UNDERSTANDING THE DETERMINANTS OF INVESTMENT REACTIONS TO DECOUPLING

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Abstract

The objective of this paper is identify the determinants of reaction to decoupling, focusing, in particular, on farm strategies and investment behaviour both on-farm and off-farm investment. The paper analyses a sample of 248 farm-households located in 8 EU countries, using decision tree algorithms. The factors emerging as determinants of an increase of on-farm investment as a reaction to decoupling are the existence of a successor, age, farm size, part time vs. full time head of farm. Allowing for the use of country variables, these tend to account already for the factors listed above and become the main predictors, followed by labour endowment, specialisation and expectations.

Key Words: PAC reform, investment behaviour, households, decoupling

JEL code: Q18, Q12.

Introduction

The 2003 reform of the Common Agricultural Policy (CAP) set a clear cut change compared to the past. Such change is amenable to produce a variety of effects in term of farm management, cropping practices and entrance/exit decision from the sector.

A number of studies in recent years have attempted to assess the impact of CAP reforms on farm behaviour, taking different points of view (crop mix, farm structural changes, etc.). Long term effects of policy changes and related impacts on investment behaviour received relatively little attention in ex post analysis CAP reform up to now.

Literature available show however that a number of variables may interact in decision to invest and, even more, in the reaction to policy changes in terms of investment.

The objective of this paper is identifying the determinants of reaction to decoupling, focusing, in particular, on on-farm investment behaviour. The paper analyses a sample of 248 farm-households located in 8 EU countries. The methodology used is a decision tree analysis aimed at identifying the relations between farm strategies and structural and personal characteristics.

The reminder of the paper is organised as follows. In section 2 a short summary of the state of the art is provided. In section 3 the methodology is explained, followed in section 4 by a description of the sample. Section 5 illustrates the results, followed, in section 6, by some discussion.

State of the art and open issues

The literature on farm investment behaviour includes a variety of contributions, focusing on the determinants of investment behaviour, the effects of policy on investment behaviour and the tools for analysing farm investment behaviour.

Contributions on this issue have been relatively less numerous than for other fields of agricultural economics research, despite its evident importance for the representation of farm behaviour. The analysis of investment at firm level became an important issue in the general economic literature during the 1950s and 1960s, and burgeoned in the agricultural economic literature during the 1990s. Early approaches, based on the neoclassical theory of the firm, were subsequently discussed and improved.

During the last two decades the literature focused on a number of investment-related topics such as asset fixity and adjustment costs, uncertainty and information, risk and other objectives, household characteristics, on-farm vs. off-farm investment, investment and labour allocation, investment and farm structure, investment and technical change, investment and contracts and investment and credit constraints (Thijssen, 1996; Andersson et al., 2005; Gardebroeck and Oude Lansik, 2004; Elhorst, 1993; Ahituv and Kimhi, 2002; Gardebroeck, 2004; Serra et al., 2004).

Despite the variety of themes and approaches, the present understanding of farm investment behaviour is considered to be, to a large extent, unsatisfactory. The main research gaps include the need for: a) more adequate instruments for ex-ante analysis; b) model adaptation to incorporate empirical information about farm preferences and expectations; c) closer attention to the connection between investment, technical change and learning; and d) a more empirically relevant treatment of the decision maker's (farm household's, firm's) objectives.

The amount of literature and the state of the art appear particularly unsatisfactory as far as policy analysis is concerned. Although a few recent studies tackled this issue, focusing to a large extent on decoupling, the analysis of policy impact on investment behaviour still appears to be a particularly challenging task. This may be attributed to the fact that policy scenarios interact with all other (numerous) determinants, particularly whole household/firm management, risk perception, asset liquidity and output prices.

For this reasons, methods tracing a too deterministic connection between investment behaviour and investment choice may appear not suitable for the analysis of farm-household reaction to policy.

