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TITRE: What determines the choice over asset specificity? An empirical test with agro-environmental contracts

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Abstract :

The agro-environmental contract is a widely used policy-instrument in Europe dedicated to produce environmental services in rural areas. The State designs the form of offered contracts: flexibility, duration, eligibility, menu of environmental friendly practices and compensation payment rates. Every voluntary farmer freely chooses environmental friendly practices according to their characteristics, among which involved specific assets have a major role. This paper models the farmer's choice from among different practices with different asset specificity levels. We assume a utility maximizing farmer who compares the offered compensation with compliance costs. Compliance costs include costs derived from the adaptation of the farm technology to contract requirements and transaction costs. Since the calculation of compensation rates is based on average operational costs only, the variability of transaction costs across practices deeply affect their uptake rate. The empirical analysis is based on a sample of 328 French farmers interviewed in 2005. The questionnaire enables to describe determinants of transaction costs rooted in farmers' characteristics and environmental characteristics of the transaction. Results support that distrust in the State and uncertainty stemming from the opacity of public decisions have a significant negative effect on the probability the farmer chooses specific assets. They also show the more the agro-environmental transaction is similar to ones the farmer he is already engaged, the higher the probability he chooses non specific assets.

Key words: Agro-environmental contract, asset specificity, endogeneity, transaction costs

JEL classification : D23, Q12, Q28

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What determines the choice over asset specificity? An empirical test with agro-environmental contracts¹

Géraldine DUCOS and Pierre DUPRAZ

I. INTRODUCTION

The agro-environmental contract is a widely used policy-instrument in Europe dedicated to produce environmental services in rural areas. These services are, for instance, water quality improvement (towards low nitrates concentration), landscape, or biodiversity. The State designs the form of offered contracts: flexibility, duration, eligibility, menu of environmental friendly practices and corresponding compensation payment rates. Every voluntary farmer freely chooses environmental friendly practices according to their characteristics, among which involved specific assets have a major role. Indeed, asset specificity arises when investments permit cost savings to be realized but such investments are also risky, in that specialized assets cannot be redeployed without sacrifice of productive value if contracts should be interrupted or prematurely terminated (Williamson, 1985). This constitutes a hold up problem from which difficulties of writing contracts contingent on all important future events and the fact that these contracts can be renegotiated may lead to high transaction costs. Transaction costs should then be taken into account in the decision over what level of asset specificity to invest in. Therefore, since the production of environmental services depends on the specificity of chosen assets, conditions favouring farmers' choice toward specific assets require to be better known. The objective of this study is thus to examine the determinants of farmers' choice over asset specificity.

The usual approach to explain farmers' participation in agro-environmental contracts assumes the standard maximization of farm profit. When the contract payment exceeds the profit forgone due to contract requirements, the farmer enrolls. The model may also take the farmer's preferences into account as a consumer (Dupraz et al., 2003). These preferences may then interact with farm management decision making. Especially, a higher environmental awareness may decrease the minimal contract payment that triggers the farmer's participation. The present contribution is based on similar assumptions, but focuses on farmers' adoption of environmental friendly practices involving specific assets.

In line with the EU rural development regulation 1257/99, the compensation payment only covers "operational costs" which are additional costs and profit foregone resulting from the farm technology adaptation to the commitment made. Usually, per-hectare payments are based on the average operational costs in each region. With such payment patterns, all proposed environmental friendly practices are expected to attract a good share of farmers if transaction costs borne by the farmers are negligible or compensated by his own willingness to pay for implementing agro-environmental contracts. Therefore, from this analysis framework, we assume the farmer will choose the environmental friendly practice associated to the lowest magnitude of transaction costs. This paper aims at studying conditions which may lower or increase transaction costs associated to a level of asset specificity and impact on farmers' choice over asset specificity.

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Our empirical analysis is based on farmers' choice modelling. Facing different bundles of environmental friendly practices, with or without compensation payments, each farmers select the bundle that maximises his utility. Of course, without payment, his willingness to pay should compensate his profit foregone. If the different selected bundles are associated to different asset specificity levels, the corresponding contracts induce different levels of transaction costs borne by the farmer. As transaction costs and asset specificities are endogenous in the farmer's decision, such differences are expected to be revealed by the statistical effect of transaction cost determinants on this decision. Such effect should distinguish contractors and non contractors, but also the different types of practices. The interpretation of the results relies then on propositions derived from the transaction cost economics literature and its empirical outcomes to relate exogenous determinants of transaction costs to asset specificity. We identified eight principal determinants of transaction costs, namely trust, bounded rationality, utility in the transaction, uncertainty, frequency of the transaction, similarity of transactions, evolving production system and capital ownership status. Propositions such as "the more the farmer trusts in the State, the higher the probability he chooses specific assets, *ceteris paribus*" are then stated.

