DETERMINANTS OF FARM SIZE EXPANSION AMONG EU FARMERS

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ABSTRACT

This paper aims to identify the determinants of the intention to expand farm size under two different policy scenarios 1) baseline, that implies the current Health Check policy, and 2) a NO-CAP scenario, providing a full removing of all CAP payments. Results highlight that farm/farmer and household characteristics such as age, amount of SFP and land size are determinants of farm size expansion under baseline scenario. Otherwise, under NO-CAP scenario, farm specialisation and organisational variables became significant in explaining the farm size expansion.

Keywords: farm expansion; multinomial logit; stated intentions

1) INTRODUCTION

Structural change represents a possibility to increase competitiveness and efficiency of the whole sector with a better allocation of the productive factors. The movement of productive factors among farmers/farm typologies is mainly determined by the marginal utility of different factors (Colman and Young, 1989). Among the productive factors, land is one of the ones most often constraining farm development. Such implies that land size expansion and land market is one of the structural changes components more studied in the literature (Swinnen et al. 2008).

Generally, farm size is quite heterogeneous among European agricultural areas, and the average farm dimension is very small compared the non-EU agricultural areas. On one hand, such small dimension has been viewed as hindering the exploitation of economies of scale and has been seen as a constraint for investments on farm. On the other hand, the literature has emphasised the important function that small farms (even those considered marginal) have on the territory and on the local economies.

Literature highlights the effect of policy changes on the re-allocation of productive factors over time. In particular, on the one hand several authors have found a positive effect on the land market of decoupling policy, generated by an increasing of formalised relationships between actors concerning land possession. On the other hand the income support payments, have reduced land re-allocation towards more efficient farms, with the effect of preventing farmers exit and maintaining active also less efficient farms.

Concerning the assessment of the policy impacts (decoupled vs. coupled CAP) on structural change, studies have been carried out both ex-ante and ex-post. Three different approaches have been used to investigate structural change and the policy impact on such topic.

The first field of literature concerns the use of Markov models. The results of Markov Models could be summarised as the prediction of the number of farms in a certain farm types/typology and the effect of exogenous variables on the transitions (Stationary or non stationary Markov Chain Model). See Zimmerman et al. 2009 for a review.

The greater part of the literature can be included in the second field of study that can be described as econometric analysis. The regression or choice models results allow to identify the set of variables able to explain a specific farms' behaviour in terms of structural change. The analysis of structural change is carried out using panel data or time series (Ahearn et al. 2005), or cross section data (Goodwin and Mishra, 2003; Douarin, et al., 2007). Panel data are the most used approach (Key and Roberts, 2003; Ahearn et al, 2005). Differently other authors used cross-sectional data. For example Goodwin and Mishra (2003) use stated reactions in order to assess the impact of direct payments in the acreage decision. Another application of the analysis of structural change based on the state reactions is presented in Douarin, et al., 2007, in which the authors use a probit model in order to explain stated reactions (exit or farm growth) to decoupling.

Finally other authors have applied models based on mathematical programming approaches in order to assess the ex-ante impacts of policy changes (i.e. Gallerani et al., 2008). Mathematical programming aims to simulate the farm size expansion/farm growth under different conditions of prices, policy, costs, etc. Application of the mathematical programming models use linear/non linear, static/dynamic programming models or more sophisticated agent-based models (Happe, 2004). Generally these models allow a different land allocation among heterogeneous farm/agents, driven by the marginal value of land.

This paper aims to identify the determinants of farm size expansion under two different policy scenarios and to provide an ex-ante analysis of the role of policy (CAP) based on the stated intentions. Ex ante policy analysis has been performed comparing the results of two separated analysis of the farm size expansion stated behaviour under a baseline scenario that has been built assuming the continuation of the current Health Check policy and a No CAP scenario that assumed the full removing of all CAP payments.

The paper is structured as follows. In the next section we describe the methodology adopted; in the following we describe data sources and sample descriptive statistics. This is followed by a result section and a discussion.

2) ANALYSIS OF LAND SIZE EXPANSION

We start with discussing two distinguishing features of our exercise. The first qualification concerns the use of stated intention rather than observed behaviour and the second concerns the treatment of the land size expansion strategy as a qualitative non-ordered variable.