Methodology

The understanding of the determinants of the reaction to decoupling is pursued using decision tree algorithms or CHAID (Chi-squared Automatic Interaction Detector) (Kass, 1980). This analysis studies the relationship between a dependent variable and a group of predictor variables to find those that best predict the dependent measure. This technique depends on the interactions between the variables. The developed model takes the form of a "tree trunk" with progressive splits into smaller and smaller "branches." The initial tree trunk is all of the participants in the study. A series of predictor variables are then analyzed to determine if splitting the sample leads to a statistically significant effect on the dependent measure. It assumes that interactions are present and proceeds to find the ones that explain the greatest differences between groups of households.

Farm sample

Data used in this paper are drawn from Gallerani et al., 2008. Households' sample was selected in order to fit in the intersection of the following categories: different countries, different altitudes (plain/mountain); different specialisation (arable crops, livestock, trees), different technology (conventional, organic). The survey included information about farm and household structure, expectations, reaction to planned and intended investment, as well as about potential reforms such as decoupling of EU payments. A summary of the case studies analysed in the study with the number of questionnaires is shown in

Table 1.

Table 1 – Summary of case studies and farms surveyed (number of questionnaires)

Technology	Area	Specialisation	DE	ES	FR	GR	HU	IT	NL	PL	Total
Conventional	Mountain	Arable	4			1		6		1	12
		Livestock	5					4		12	21
		Trees	7	2				7		9	25
	Plain	Arable	3	1	6	6	3	14		5	38
		Livestock	5				3	7	6	17	38
		Trees	3	14				11		4	32
Emerging	Mountain	Arable	7			3		7			17
		Livestock	3					6		7	16
		Trees	5					5			10
	Plain	Arable	4			2		6		1	13
		Livestock	4					3	6	3	16
		Trees						6		4	10
Total			50	17	6	12	6	82	12	63	248

Altogether, 248 farms were surveyed, distributed into 43 case studies. Of these, 33 were located in the three countries chosen as the main targets of the study (Italy, Germany and Poland).

Of the 248 household case studies, 195 were conducted in Italy, Germany or Poland. Questionnaires were asymmetrically distributed among conventional and emerging farming systems, with a higher number for the former (166) compared to the latter (82). Sample composition in Italy, Germany and Poland was designed to cover all the production specialisations that were chosen ex-ante (Table 4). However, for some of them, namely emerging mountain arable and trees in Poland as well as emerging plain trees in Germany, it was not possible to identify relevant examples (with the exception of very peculiar cases that were excluded).

Basic sample statistics are given in

Table 2.

Table 2 – Sample descriptives

	Sample descriptive statistics				
	Minimum	Maximum	Mean	Std. Deviation	% of farms with positive value
Family farms (%)	-	-	83	-	-
Age of farm head (years)	21	82	49	12	98%
Succesor (% of yes)	-	-	50%	-	-
Household head labour on farm (hours/year)	0	2200	1895	624	95%
Household head labour off farm (hours/year)	0	2200	151	508	7%
Household labour on farm (hours/year)	0	14400	4246	2826	78%
Household labour off farm (hours/year)	0	8800	1144	1921	28%
Total external labour purchased (hours/year)	0	62496	2475	6365	48%
Owned land (ha)	0	3830	56	249	96%
Land rented in (ha)	0	2954	42	197	64%
Land rented in (% of total farm area)	-	-	32	-	-
Land rented out (ha)	0	13	0	1	4%
Total land (ha)	1.3	4260	98	336	100%
Share of organic products (%)	0	100	28	44	31%
Debt/asset ratio	0	1	0.13	0.22	56%
SFP amount in 2005 (euro/farm)	0	500000	12092	37587	77%
SFP amount in 2006 (euro/farm)	0	160000	9847	18640	74%

The legal status of the farms was normally individual/family farms. The age of the farm head/manager covered a very wide range, though in the majority of cases it was concentrated between the mid-forties and mid-fifties, making the sample younger than the national average in most countries. About 50% of the farm heads have a successor to maintain farming.