The estimation of a multinomial logit model with data collected among 328 French farmers in 2005 clearly supports that trust in the State, and the similarity of transactions have a major role in farmers' choice over asset specificity. The higher the farmer trusts in the State, the higher the probability he chooses specific assets. The more the agro-environmental transaction is similar to ones the farmer he is already engaged, the higher the probability he chooses non specific assets. They also support, but in a less rigid way, that uncertainty stemming from the opacity of public decision making and bounded rationality reduce the probability the farmer chooses specific assets.

Very few studies tried to take the asset specificity endogeneity into account whereas it is asserted (Masten, 1995, Masten and Saussier, 2002) that the specificity of assets is itself a decision variable and should be treated as an endogenous variable. From what we know, two authors focused on that issue. Lyons (1995) observed the probability of buying-in specialized inputs is higher if the production technology is non specific, but only if there are economies of scale and scope. In coal procurement contracts, Saussier (2000) endogenizes site specificity and the carrier's transportation capacity with river characteristics, or the annual residual demand for coal. We believe this study to be a first attempt to identify and widen the spectrum of hypothetical conditions of specific asset integration.

In section 2, we present the conceptual framework from which we derived propositions to relate exogenous determinants of transaction to asset specificity and transaction costs.. Section 3 describes the hold up problem in the agro-environmental transaction and characterizes the different possible "contract types" or asset specificity levels the empirical analysis is based on. Section 4 provides data information and estimation results. Section 5 concludes.

II. THE CONCEPTUAL FRAMEWORK AND HYPOTHESIS

II.1. Asset specificity: Theory and evidence

Asset specificity is the most important and most distinguishes transaction costs economics from other treatments of economic organization. Transaction specific investments results in assets that have greater value when used to service a particular transaction, than they would have if that relationship broke down. This constitutes a hold up problem in which the economic relationship is characterized by the existence of quasi-rents that are available to parties to bargain over. Thereby, significant problems related to negotiation or maladaptation aspects may arise and generate important transaction costs (Athias and Saussier, 2006).

The literature on hold-up originated within transaction cost theory literature and more recently in the incomplete contract theory literature. Both literatures begin with Coase (1937) and have consistently focused on the role transaction costs play in determining the distribution of property rights, broadly defined as all laws, rules, social customs and organizations that generate incentives for behaviour. Every distribution of property rights has with it a set of production costs and a set of transaction costs. The distribution of property rights that maximizes the gains from trade net of all costs is the optimal distribution. This in fact is the grand hypothesis of transaction cost economics under the property right approach. Williamson is the first to note the role sunk costs² can play in causing contracting problems and incentives to vertically integrate. This idea is then popularised in Klein, Crawford and Alchian (1978). They assume an asset is owned by one individual and rented to another individual. The quasi-rent value of the asset is the excess of its value over its salvage value, that is, its value in its next best use to another renter. The potentially appropriable specialized portion of the quasi-rent is that portion, if any, in excess of its value in its second highest-valuing user.

Asset specificity may have different forms. According to Williamson (1985), four types of asset specificity are usefully distinguished: “site specificity –e.g. successive stations that are located in a cheek-by-jowl relation to each other so as to economize on inventory and transportation expenses; physical asset specificity –e.g. specialized dies that are required to product a component; human asset specificity that arises in a learning-by-doing fashion; and dedicated assets, which represent a discrete investment in generalized (as contrasted with special purpose) production capacity that would not be made but for the prospect of selling a significant amount of product to a specific customer.” Masten et al. (1991) add a fifth type of asset specificity: time specificity, which we will be interested in the present case study. Indeed, “when timely performance is critical, delay becomes a potentially effective strategy for exacting price concessions. Knowing that interruptions at one stage can reverberate throughout the rest of the project, an opportunistic supplier may be tempted to seek a larger share of the gains from trade by threatening to suspend performance at the last minute. Even though the skills and assets necessary to perform the task may be fairly common, the difficulty of identifying and arranging to have an alternative supplier in place on short notice introduces the prospect of strategic hold ups”.

