Factors affecting the impact of CAP scenarios on farm structure: an analysis based on stated intentions

Bartolini F. and Viaggi D.

Alma mater studiorum - University of Bologna,
Department of Agricultural Economics and Engineering, Italy

Corresponding author
fabio.bartolini@unibo.it

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Abstract

Several authors have emphasised the effect of agricultural policy (such as SFP) as a driver of structural change. This paper aims to identify the determinants of the change in the use of productive factors under different policy scenarios. The analysis is performed ex ante, assessing the effect of CAP abolishment (as compared to the current CAP) on the use of productive factors, based on stated intentions by farmers. The results highlight the role of farm size, intensity and education in determining different patterns of reaction to policy changes. Also differences are identified among the three main component of structural change, land, capital and labour, with the latter being the less dependent upon the CAP.

Keywords: structural changes, CAP, stated intentions, multinomial logit.

1. INTRODUCTION

Agricultural economics literature has paid attention to the effect of the Common agricultural Policy (CAP) on the changes in the use of productive factors. Several authors have emphasised the effect of agricultural policy (such as SFP) as one of driver of structural changes (Harrington et al., 1995; Ahearn 2005; Hechelei, 2010).

Recently the effects of the decoupling on the productive factors were analysed. The findings of this literature are that the decoupling have generated a maintenance of less competitive farms, with a reduction of exits from agriculture; and, for the more competitive farmers, an increasing of farmers' long-term investments and the growth of farm size mainly, mainly with more rented-in has been observed (Gallerani et al., 2008; Latruffe and Le Mouël 2009; Brady 2009; Viaggi. et al., 2011). Finally literature has pointed out that the mechanism of the entitlements has determined an increasing of formalisation of the tenure contracts (Ciaian et al., 2010).

Analyses of policy effects on structural changes have been conducted with two different approaches: using simulation models and using econometric/statistic models (Zimmerman et al. 2009). Simulation models aim to analyse the change on farm size or on land/labour use or on capital investment under different conditions of prices, policy, costs, etc. Applications of mathematical programming models use linear/non linear, static/dynamic programming models or more sophisticated agent-based models, and such model are generally ex-ante (Happe 2004 and Happe et al., 2008; Heckelei 2010 and Viaggi et al. 2010). The econometric/statistic approach can be further differentiated in two fields of literature: those based on Markov chain models and those based on econometrics models. The results of Markov Models can be summarised as the prediction of the number of farms of 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. Such 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).

This paper aims to identify the determinants of the change in the use of productive factors under different policy scenario. The analysis is performed ex ante, assessing the effect of CAP abolishment (as compared to the current CAP) on the use of productive factors, based on stated intentions by farmers.

METHODOLOGY

We start with discussing two distinguishing features of our approach. The first concerns the use of stated intentions rather than observed behaviour and the second concerns the choice of an extreme policy hypothesis, namely the CAP abolishment, tu study the effects on the use of production factors.

The use of stated intentions 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 (Viaggi et al., 2011); 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.

The impact of policy scenarios on structural change are quantified comparing the stated intention under baseline and NO-CAP scenario concerning the changes in land, labour and capital use. The observations (farm cases) used for the simulation are those that allow for a clear identification of the intentions revealing a negative or positive or no change effect of the hypothesis of CAP removal on the factor use. On the contrary, the observations where there is a substitution in modality of the factor use have been excluded (e.g. stated intention to decrease the land owned with simultaneous intention to reduce land rented-in).

This approach is suitable to derive the additional effect of CAP, through the comparison between changes in the stated intentions moving from the current policy situation to a situation with full removing of the CAP. Questions are posed in order to obtain a categorical response chosen between the following options: increase, no change or decrease in the factor use.

