, 2001) supports the zero-inflated negative binomial model over the negative binomial model.

3. Results

Table 2 presents the estimation results of the equation explaining whether or not strategies will be adopted in the present CAP and the no-CAP scenario (inflate equations). Table 3 gives the results for the equation explaining the number of strategies adopted in both scenarios.

Table 2 Marginal effects for the binary equation of the zero inflated negative binomial regression[1]

Variable	Marginal effect Present CAP		Marginal effect No-CAP	
Percentage of farmland leased (%)	0.60		1.85	
Percentage part time labour (%)	1.49		1.17	
Single farm payment per ha (€)	0.86		1.27	
Income from farming > than 50% (dummy)	1.31		0.49	*
Household members (number)	0.71	***	0.59	***
Membership social organisation (dummy)	1.62	*	1.45	
Membership farmers' union (dummy)	0.60	**	0.89	
Membership nature preservation organisation (dummy)	0.52		2.08	
Multi-functional non-farm activities (dummy)	0.94		0.42	
Area (ha)	0.02	**	0.01	*
Age (years)	12.33	***	6.69	
Agricultural education (dummy)	1.38		0.63	

Higher education (dummy)	0.75		0.38	*
Specialization in livestock (dummy)	1.02		0.43	
Specialization in crops (dummy)	1.62	*	0.84	
Regions:				
Emilia - Romagna, Italy (dummy)	0.87		2.41	
North-Holland, the Netherlands (dummy).	0.06	**	0.31	
Macedonia and Thrace, Greece (dummy)	1.02		0.67	
Podlaskie, Poland (dummy)	0.60		5.71	
North East of Scotland, UK (dummy)	0.40		1.67	
Southeast Planning Region, Bulgaria (dummy)	0.12	***	0.74	
Centre, France (dummy)	1.46		0.38	
Midi Pyrénées, France (dummy)	0.44		0.76	
Lahn-Dill-District, Germany (dummy)	1.49		2.94	
Ostprignitz-Ruppin, Germany (dummy)	0.59		5.32	

Number of observations = 1368, statistical significance: * = $P < 0.10$; ** = $P < 0.05$; *** = $P < 0.01$

1: A number smaller than 1 implies that if the variable goes up by 1 than the number of strategies goes down. The opposite is true for a value larger than 1.

There are two explanations for the differences between the results for both scenarios in Table 2. First, the number of farms in the no-CAP scenario is smaller, this has a negative effect on the significance of the results found. Second, farms that exit could have different characteristics than those that continue. In the present CAP scenario some farms can cope to disturbances while they cannot in the no-CAP scenario.

Larger farms are less likely to adopt strategies in both scenarios (marginal effect is smaller than one). Apparently they do not need them to deal with disturbances. The same goes for farms where the farm household has a large number of members.

In the present CAP scenario membership of a social organisation has a significant positive effect (marginal effect is larger than one). Membership of a farmers' union has a significant negative effect (marginal effect is smaller than one). Social capital apparently plays a role, but it can have both a positive and negative effect. A reason for the difference could be that membership of a farmers' union is more likely for 'conservative' farmers that hope politics will solve their problem instead of dealing with them by adopting survival strategies. Membership of a social organisation would be in that case a way to increase social and human capital to be better equipped to deal with disturbances. In the no-CAP scenario both variables do not play a role. Apparently, these are relevant variables for farms that exit in the no-CAP scenario to deal with disturbances in the present CAP scenario. Farms that do not exit do not need both means to deal with disturbances.

Older farmers have a significant positive effect in the present CAP scenario on the decision whether or not strategies are adopted. This could reflect the experience they have gained during their live with dealing with risks. In the no-CAP scenario this variable has no longer a significant influence. This maybe because older farmers are

overrepresented in the farms that exit. An additionally estimated logit model (results are not shown in this paper) that explains the exit of farms confirms this.