The average labour availability per household was rather varied across countries. The share of off-farm labour was even more varied across cases. While in Greece and Hungary all labour is dedicated to the farm, in France and Spain off-farm labour tends to prevail. Italy is in an intermediate position. Livestock and fruit farming tend to require greater participation of household labour on the farm.

The farms in the sample were rather large compared with the respective national averages. The largest farms are those in Hungary and the annual crop producers in France and Italy, as well as emerging livestock producers.

Renting plays a major role in land availability, particularly for annual crops and livestock. In most case studies except Poland, the Netherlands and, to a lesser extent, Italy, rented land accounted for a share of the farm area equal to or higher than owned land.

The amount of CAP payments received by farms varies substantially across systems (Table 3).

Table 3 – SFP payments received (euro/farm)

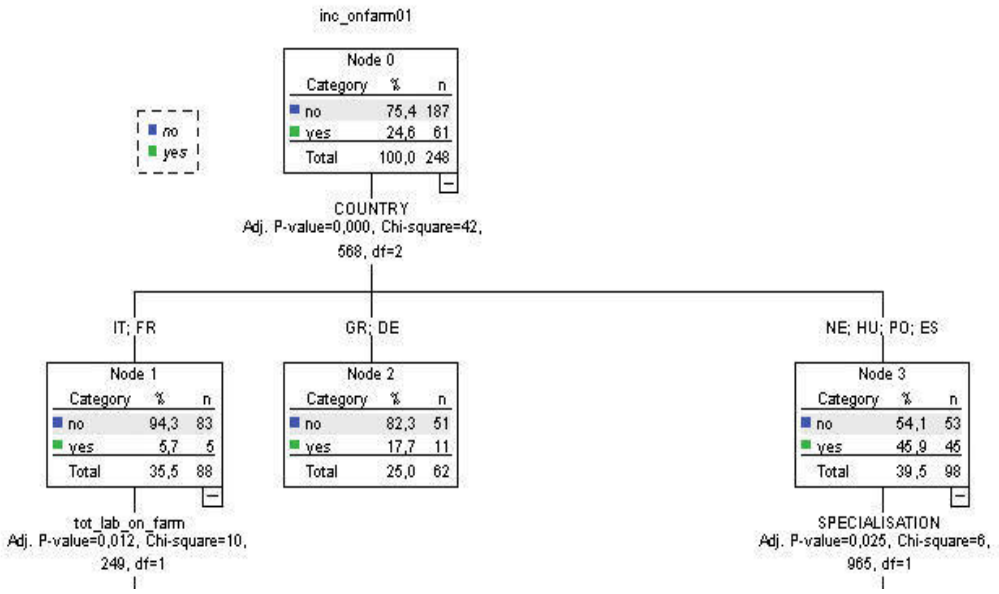
Technology	Area	Specialisation	DE	ES	FR	GR	HU	IT	NL	PL
CONVENTIONAL	Mountain	Crop	21798	-	-	11626	-	2508	-	960
		Livestock	23200	-	-	-	-	8631	-	1895
		Orchard/vineyard/forest	1600	7800	-	-	-	189	-	421
	Plain	Crop	16500	22000	47298	8595	-	25664	-	11145
		Livestock	48500	-	-	-	-	15357	13983	5573
		Orchard/vineyard/forest	1166	4004	-	-	-	281	-	901
EMERGING	Mountain	Crop	36174	-	-	1343	-	4100	-	-
		Livestock	15000	-	-	-	-	2667	-	1231
		Orchard/vineyard/forest	2733	-	-	-	-	0	-	-
	Plain	Crop	26000	-	-	9750	-	5867	-	1131
		Livestock	13933	-	-	-	-	11500	15343	4581
		Orchard/vineyard/forest	-	-	-	-	-	198	-	-

Arable crop systems and livestock receive much higher revenues from CAP payments, both as an average per number of hectares and as a total amount per farm. It is relevant to point out that in some systems/countries/farms the CAP payment does not reach an amount high enough to justify any relevant effects on household/farm decision-making. In Italy, for example, payments are limited to a few hundred Euros for tree cultivation and are never big sums in mountain areas, except for livestock.