Such comparison can have three directions: negative effect: positive effects or no effects. The negative effects of the CAP abolishment on the factor use, means that comparing the NO CAP versus Baseline the farmer states an intention to reduce the factor use. Reducing the factors use has been interpreted as: a) change of the stated intention from “increase” (in Baseline) to “no change” or “reduction” (in NO CAP scenario); b) change of the stated intention from “no change”(in Baseline) to “reduction” (in NO CAP scenario).The positive effects of the CAP abolishment on the factor use means that comparing the NO CAP versus Baseline the farmer states the intention to increase the factor use. Increasing the factors use has been interpreted as: a) change of the stated intention from “reduction” (in Baseline) to “no change” or “increasing” (in NO CAP scenario); b) change of the stated intention from “no change”(in Baseline) to “increasing” (in NO CAP scenario. The no effects of the CAP abolishment on the factor uses means

that the abolishment of the CAP does not affect the use of the productive factor: farmers in both scenarios maintain the same intention (e.g. “no change” in Baseline and “no change” in NO CAP scenario).

Each of the three productive factors has been represented through a single variable, and the determinants of CAP abolishment effect on the use of land/labour/capital factors were estimated using four independent multinomial logit models. The independents variables are: 1) total land used (land rented in plus land bought minus land rented out); 2) labour used on-farm (household labour use on farm plus external labour used on-farm); 3) capital used (investment in the farm buildings and machinery using a entire database) 4) capital used (investment in farm building and machinery plus the investment in the animal reared) using only the data from livestock farms. Such models allow expressing and explaining the probability that a stated farm household strategy about the factor use was been affected by CAP abolishment.

In all four models the stated choice has been interpreted as a multiple choice among: 0) negative effect of the policy abolishment on the factor use, 1) no change of the policy abolishment on the factor use and 2) positive effects of the policy abolishment on the factor use.

Let U_{ij} denote a non observed utility that farm household i derives in the change (j) of productive factor use; it is possible to write $U_{ij} = \mu_{ij} + \varepsilon_{ij}$ where μ_{ij} is an 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 have a change (j) in the use of a productive factor is: $P_{ij} = \dfrac{\exp\{\mu_{ij}\}}{\sum_{j}^{M} \exp\{\mu_{ij}\}}$ 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, which means that it 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 as:

$P_{ij} = \dfrac{\exp\{x_{ij}^{'}\beta\}}{\sum_{j}^{M} \exp\{x_{ij}^{'}\beta\}}$ for each $j = 1,.....,M$ alternatives. Under this notion, the probability for the $i-th$ farmer choice to have a behaviour (j) facing the policy change, among a set of M alternatives is a function of the explanatory variables $x_{ij}^{'}$ and of the β coefficients (Green, 2000). The positive/negative sign of β coefficient, when significant, can be interpreted as the increase/decrease of the probability that a farmer with a certain characteristic being affected positively or negatively or not affected by policy abolishment. Note that a non-significant coefficient implies that the regressor do not affect the utility or the probability of being in a certain group.

2. DATA DESCRIPTION

Data used are obtained from a survey of 2363 farm household in 11 Case Study Areas belonging to 9 different European Countries[1]. The survey has been conducted within the FP7 project named CAP-IRE (Assessing the multiple Impacts of the Common Agricultural Policies (CAP) on Rural Economies). During the interview the intention concerning the future changes in land size (either rented-in or bought); the labour use on farm (either household or external labour) and the capital invested on-farm (relatively to the farm buildings; farm machinery and animal rearing) was asked to the farmers. This information was collected under the two mentioned policy scenarios: baseline (2009) and No-CAP.

In this section we first present the stated intention comparing the two policy scenarios for all of the three factors (two tables are presented for the capital factor). In Table 1 the stated intentions concerning the land use are shown.

Table 1 – Policy effect on the stated intention about the land used (owned +rented-in) (Baseline VS NO-CAP scenario).

		NO-CAP			
		Reduction	no change	increasing	Total
BASELINE	Reduction	30	0	4	34
	No change	48	479	37	564
	Increasing	31	153	237	421
	Total	109	632	278	1019

The great part of the farmers (45%) state an intention not to change the use of land in both scenarios. Farmers state a high reduction in the increase of the land use (19%), due to the abolishment of the CAP. Such policy effect is mainly observed in those farmers that have an expectation to increase the amount of land under baseline and with the CAP abolishment prefer to state "no change" in the land use.