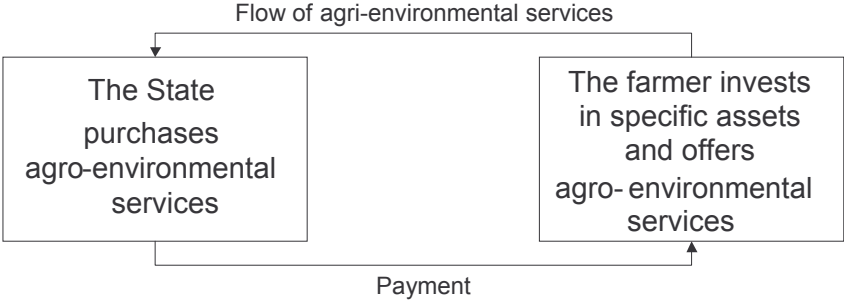
² The sunk cost notion, as defined by Baumol et al. (1983) can be linked to the Williamson’s specificity in the sense that difficulties to resell assets imply their non-redeployability. However, specificity goes beyond the “sunkness” since it is not characterized from the resell market state but from asset idiosyncratic attributes.

Even if the transaction cost economics approach is not linked with formal models, it offers an “empirical success story” in the sense that many empirical tests flourished and confirmed propositions on make or buy issues (Masten, 1999 and Boerner and Macher, 2002) or contractual choices (Masten and Saussier, 2002) . As regard to the literature on environmental service transactions, the presence of transaction costs has also been widely demonstrated (Stavins, 1995, Kuperan et al. 1998, McCann and Easter, 1999, Falconer et al. 2001). However, as previously said, the specificity of assets is usually treated as an exogenous variable whereas they are themselves decision variables and should be treated as endogenous variables. This study aims at identifying determinants of asset specificity. Next section provides an analysis framework.

II.2. Conditions for choosing specific assets

We consider two contracting parties, the State and the farmer. Next figure illustrates the economic relationship between these two parties.

Figure 1: Contract description when trade occurs



The State offers pre-designed contracts, i.e. duration, renegotiation rules, eligibility, payments and sanctions are defined by the State, for environmental services performed by the voluntary farmer. The State is the only purchaser of environmental services in rural areas. A menu of environmental friendly practices, or contract requirements, the farmer can choose among is also provided with offered contract. From chosen environmental friendly practices, the farmer will make investments which may require specific assets. We assume the farmer maximizes his utility and decides to enroll with given environmental friendly practices if the offered contract price is higher than compliance costs. Compliance costs are technology adaptation costs derived from additional costs and income foregone resulting from the commitment made, and transaction costs. Since the payment is based on average technology adaptation costs only, the variability of transaction costs from an environmental friendly practice to an other is assumed to affect their uptake rate. Therefore, given that asset specificity is a factor of transaction costs, the farmer should choose the environmental friendly practice which involves the lowest transaction costs.

From this framework, some conditions may lower or increase transaction costs associated to a level of asset specificity and thus impact on farmers’ choice over asset specificity. These conditions and related hypothesis on their effect on farmers’ choice are presented below.

II.2.1. Trust

As defined in Sako and Helper (1998), trust is an expectation held by an agent that its trading partner will behave in a mutually beneficial manner. Even if they conceptualize trust has not being a mere opposite of opportunism, for simplification, we will consider trust as the opposite of opportunism. A lack of trust may stem from the fear the co-contracting party might try to take unfair decisions, or suspicion on his use of given information, or distrust arising from non shared goals. Trust is thus expected to reduce the hold up pressure on the investing party, and consequently the magnitude of transaction costs he bears, other things being equal.

Proposition 1: The more the farmer trusts in the State, the higher the probability he chooses specific assets, *ceteris paribus*.

II.2.2. Bounded rationality

According to Williamson (1985), bounded rationality is a semi-strong form of rationality in which economic actors are assumed to be “intendedly rational, but only limitedly so” (Simon, 1961, p.xxiv). Bounded rationality thus implies “economic agents do not know all the solutions to the problems they face, are unable to calculate the possible outcomes of these solutions, and cannot perfectly arrange these outcomes in order in their space of preferences. With regard to contracts, this means that they are unable to design the optimal solutions (behavioral rules) taking into account every relevant contingency without high, and sometimes prohibitive, costs and delays” (Brousseau and Fares, 2000). Therefore, if we assume decisions are time-consuming and costly, that agents can make mistakes, and that they are victims of strong information asymmetries, we can acknowledge more bounded rationality lead to more transaction costs.

Proposition 2: The more the farmer has a bounded rationality, the lower probability he chooses specific assets, *ceteris paribus*.