Results

The choice to increase investment on farm is primarily explained by the country variable (Figure 1).

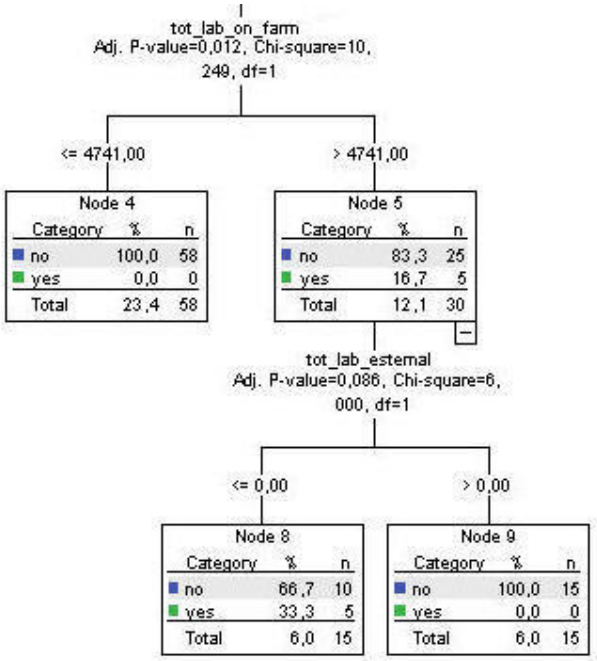
Figure 1 – Classification tree for the increase of on-farm investment (1)



Though in the whole group only 25% of the farms react to decoupling with an increase in investment, this share is highly differentiated between three groups. On one hand Italy and France have about 95% of no investment; on the opposite, the Netherlands, Hungary, Poland and Spain have a more equilibrated distribution between those that react with an increase of on-farm investment and those that do not. The importance of the variable "country" may be due to either the selection criteria in each country and the actual features of agriculture in each area.

In the case of Italy and France, the next major variable explaining the choice to invest on farm as a reaction to decoupling is the total labour on farm (Figure 2).

Figure 2 – Classification tree for the increase of on-farm investment (2)