In Table 2 the stated intentions concerning the labour use are shown.

Table 2 – Policy effect on the stated intention about the labour used on-farm (household labour+ external labour used on-farm) (Baseline VS NO-CAP scenario).

		NO-CAP			
		Reduction	no change	increasing	Total
BASELINE	Reduction	77	1	5	83
	No change	83	500	30	613
	Increasing	40	53	210	303
	Total	200	554	245	999

The effect of the CAP abolishment on the amount of labour used on farm is lower compared to land use. In fact the farmers that maintain the same behaviour under the two scenarios are 80% of the surveyed sample. Farmers that state an intention in the reductions of labour used on-farm are about 17% (176 farmers) which are equally distributed between those that state a change from the "No-change" answer under

[1] The entire dataset counts more than 2000 interviews. Form this database we dropped observations from farmers that stated the intention to exit from farming activity. For an analysis of the exit choices drawing from the same database see Mishra et al., 2010.

Baseline to the "reduction" answer under the NO-CAP scenario (83 farmers) and a change from "increasing" intentions under baseline to "no-change", or "reduction" under NO-PAC scenario (93 farmers).

In Table 3 the stated intentions concerning the capital used are shown (without livestock).

Table 3 – Policy effect on the stated intention about the capital used on-farm (machinery+ buildings) (Baseline VS NO-CAP scenario).

		NO-CAP			
		Reduction	no change	increasing	Total
BASELINE	Reduction	30	1	1	32
	No change	83	504	31	618
	Increasing	46	210	223	479
	Total	159	715	255	1129

Changes in the use of capital (identified through the proxy represented by buildings and machinery endowments) as a consequence the hypothesis of the CAP abolishment shows high reduction (about 30% of the farmers), compared to the previous factors. However, farmers that maintain the same behaviour are about 67%. Only few farmers react to policy abolishment with a higher use of capital (3%).

In Table 4 the stated intentions concerning the capital uses are shown (without livestock).

Table 4 – Policy effect on the stated intention about the capital used on-farm (livestock+ machinery+ buildings) (Baseline VS NO-CAP scenario).

		NO-CAP			
		Reduction	no change	increasing	Total
BASELINE	Reduction	35	0	2	37
	No change	37	104	24	165
	Increasing	37	126	189	352
	Total	109	230	215	554

Adding the changes in the number of animal reared, the effect of the CAP abolishment goes more clearly in the direction of the capital use reduction. In fact the farmers that stated an intention to reduce the use of the capital with such abolishment are 36%.

In Table 5 the CAP abolishment effects on factor use are presented.

Table 5 – Policy effect on the use of productive factors (dependent variables for the four multinomial logit models)

Productive Factor	**Baseline VS NO-CAP scenario**			**Sum**
	negative effects (-)	**no effects (=)**	**positive effects (+)**	
land	232	746	41	1019
	(23%)	(73%)	(4%)	(100%)
labour	176	787	36	999
	(18%)	(79%)	(4%)	(100%)
capital (without livestock)	339	757	33	1129
	(30%)	(67%)	(3%)	(100%)
capital (with livestock)	200	328	26	554
	(36%)	(59%)	(5%)	(100%)

The effects are calculated using the data in Table 1, Table 2, Table 3 or Table 4and summing all the farmers that states to maintain or to change the behaviours comparing the two policy scenarios. For instance the 41 farmers that state to be positively affected (increase the land use) by CAP changes are those that in Table 1 have stated to switch the land use intentions from reduction to no change, plus those that state to switch from reduction to increase and finally those that state intention to switch from no change to increase.