Arable farms (specialisation in crops) are more likely to adopt strategies in the present CAP scenario. This could be due to the fact that these farms, opposed to dairy farms, have more experience with dealing with uncertainty. This experience makes that they learned that uncertainty requires action. In the no-CAP scenario this variable is no longer significant. Apparently there is among the farms that exit a relatively large number of arable farms (which the exit model confirms). The shock of CAP abolition is for them too large to cope with.

For farms where a relatively large of income is coming from agriculture and where the education level is high are less likely to adopt strategies in the no-CAP scenario but not in the present CAP scenario. Apparently there is among the farms that exit a relatively large number of farms where income is coming from alternative sources and with farmers with a lower education level (again the exit model confirms this).

Farms in North-Holland and the Southeast Planning Region are less likely to adopt strategies. For North-Holland this could be due to the large share of dairy farms that yet do not feel the urge to deal with disturbances, and the large share of flower bulb farms that are not affected by the CAP as they do not receive any CAP subsidies. For Bulgaria the explanation could be found in the large former state farms that already familiar with a very uncertain environment.

Table 3 Marginal effects for count equation of zero inflated negative binomial regression on number of strategies per farm[1]

Variable	Marginal effect Present CAP		Marginal effect No-CAP	
Percentage of farmland leased (%)	1.18	**	1.24	***
Percentage part-time labour (%)	0.83	**	0.90	
Single farm payment per ha (€)	0.94	*	1.01	
Income from farming > than 50% (dummy)	1.10	*	0.98	
Household members (number)	1.03	**	1.02	
Membership social organisation (dummy)	1.28	***	1.19	***
Membership farmers' union (dummy)	1.02		1.27	***
Membership nature preservation organisation (dummy)	1.04		1.13	*
Multifunctional non-farm activities (dummy)	1.06		0.95	
Area (ha)	0.93		1.10	
Age (years)	0.49	***	0.42	***
Agricultural education (dummy)	1.10	**	1.01	
Higher education (dummy)	1.11	**	1.13	**
Specialization in livestock (dummy)	1.29		1.09	
Specialization in crops (dummy)	1.10	*	1.01	
Regions:				
Emilia - Romagna, Italy (dummy)	0.67	***	0.59	***

North-Holland, the Netherlands (dummy).	1.06		1.33	**
Macedonia and Thrace, Greece (dummy)	0.93		0.72	**
Podlaskie, Poland (dummy)	0.89		0.35	***
North East of Scotland, UK (dummy)	0.81	*	1.01	
Southeast Planning Region, Bulgaria (dummy)	1.93	***	1.44	***
Centre, France (dummy)	0.80	*	0.98	
Midi Pyrénées, France (dummy)	0.70	***	0.94	
Lahn-Dill-District, Germany (dummy)	1.08		0.93	
Ostprignitz-Ruppin, Germany (dummy)	1.07		0.89	

Number of observations = 1368, statistical significance: * = $P < 0.10$; ** = $P < 0.05$; *** = $P < 0.01$

1: A number smaller than 1 implies that if the variable goes up by 1 than the number of strategies goes down. The opposite is true for a value larger than 1.

There are two explanations for the differences between the results for both scenarios in Table 3. First, the number of farms in the no-CAP scenario is smaller, this has a negative effect on the significance of the results found. Second, farms that exit could have different characteristics than those that continue. In the present CAP scenario some farms can cope with disturbances while they cannot in the no-CAP scenario.

Farm governance has an effect on the number of strategies indicated. The percentage of land leased has a positive effect in both scenarios as expected (marginal effect is larger than one). More land leased makes farms more susceptible to disturbances, and therefore increases the number of strategies. Part-time versus full time labour has a negative effect as expected but only in the present CAP scenario. More part-time labour implies that farmers have alternative sources of income making them less susceptible to disturbances. The reason that in the no-CAP scenario this variable is no longer significant could be caused by the fact that many of the farmers that exit are part-time farmers (which the exit model confirms).