The use of stated intention is rather frequent in the literature about policy impact on structural change (i..e Goodwin and Mishra, 2003 and Douarin et al. 2007; Genius et al., 2008). Though stated intentions could not be seen as equally certain than past behaviour, available literature points out that: a) in the majority of cases stated behaviour reveals true ex-post (Gallerani et al., 2008), and so it is reliable enough to study policy ex ante; b) stated behaviour can help in eliciting differential effects of policy, while actual behaviour have to be interpreted using more or less sophisticated (and more or less usable) econometric techniques in order to disaggregate the effect of policies form other determinants; in some cases this ex-post exercise simply reveals impossible.

As for the way the choice to expand is represented, we consider the intention to expand farm size (intended as the amount of land operated by the farm) as a discrete variable, including an options of no expansion, while increase in land size can occur with rent-in or with land purchases. Using this representation, future farm size expansion can be structured as a discrete choice among three different options: no expansion; expansion increasing rented-in land and expansion buying land. Expansion using only land rent can be seen as a weaker strategy compared to buying land, as renting allows a more flexible reversibility of the expansion choice and less capital investment.

The determinants of land size expansion were estimated using a multinomial logit model. Such model allows expressing and explaining the probability that a farm household strategy with respect the land size expansion being in a specific category.

Two separate models were implemented, each model containing, as a dependent variable, the stated intention of farm size expansion respectively under the baseline scenario and under the NO-CAP scenario (complete removing of both first and second pillar policies). In both models the stated choice to increase farm size has been interpreted as a multiple choice among: 1) no change, 2) rent-in land, 3) buy land[1].

[1] Actually in a previous version of the paper an additional category was considered, with a farm size expansion through mixed rent-in and land purchase. Such additional category failed the Hausman test of independence of irrelevant alternatives and is not considered in this paper.

Let U_{ij} denote a non observed utility that farm household i derives by farm size expansion strategy j, is possible to write $U_{ij} = \mu_{ij} + \varepsilon_{ij}$ where μ_{ij} is a observable portion of the utility function which is a linear combination of the covariates (set of observed variables) and ε_{ij} is an unobservable term (Werbeek, 2004).

Assuming that ε_{ij} are independent and with Gumble distribution (extreme value distribution Type 1), the probability that the $i-th$ farm chooses the farm size strategy j is: $P_{ij} = \frac{\exp\{\mu_{ij}\}}{\sum_j^M \exp\{\mu_{ij}\}}$ with $j = 1,2,\cdots,M$ alternatives.

Under this notion, it is automatically assumed that $0 \le P_{ij} \le 1$ and $\sum_j^M P_{ij} = 1$.

Assuming that μ_{ij} is a linear function, that means that is possible to write $x_{ij}^{'}\beta = \mu_{ij}$, where the matrix $x_{ij}^{'}$ contains the set of the explanatory variables. Under the assumptions of linearity and error distribution it is possible to rewrite a normalised form of probability calculation:

$P_{ij} = \frac{\exp\{x_{ij}^{'}\beta\}}{\sum_j^M \exp\{x_{ij}^{'}\beta\}}$ for each $j = 1,.....,M$ alternatives.

Under this notion, the probability for the $i-th$ farmer to choose an alternative j between a set of M alternatives is a function of the explicative variables $x_{ij}^{'}$ and the β coefficients (Green, 2000). The positive/negative sign of β coefficient, when significant, can be interpreted as the increment/decrement of the probability of a farm of being in the specific group. Note that a non-significant coefficient implies that the regressor do not affect the utility or the probability of being in a certain group.

3) DATA AND DESCRIPTIVE STATISTICS

Data used are obtained from a survey of over 2363 farm household in 11 Case Study Areas belonging to 9 different European Countries[2]. The survey has been conducted within the 7FP

[2] The entire dataset count more than 2000 interviews. Form this database we dropped observation from farmers stated the intention to exit from farm activity and those with a farm size expansion through rent-in and rent-out.

project named CAP-IRE (Assessing the multiple Impacts of the Common Agricultural Policies (CAP) on Rural Economies). During the interview the intention concerning the land size expansion was asked to the farmers, asking them to consider the two scenarios and to state their intention to rent/buy land under each scenario. The data were collected in the year 2009 and the sampling procedure was based on random sample. Descriptive statistics about data used in the first and second model are shown respectively in Table 1 and Table 2

TABLE 1

TABLE 2

Farm_expansion was selected as dependent variable for the first model (with baseline scenario) and *n_farm_expansion* for the second model (with “n” being a reminder of no-CAP scenario). *Farm_expansion* variable count for 1273 observations and *n_farm_expansion* count for 783 observations. Such difference is the (expected) consequence of the different scenario hypothesis, including the cut of all CAP payments that the farmer could receive from both first and second pillars.