The greater part of the farmers state to maintain the same intention about the factors use with the CAP abolishment. This is particular relevant for land and labour factors where the farmers that maintain the same intention (no-changes) are respectively about the 73 and 78%. A relevant percentage of farmers, stated to have a negative effect of CAP abolishment on factor use (23% concerning the land use; 18% concerning the labour and 30% and 36% concerning the capital use). Few farmers state a positive effect of the CAP abolishment on the factor use, with a value less than the 5% for all factors.

In Table 6 the statistical descriptive are presented for all independent variables considered.

Table 6 – Statistical Descriptive of the independent variables

Category	Variable (Description)	Variable (Code)	Obs	Mean	Std. Dev	Min	Max
	Centre CSA (dummy)	centre	2363	0.30	0.46	0	1
	Eastern CSA (dummy)	eastern	2363	0.22	0.41	0	1
	Mediterranean CSA (dummy)	med	2363	0.40	0.49	0	1
CSA	North CSA (dummy)	north	2363	0.07	0.26	0	1
	Plain (dummy)	plain_d	2358	0.57	0.50	0	1
	Hill (dummy)	hill_d	2358	0.34	0.47	0	1
Geographical	Mountain (dummy)	mountain_d	2358	0.09	0.28	0	1
	Household members younger than 18 years old (dummy)	house18_d	2363	0.41	0.49	0	1
	Land-in relative (dummy)	land_in_relatives	2363	0.16	0.37	0	1
	Unemployed (# in the Household)	unemp_c	2336	0.21	0.58	0	3
Household characteristics	Farm income from agricultural activity > 50% of total household (dummy)	f_inco_more50	2363	0.65	0.48	0	1
	farmer younger than 40 years old (dummy)	age_min_40	2363	0.23	0.42	0	1
	farmer older than 60 years old (dummy)	age_more_60	2363	0.20	0.40	0	1
	Age of respondent (Ln of age_y)	lnage_y	2334	3.85	0.29	2.89	4.44
	Educational level lower than secondary school (dummy)	edu_level_low	2363	0.14	0.34	0	1
Farmer characteristics	Educational level higher than degree (dummy)	edu_level_high	2363	0.51	0.50	0	1
	Current SFP received (1000€)	pay_sfp_1000e	2363	18.32	52.54	0	1200
Policy	Payment per ha (€)	SFP_ha	2363	395.27	1124	0	17675
	Regular activity of advisory (dummy)	advisory_d	2363	0.56	0.50	0	1
Commercial Relational characteristics	sell to contract (dummy)	sell_contrac_d	2363	0.25	0.43	0	1
	sell to cooperative (dummy)	sell_coop_d	2363	0.40	0.49	0	1
	sell to private (dummy)	sell_private_d	2363	0.44	0.50	0	1
	external labour used on farm (# of Full time equivalents)	fulltime_equ	2363	1.48	4.93	0	104
	hosehold labour used on farm (# of Full time equivalents)	hh_fulltime_equ	2363	1.56	0.86	0	12
	household members working on farm > 2 (dummy).	hh_fulltime_more2	2363	0.39	0.49	0	1
Farm Structure	land rented-in (dummy)	land_in	2363	0.67	0.47	0	1
	land rented-out (dummy)	land_out	2363	0.12	0.32	0	1

UAA (ha)	UAA_ha	2363	95.71	281.2	0	7500
UAA less than 10 ha (dummy)	UAA_less10	2363	0.27	0.44	0	1
UAA greater than 50 ha (dummy)	UAA_more50	2363	0.09	0.28	0	1
UAA greater than 100 ha (dummy)	UAA_more100	2363	0.22	0.42	0	1
More than 50 dairy cows reared (dummy)	liv_dairy_more50	2363	0.09	0.28	0	1
Farm type field crop (dummy)	field_crops	2363	0.27	0.44	0	1
Farm type permanent crop (dummy)	permanent_crop	2363	0.07	0.26	0	1
Farm type grazing livestock (dummy)	grazing_livestock	2363	0.27	0.44	0	1
Farm type mixed crop livestock (dummy)	mixed_crop_livestock	2363	0.21	0.41	0	1

While the dependent variables differ among the models, the set of independent variables is mostly the same. Independent variables can be classified as belonging to the following categories: CSA geographical characteristics, farm-household, farmer, farm, commercial, relational and policy variables.