Although older farmers are more likely to adopt a strategy to cope with disturbances they adopt less strategies than younger farmers in both scenarios. Better educated farmers adopt more strategies in both scenarios. Farmers with an agricultural education also adopt more strategies but this is only significant for the present CAP scenario. In the no-CAP scenario this variable does no longer has a significant positive effect. This may be caused by the fact that a relatively large amount of these farms decide to exit in case of CAP abolition (which the exit model confirms).

Farmers that are relatively dependent on CAP support, as indicated by the single farm payment, are less likely to adopt a large number of strategies in the present CAP scenario. This is as expected. The single farm payment is not significant in the no-CAP scenario as there are no subsidies anymore. The exit model confirms that farms that are dependent on CAP support are more likely to exit.

A large share of agriculture in total income has a significant positive effect on the number of strategies adopted in the present CAP scenario this effect alters in sign and is no longer significant in the no-CAP scenario. For a farm where agriculture is

important it seems obvious that alternative strategies are found within agriculture. However, farms that decide not to exit are probably large and specialised, and therefore less likely to adopt a large number of strategies to deal with disturbances.

Larger farms are less likely to adopt strategies to cope with disturbances (Table 2), and therefore, it is not surprising that farm size has no effect on the number of strategies farmers indicate to adopt to deal with disturbances.

Although farms where the farm household has a large number of members is less likely to adopt a strategy to survive they adopt more strategies. This could be due to the larger possibilities they have compared to smaller farm households. In the no-CAP scenario this variable is no longer significant which could be due to the fact that larger more specialised farms decide to continue (which the exit model confirms).

Membership of a nature preservation organisation and a farmers' union have no significant positive effect on the number of strategies adopted in the present CAP scenario but do have a positive effect in the no-CAP scenario. This is could be because these memberships in a more uncertain environment (no-CAP versus CAP) could provide information that helps to construct social and human capital that makes it easier to deal with disturbances. For the same reason membership of a social organisation has a positive effect in both scenarios.

The regional dummies show a very mixed result. This could be due to regional differences in legal structures and social and cultural values that could affect the possibility to adopt certain strategies.

4. Discussion and conclusions

The objective of this research is to explain the number of strategies that farmers indicate that they will use in a situation where the current CAP will continue and in a situation where it will disappear in order to obtain knowledge about the resilience of farms.

The results obtained indicate that one can distinguish between three groups of farms. First, large more specialised farms with young and highly educated farmers indicate that they will adopt no or less strategies both under the current CAP and in the situation where the CAP will be abolished. These farms are clearly most resilient. They do not need any or a lot of strategies to cope with disturbances. Second, small and less specialised farms with older and less educated farmers that are relatively dependent on CAP support indicate that they adopt a lot of strategies to deal with disturbances already under the present CAP. Finally, there is a group of farms with a relatively large share of land leased and better educated farmers that indicate to adopt a larger number of strategies to deal with disturbances. They cannot afford to, like the first group, to adopt no or only a small number of strategies while at the same time they are capable of implementing adaption strategies. This is confirmed by the fact that they are also often members of social organisations that apparently help them to obtain information that is used to construct social and human capital.

Results also indicate that a relatively large number of farms decides to exit with CAP abolition. These farms are clearly least resilient to the disturbance CAP abolition

represents. Results show that farms that indicate to exit are the ones that are most dependent on CAP support, have old farm heads, and are part-time and diversified farms.

These results clearly show that there are differences between farmers, farms, and regions with respect to resilience indicating that policies trying to improve resilience of farms need to be tailor made. This is extremely relevant given the upcoming CAP reforms.

This paper is one of the first attempts to model empirically resilience of farms and the influence of a wide variety of factors as farm and farm household characteristics, location and membership of social organisations on resilience. In future research alternative measures of resilience could be constructed. Moreover, a methodology could be developed that integrates the present model with a model of exit.

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