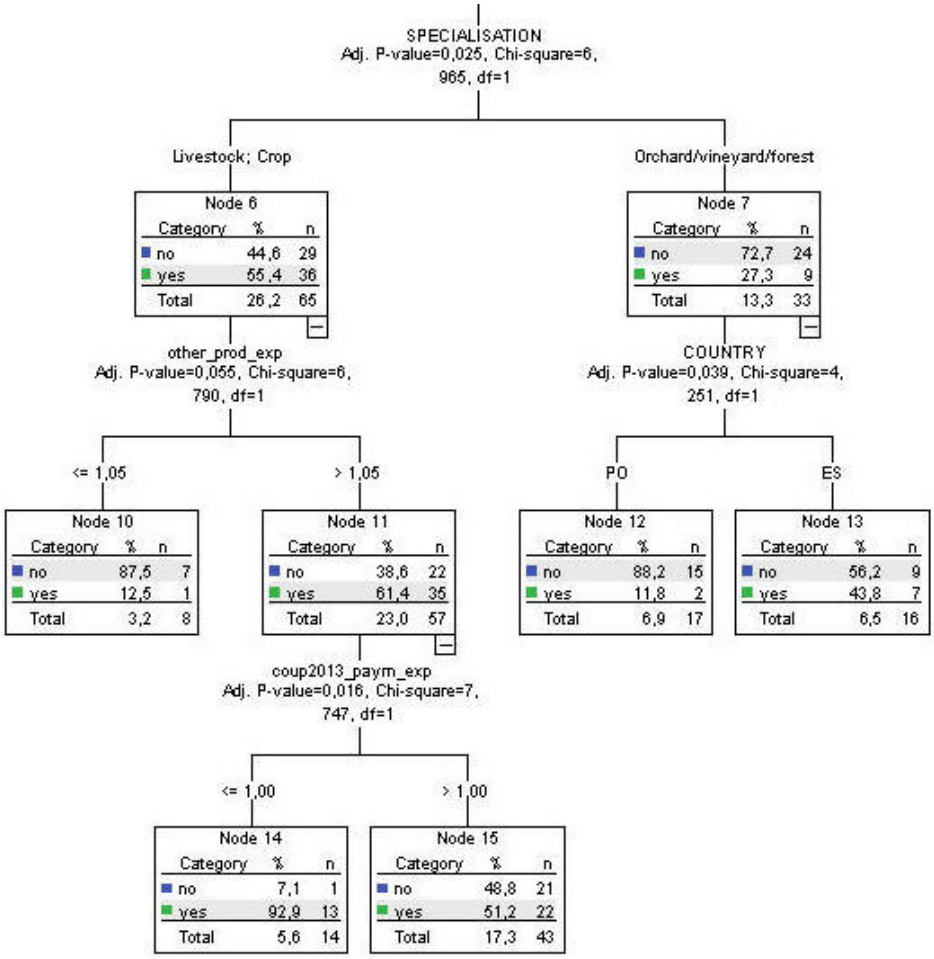


On-farm investment never happens in farms with labour availability below 4700 hours per year, while the only farms reacting with investment are those with a higher labour availability. Those investing, on the other hand, are only those characterised by absence of non-family labour.

In the case of the Netherlands, Hungary, Poland and Spain, the next explanatory variable better explaining the choice to invest on farm as a reaction to decoupling is farm specialisation (

Figure 3).

Figure 3 – Classification tree for the increase of on-farm investment (3)

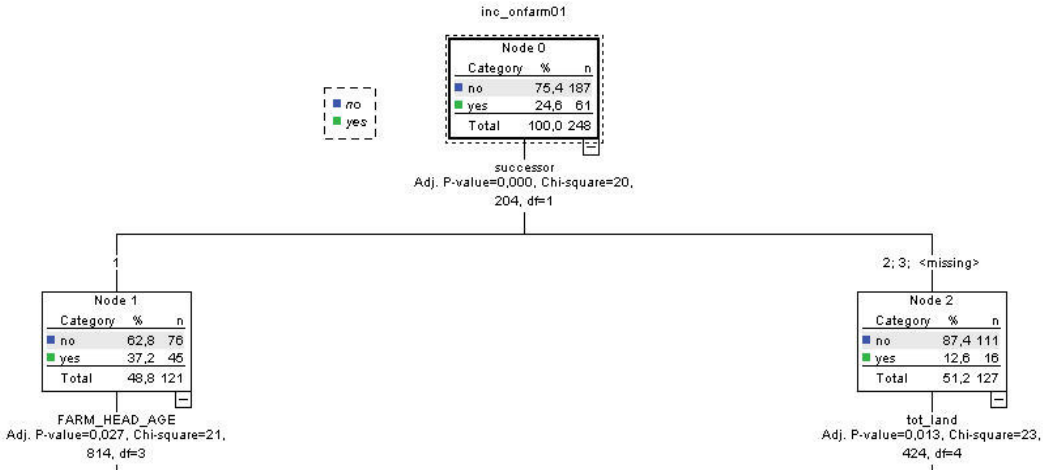


While livestock and crop react to decoupling with a prevailing attitude to increase investment, the opposite happens for orchard, vineyard and forestry. This latter is then further explained by the different country, where the difference between Poland and Spain may be easily related to the different system considered (fruit in Poland, olive in Spain). Reaction through investment for livestock and crop is further explained through positive expectations about prices and negative expectations about payments.

The main outcome of this analysis is that country actors affect the choice, together with labour endowment, specialisation and expectations. Contrary to previous research (e.g. Gallerani et al., 2008), factors such as Single Farm Payment amount (SFP), the presence of a successor, and total land owned, farm head age do not appear here. The main potential problem behind this outcome is that the country variable could hide some of these relevant factors, due to either the fact that different sample selection criteria have been used or that some of the relevant factors identified in previous research are in fact very differentiated among countries.