In all models the CSAs have been grouped in different areas, which are presented as four dummies (North CSAs; Mediterranean CSAs; Eastern CSAs and Centre CSAs). In all models, geographical variables are represented by altitude, which is presented as three dummy variables (plain, hill and mountain). Household variables are mainly related to the number of household members that are 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) and the presence/absence of household members younger than 18 years old (house18_d). Farm characteristics variables are the age of the farm owner (lnage_y; age_more_60; age_less_40), which, however, is expressed in different ways among the models considered and two variables connected with education level (edu_level_low; edu_level_high, respectively lower than the university degree and higher than secondary school).Commercialisation and relational characteristics variables are the presence/absence of the technical advice received by the farmer (advice_d); the typology of collocation on the market of the farm productions: presence or absence of contracts for selling the production (sell_contrac_d); presence or absence of vertical relationship with cooperative (sell_coop_d) or private firms (sell_private_d) In all models, 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, and the amount of labour needed. Finally the amount of SFP received and the SFP per ha received has been included into the policy category.

3. RESULTS

In Table 7 the results of the four multinomial logit models are presented.

Table 7 – Results of the four multinomial logit (not significant variables omitted).

Variable (Code)	Land		Labour		Capital (without livestock)		Capital (with livestock)	
	Negative effects	Positive effects	Negative effects	Positive effects	Negative effects	Positive effects	Negative effects	Positive effects
centre					+		-	
eastern	+				+			
med			-					
north				-				
plain	-							
house_18					+		+	
land_in_relative			+					
unemp_c							-	
f_inco_more50				+				
age_more_60							-	
ln_age								-
edu_level_low			-	-				
pay_sfp_1000e		+					-	
SFP_ha				+				
advisory_d					+			
sell_contract								+
sell_private					+			
sell_coop					+			
full_time_equ		-	+				+	
hh_fulltime_eq				-				
hh_fulltime_eq_more2		+						
land_in	+		+					
UAA_ha							+	
UAA_less10	-	-		-	-	-		
UAA_more50	+							
UAA_more100					+			
live_dairy_more_50			-					
field_crops	+		+					
permanent_crop	+	+	+					
grazing_livestock	+		+			-		
mixed_crop_livestock	+		+	+				
Observation	**999**		**979**		**1129**		**547**	
R2	**0.16**		**0.18**		**0.18**		**0.21**	

(for all dependent variable value=1 (no change) is the base outcome).

In the first model (effect of CAP abolishment in the land use) the probability to have negative effects increase for those farmers with large farm size (more than 50 ha), that are currently renting-in land and that are located in Eastern CSAs. In addition, such probability increases for those farmers specialised in field crops, permanent crops, grazing livestock and mixed crop and livestock. The probability to have negative effect is negatively related to the farmers with low UAA (less than 10 ha) and finally for those farmers located in plain. The probability to have a positive effect of CAP abolishment is increasing for those farmers that are using a high amount of household labour on farm, those farmers specialised in permanent crops and for those farmer that in the past have received a high amount of SFP. On the contrary, the probability to have the same effect of policy abolishment is lower for those farmer that are using a very low amount of land (less than 10 ha) and increasing the external labour used on farm.

The probability to have changes (reduction of the factor use) in the stated intention about the on-farm labour use after policy abolishment is mainly consequence of farm, farmer and household characteristics. The probability to have negative effect on the on-farm labour use; decrease with a higher amount of animal reared; with lower level of the education of the farmer owner and in the farmer placed on the Mediterranean area. Differently the probability to have the same effect of policy abolishment increasing with higher amount of external worker used, if the farmer rented-in some land and if a portion of this land is rented-in from the relatives. Finally specialised in fields crops, in permanent crops, in grazing and livestock and in mixed crop-livestock have higher probability to reduce the amount labour used on-farm.