The dependent variables differ among the two models, while the set of independent variables is mostly the same. In fact, independent variables can be classified as belonging to the following categories: geographical, farm-household, farmer, farm, organisation, policy variables.

In both models, geographical variables are represented by altitude, which is presented as three dummy variables (plain, hill and mountain).

Household variables differ between the two models. In the first model (baseline scenario) this category includes the character of the household including a long term unemployed (*unemp_c*) and the weight of farm income with respect to the total household income (*f_inco_more50*). Finally the presence/absence of land rented-in among relatives has been considered (*land_in_relatives_d*). Household characteristic variables used in the second model are the amount of on-farm household labour (*hh_fulltime_eq*) the variable measuring the fact that the household lives on-farm (*live_on_d*), and the presence/absence of land rented-in among relatives has been considered (*land_in_relatives_d*).

Farm characteristics include in both models the age of the farm owner (*lnage_y; age_more_60; age_less_40*), which, however, is expressed in differ ways among the two models. In addition, while in the first model two variables (*edu_level_low; edu_level_high*) were included representing the educational level (respectively upper than the university degree and lower than secondary school), in the second model the use of advisory services were included (*advisory_d*).

In both model the farm characteristic variables are related to farming specialisation and the current farm size, regarding operated land area, the land rent-in and the number of dairy cows reared.

Finally the amount of SFP received is included only in the first model, while organisational variables, such as farm production sold through contracts and to cooperative are included only in the second model[3].

4) RESULTS

Results of both models are shown in Table 3.

Table 3

In the first model (under baseline= Health check CAP plus the already planned measures) the geographical variables do not influence the probability to expand farm size through increased rent-in. Only the mountain altitude increasing the probability of the farm size expansion through rent-in. Such results can be read as a consequence of a lower off-farm job opportunity for the farmer that live in mountain areas with respect the other areas and/or as an interest in expanding farm size, in presence of CAP subsidies, in areas where the cost of rents is lower (that would imply potential higher profits from the SFP).

Three variables belonging to household characteristics were considered in the set of determinant in the first model and two for the second model. Within the first model, a negative effect on the probability to expand farm size (both rent-in and land purchased) is determined by the current renting-in by the relative members. Other household variables, such as the number of current

[3] The independent variables used in both models were selected coherently with the literature on determinants of farm expansion and the final model was, for each scenario, the one with lower BIC value (Bayesian Information Criterion).

household unemployed and the prevalence of the farm income on total household income, have a positive effect on the probability to expand farm size through a rent-in strategy. Such results are consistent with the opportunity for the farm to use on-farm the unemployed labour and the need to maintain the level of income through a (temporary) expansion based on rent-in. Two household variables were considered in the second model. Such variables concern the amount of household labour spent on farm and the place where the household lives. Both variable are significant but with different sign and to different category of the dependent variable. The positive effect on rent-in is the consequence of an increasing in on-farm household full time equivalent number. The negative effect on land purchased is connected to the fact that the household lives on-farm. In fact, contrary to what is expected, the probability to purchase land is reduced if the household live on the farm.

Significant farm characteristics are generally connected with the age of the farm owner. The age in the two models has been considered in different ways; however the signs of the variable are all negative. Overall, both models are coherent with the life cycle expectation. Under baseline scenario the natural logarithm of the farm owner' age has negative impact on farm expansion. Differently, without policy intervention (no-cap scenario) young farmer (with less than 40 years) and 60 years old farmers have negative probability to expand farm size.

Farm characteristics included into the models are connected to the farm size concerning the land and the reared animals' number and concerning the farm specialisation. Farm specialisations included are field crops, permanent and mixed with grazing and livestock. Low sized farms with the UAA less than 10 ha have negative probability to expand farm size in both scenarios. Belonging to field crops and mixed grazing livestock specialisations increases the probability to expand farm size dimension only under baseline scenario respectively with an increase in land purchased and in rent-in. Intensive livestock (more than 50 animals) have positive effect on probability to expand land size through purchase land under the no-CAP scenario.