In order to dig further into this issue, the exercise has been repeated excluding the variable "country". The resulting classification trees are reported in the following figures. The main determinant of the choice to invest on farm is the presence of a successor (Figure 4).

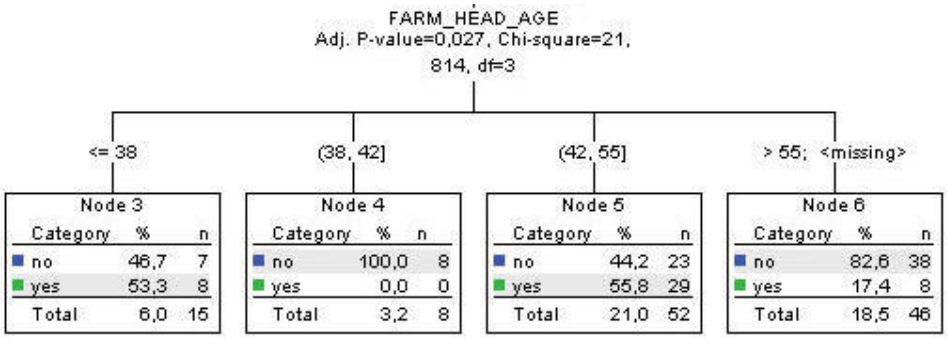
Figure 4 – Classification tree for the increase of on-farm investment-no country variable (1)



This distinguishes a group with higher percentage of investment (37%) from a group with a lower percentage (about 13%). The first group is marked, as expected, by the existence of a successor, while the second by the absence of a successor or by a "do not know".

The first of these groups (the one with a successor) is further split into four groups based on farm head age (Figure 5).

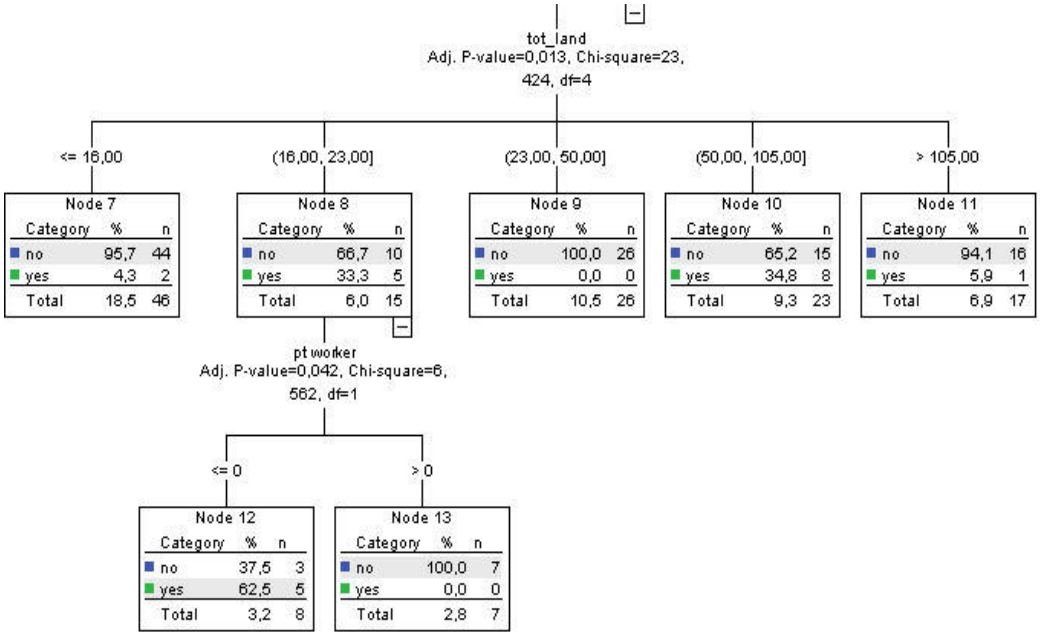
Figure 5 – Classification tree for the increase of on-farm investment-no country variable (2)



It is remarkable that the reaction characterised by investment is not linearly correlated to age. In fact the investment on farm is sharply stronger (with yes higher than 50%) for groups below 38 and between 42 and 55, while it is zero in the group between 38 and 42, and only about 17% in those above 55.