These variables allow to consider more resilient to the reduction in the use of labour the large livestock farmer that could be expected a benefit from the quota abolishment mechanism and farmer located Mediterranean area as consequences of a lower expectation to allocate household labour in off-farm activity or due to the lower opportunity cost of the labour allocated to such activities.

The probability to have positive effect on the stated intentions concerning the on-farm labour use after policy abolishment, decrease for those farmers with lower level of education and for those farmers that currently use high amount of household labour and lower amount of land currently used. Finally the location in the North of Europe induces a lower probability to increase the labour on-farm as consequence of CAP abolishment mainly due to the lower needed of labour for alternative crops. The probability to have a positive effect on the stated intentions concerning the on-farm labour use after policy abolishment, increase in those farmers for which the main part of the household income comes from farming activities and for those farmers that receive a higher SFP per ha.

The probability to have negative impact (reduction of the factor use) in the stated intention about the capital use on-farm after policy abolishment (without changes in livestock), decrease only for those farms with UAA lower than 10 ha. Otherwise the probability to have a reduction in state intention about the capital use after a CAP removal increases for those farmer that are regularly using farm advice, which sell the main production directly to cooperatives or to private firms, those farmers with young household components and those farmers that have a large farm. The results show that the probability of a negative impact is increased also for farmers placed in the CSA belonging to the Centre area.

The probability to have an increase of the capital uses on-farm consequently to the CAP abolishment increases for farms specialised in livestock and grazing and reduces for farmers with lower amount of UAA. The reduction of capital use on-farm is differentiated between farm sizes. In fact such reduction is more likely for large farm size and for those farmers with characteristics that in the literature has been associated to the market oriented form and has low probability for small farm size. Similarly to the changes in land, the farms with lower size are more resilient to the changes in capital due to the CAP abolishment. The probability to have a reduction in the capital use on-farm (with changes in the amount of animals reared) consequently to the CAP abolishment increases for farmers with young household components; increasing the amount of external labour used on-farm and the land size and for the farmers located in the eastern CSAs. Differently the probability to have a reduction in the capital use on-farm is reducing for older farm owners; with higher amount of household un-employed, for

higher amount of the SFP received and for the farmers located on the CSAs in the Centre of Europe.

The probability to have an increase of the capital use on-farm (with changes in the amount of animals reared and only for livestock specialisation) consequently to the CAP abolishment increases for those farmers that sell the main part of the production by contracts. On the contrary, with increasing the age of farmers' owner there is a lower probability to have a positive effect due to CAP abolishment.

4. CONCLUSIONS

CAP change is expected to affect farm structure. In this paper we show that a dramatic hypothesis about CAP change (i.e. abolishment) is likely to have major effects, in particular concerning larger farms. More precisely, the model results provide a picture of impact of effect of policy removing on the use of land that suggest a substantially indifference for the small size farms (except if they decide to exit as a consequence of the scenario) but a strong impact in those farm with generally large size farms or large intensity. Among these farmers, the farms that expect to have an "expanding" behaviour under the Baseline scenario will reduce such expansion with the CAP abolishment. Such effect is particularly evident for land use and capital use on farm. For farms characterised by higher intensity, the effect are of policy abolishment is expected in both directions: the reduction of the land use is more likely for the farms with a very large size, while farmers that are receive higher SFP and with high use of household labour on farm (such as, for example, livestock farms or those farmer with high value of entitlements) have a higher probability to react to policy abolishment with an increasing of the use of land.

In addition the decision about land and capital use under different policy scenarios is correlated to each other more than with labour use on farm. In other words, the CAP abolishment affects less the decision about the labour use on farm, which can be interpreted as due to the fact that other factors, external to the farmers and the farms, play a higher importance. Farmers with low level of education are less likely to change labour use on-farm. This can be justified by the fact that such modality of the education variable reduces the off-farm alternative job opportunities and can also be associated to a lower attitude to changes and innovation.

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