The amount of SFP is the policy variable considered and is included only in the baseline scenario. The probability to buy land increases with high amount of SFP received. Such connection is quite consistent with the literature on the investment determinants, due to effect of SFP to ensure liquidity to farms.

Organisational variables are considered only for the second model (no-cap scenario). Such variables, which are referred to the selling of production by contract or to cooperative, determine an increase of the probability to expand farm size through land purchases.

5) DISCUSSION

The preliminary results highlight that, under the baseline scenario, only 26% of the farms would expand their land size. Under the complete removal of the CAP; only 45% of those farmers would maintain the same intention to expand farm size.

In the baseline, farm/farmer and household characteristics such as age, education, amount of SFP and land size are positive determinants of farm size expansion. Generally, it appears that the choice to expand farm size through rent-in is strongly driven by profit maximisation On the contrary, the choice to expand farm through land purchasing seems more connected to external factors such as location, altitude and persistence of the policy.

Scenarios comparison shows a strong difference in the determinants of farm size expansion, as shown by the fact that significant variables change sharply among scenarios. Farm characteristics such as farm organisation and on-farm employees became significant in the stated behaviours explanation under NO-CAP with respect to baseline scenario. The amount of payments and the farm specialisation increase the probability of an expansion in the baseline. Differently without payments the organisation and the vertical integration with contracting and cooperation become important for the farm size expansion.

Common to both scenarios, the small farms have a negative probability to pursue an expansion strategy even in presence of policy targeted to ensure farm income and maintaining farming activity.

CAP payments seems not to play a strong role in the determinant of farm size expansions, however in the long period such payments are relevant for expansion through land purchase.

These preliminary results suggest further research, which should be focusing on two directions. Firstly, the model can be developed in order to improve the explanation of the farm size determinants including other elements connected with the CSA area and using secondary data. Secondly the use of a nested model should be tested, including as dependent variable the option to reduce the land size through a reduction of land rented-in or of land purchased.

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Table 1 Data used in the first model (baseline scenario)

Category	Variable (Code)	Variable (Description)	Obs	Mean	Std. Dev	Min	Max
Dependent variable	farm_expansion	Farm size expansion:	1273	0.37	0.67	0	2
		0 = no expansion	(940)				
		1 = rent land	(195)				
		2 = buy land	(138)				
Geographical	plain_d	Plain (dummy)	1271	0.50	0.50	0	1
	hill_d	Hill (dummy)	1271	0.39	0.49	0	1
	mountain_d	Labour (Full time equivalent)	1271	0.11	0.32	0	1
Household characteristics	land_in_relatives_d	Land-in relative (dummy)	807	0.23	0.42	0	1
	unemp_c	Unemployed (# in the Household)	1262	0.21	0.59	0	3
	f_inco_more50	Farm income from agricultural activity > 50% of total household (dummy)	1273	0.69	0.46	0	1
Farmer characteristics	lnage_y	Age of respondent (Ln of age_y)	1259	3.83	0.28	3.00	4.43
	edu_level_low	Educational level lower than secondary school (dummy)	1273	0.12	0.33	0	1
	edu_level_high	Educational level higher than degree (dummy)	1273	0.49	0.50	0	1
Farm characteristics	liv_dairy_more50	More than 50 dairy cows reared (dummy)	1273	0.08	0.27	0	1
	type_farm1_field_crop	Farm type field crop (dummy)	1273	0.24	0.43	0	1
	type_farm4_graz_liv	Farm type grazing and livestock (dummy)	1273	0.23	0.42	0	1
	land_UAA_less10	UAA less than 10 ha (dummy)	1273	0.28	0.45	0	1
Policy	pay_sfp_1000e	Current SFP (1000€)	1273	16.27	39.28	0	681.36

Table 2 Data used in the second model (no-cap scenario)