In the group of those without any successor, the choice of increasing investment is further determined by the size of the farms (Figure 6).

Figure 6 – Classification tree for the increase of on-farm investment-no country variable (3)



Again the behaviour is not linear. Investment is almost zero for small farms (below 16 hectares), high (33%) for those farms between 16 and 23 hectares, zero between 23 and 50 hectares, about 35% for those between 50 and 105 hectares, 6% for those of above 105 hectares.

This alternate trend may be likely related to other characteristics of the farms, like farm specialisation and labour management. A hint of this is yielded by the group 16-23 hectares that further split into two groups according to the qualification of part-time worker. In this case it appears clearly that only those that work full time invest (in a share of more than 60%), while nobody in the group of part timers react to the decoupling through an increased investment on farm.

Discussion

The analysis discussed in this paper attempt to identify the main factors explaining the reaction to decoupling though a classification tree approach.

Using the full set of variables available, the main outcome is that country actors affect the choice, together with labour endowment, specialisation and expectations. Excluding the country variable, more classical factors emerge as determinants, in particular the existence of

a successor, age, farm size, part-time vs. full time head of farm. The outcome confirms the importance of personal and structural variables in determining the impact of decoupling on investment behaviour. It also supports the fact that different systems can react differently as a consequence of the different characteristics of the farms belonging to those systems and of the farms running those farms.

Altogether, this confirms that the SFP tends to contribute to reaction driven by the general strategy of the farm, i.e. increasing investment in farms that already have a positive attitude to investment and enlargement. Location (accounting for physical characteristics and legal context) contribute to explain the reaction to policy.

However, the alternate characteristics of the groups produced hints at the fact that the variables identified may have a complex effect on farm reaction to investment (age and size in particular), likely, but not only, expandable through their interaction with other variables. Discrepant outcomes related to the role of single factors may suggest that further qualitative and in deep research is needed in order to understand the actual mechanisms of reaction to policy, particularly where one attempts to detect minor changes compared to the evolution of variables in the wider socio-economic and market framework.

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References

Ahituv A. and Kimhi A. (2002): Off-farm work and capital accumulation decisions of farmers over the life-cycle: the role of heterogeneity and state dependance, *Journal of Development Economics* 68: 329– 353.

Andersson, H., Ramaswami, B., Moss, C. B., Erickson, K., Hallahan, C. and Nehring, R. (2005): Off-farm Income and Risky Investments: what Happens to Farm and non Farm, Selected Paper for presentation at the *2005 AAEA annual meeting Providence*, RI July 24-27, 2005.

Elhorst J. P. (1993): The estimation of investment equations at the farm level, *European review of agricultural economics* 20: 167-182.

Gallerani V., Gomez y Paloma S., Raggi M., Viaggi D. (2008). *Investment behaviour in conventional and emerging farming systems under different policy scenarios*. JRC Scientific and technical reports, EUR 23245 EN – 2008.

Gardebroek C. (2004): Capital adjustment patterns on Dutch pig farms, *European Review of Agricultural Economics*, 31(1), pp. 39-59.

Gardebroek, C. and Oude Lansink, A. G. J. M. (2004): Farm-specific Adjustment Costs in Dutch Pig Farming, *Journal of Agricultural Economics* 55 (1): 3-24.

Kass G. (1980): An explanatory Technique for investigating large quantities of categorical data, *Applied Statistics*, 29, 119-127.

Serra T., Goodwin B. K., and Featherstone, A. M. (2004): Determinants of investments in non-farm assets by farm households, Selected Paper prepared for presentation at the *American Agricultural Economics Association Annual Meeting*, Denver, Colorado, July 1-4, 2004

Thijssen G. (1996): Empirical Assessment of Two Specifications of Expectations, *American Journal of agricultural Economics* 78: 166-174.