Category	Variable (Code)	Variable (Description)	Obs	Mean	Std. Dev	Min	Max
Dependent variable	n_farm_expansion	Farm size expansion: 0 = no expansion 1 = rent land 2 = buy land	783 (649) (73) (61)	0.24	0.58	0	2
Geographical	plain_d	Plain (dummy)	783	0.56	0.50	0	1
	hill_d	Hill (dummy)	783	0.35	0.48	0	1
	mountain_d	Hill (dummy)	783	0.09	0.29	0	1
Household characteristics	hh_fulltime_eq	Household labour on farm (# of full time equivalent)	783	1.65	0.82	0	5
	land_in_relatives_d	Land-in relative (dummy)	783	0.59	0.49	0	1
	live_on_d	Household live on farm (dummy)	783	0.73	0.45	0	1
Farmer characteristics	advisory_d	Advisory received (dummy)	783	0.55	0.50	0	1
	age_more_60	Age of respondent older than 60 years (dummy)	783	0.16	0.37	0	1
	age_less_40	Age of respondent younger than 40 years (dummy)	783	0.33	0.47	0	1
Farm characteristics	land_UAA_less10	UAA less than 10 ha (dummy)	783	0.25	0.43	0	1
	liv_dairy_more50	More than 50 dairy cows reared (dummy)	783	0.07	0.26	0	1
	type_farm1_field_crop	Farm type field crop (dummy)	783	0.23	0.42	0	1
	type_farm3_permanent	Farm type grazing and livestock (dummy)	783	0.07	0.26	0	1
Organisational characteristics	sell_coop_d	production sell to cooperative (dummy)	783	0.37	0.48	0	1
	sell_contract_d	Production sell by contract (dummy)	783	0.21	0.41	0	1

Table 3 Results of estimation

		Baseline (first model)		No CAP scenario (second model)	
category	**varaible**	**(1= increase rent-in)**	**(2 = increase land buy)**	**(1= increase rent-in)**	**(2 = increase land buy)**
Geographical	plain_d			1.237	**-0.978**
				(1.63)	(2.11)**
	hill_d	-0.054	0.010	0.612	-0.589
		(0.26)	(0.04)	(0.79)	(1.25)
	mountain_d	-0.385	**0.714**		
		(1.03)	(1.88)*		
Household characteristics	unemp_c	**0.446**	-0.076		
		(2.18)**	(0.26)		
	land_in_relatives_d	**-0.848**	**-0.569**	**1.512**	**-0.529**
		(3.11)***	(1.88)*	(3.93)***	(1.76)*
	f_inco_more50	**0.608**	0.009		
		(2.35)**	(0.03)		
	hh_fulltime_eq			**0.343**	0.113
				(2.03)**	(0.61)
	live_on_d			0.015	**-0.902**
				(0.04)	(2.87)***
Farmer characteristics	edu_level_low	-0.701	-0.042		
		(1.61)	(0.09)		
	edu_level_high	**-0.430**	-0.124		
		(2.02)**	(0.46)		
	advisory_d			-0.376	0.385
				(1.34)	(1.14)
	lnage_y	**-1.203**	**-1.100**		
		(3.06)***	(2.27)**		
	age_more_60			**-1.033**	**-0.883**
				(1.84)*	(1.92)*
	age_less_40			0.086	**-0.810**
				(0.31)	(2.19)**
Farm Characteristisc	land_UAA_less10	**-1.300**	**-1.090**	-0.094	**-0.668**
		(3.57)***	(2.61)***	(0.23)	(1.74)*
	liv_dairy_more50	0.271	0.726	**1.079**	**1.230**
		(0.81)	(1.85)	(2.80)***	(2.77)***
	type_farm1_field_crop	0.114	**0.533**	0.241	-0.114
		(0.41)	(1.76)*	(0.65)	(0.30)
	type_farm3_permanent			0.856	0.284
				(1.48)	(0.51)
	type_farm4_graz_liv	**1.073**	-0.204		
		(4.54)***	(0.63)		
Policy	pay_sfp_1000e	-0.000	**0.006**		
		(0.13)	(2.54)**		
Organisational characteristics	sell_coop_d			0.158	**0.855**
				(0.56)	(2.69)***
	sell_contract_d			0.346	**0.703**
				(1.09)	(2.19)**
	Constant	3.088	2.302	-4.972	-1.419
		(2.01)**	(1.22)	(5.29)***	(2.15)**
	Observations (#)	790	790	783	783

((n) farm_expanison==0 is the base outcome;), Absolute value of z statistics in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.