II.2.3. Utility in the transaction

In the case of public good transaction, it is not impossible the investing party has utility in the good he produces. This “self-utility” for the transaction gives thus a value to specific asset services outside the transaction with the State. The hold-up problem is thus reduced and transaction costs dedicated to protect the relationship with the State are lower. Therefore, we consider the more farmers have utility in a transaction, the less transaction costs he bears.

Proposition 3: The more utility the farmer get from environmental services he produces through the agro-environmental contract, the higher probability he chooses specific assets, *ceteris paribus*.

II.2.4. Uncertainty

Uncertainty is associated to disturbances from two different origins (Williamson, 1985).

Primary uncertainty is of a state-contingent kind, i.e. arises from random acts of nature and unpredictable changes in consumers’ preferences. Secondary uncertainty arises from a lack of communication among decision makers. This secondary uncertainty is of a rather innocent or non strategic kind, contrarily to behavioral uncertainty, i.e. opportunism. According to Saussier (2000), uncertainty is assumed to increase the level of transaction costs, *ceteris paribus*. Indeed, contracting becomes increasingly incomplete in the presence of uncertainty, and, asset specificity renders a firm vulnerable to other parties’ self-interested behavior.

Proposition 4: The more uncertainty surrounds the agro-environmental transaction, the lower the probability the farmer chooses specific assets, *ceteris paribus*.

II.2.5. Frequency

Frequency is also a relevant dimension since the costs of a governance structure involving investments in transaction-specific assets will be easier to recover for large transactions of a recurring kind (Williamson, 1985).

Proposition 5: The more recurring the agro-environmental transaction, the higher the probability the farmer chooses specific assets, *ceteris paribus*.

II.2.6. Similarity of transactions

The similarity of transactions can be defined as “those transactions that are similar to ones in which the firm is already engaged” (Masten et al., 1991). This characteristic will impact on internal organization costs, i.e. the costs of organizing and losses through management decision mistakes. Indeed, costs related to efforts to adapt the production technology and management decisions with the agro-environmental transaction will be higher when the farmer is unfamiliar with what he commits. We should thus observe a lower level of asset specificity when farmer’s activity is different from what the agro-environmental contract requires.

In addition to the effect the similarity of transactions may have on internal organization costs, we also consider the effect the similarity of transaction may have on economies of scale and scope. From Lyons’ study (1995) where he observes economies of scale and scope have a significant effect on the decision to buy or self-produce inputs requiring a non specific production technology, we argue economies of scale and scope and their interaction with specific assets have a role in the farmer’s choice over specific assets. Indeed, we expect farmers choose environmental friendly practices whose required technology is close to their current one and thus allow them to get economies of scale and scope. Involved asset services are thus easily redeployable on other farm uses without losing significant value and are consequently assumed to be non specific.

Proposition 6: The more the agro-environmental transaction is similar to ones he is already engaged, the higher the probability he chooses non specific assets, *ceteris paribus*.

II.2.7. Evolving production system

We consider farmers being on a dynamic of technology or management changes are looking for investments leading to cost savings and thus on specific assets. These conditions are thus expected to favor the introduction of specific assets.

Proposition 7: The more the farmer is in a dynamic of production system change, the higher the probability he chooses specific assets.

II.2.8. Capital ownership status

This is the last condition we suspect to have a role on farmers’ choice. Bougherara et al. (2005) argue the probability farmers enrol environmental friendly practices producing long term environmental services is higher when they own their land. Assuming these practices require specific assets, we state the last proposition.

Proposition 8: The more land the farmer owns, the higher the probability he chooses specific assets.

Next table presents a synthesis of expected effects of the determinants described above on the choice over asset specificity.

Table 1: Synthesis of expected effects of determinants on the probability to choose specific assets

Determinants	Asset specificity level
Trust	+
Bounded rationality	-
Utility	+
Uncertainty	-
Frequency	+
Similarity of transactions	+
Evolving production system	+
Capital ownership	+
-: reduced asset specificity +: increased asset specificity	

II.3. The econometric specification

We assume a utility maximizing farmer facing K environmental friendly practices. Offered per-unit payments are included in the K -dimensional vector q . The farmer selects the K -dimensional vector y of environmental service units for each practice, according to his preferences and budget constraint. These agro-environmental commitments last 5 years corresponding to a medium term time horizon. Utility is supposed to be non decreasing, continuous, differentiable and quasi-concave in the private consumption m and the vector y . Utility also depends on exogenous farmer's preferences. In the budget constraint, the medium term income m can not exceed the contract payment $q \cdot y$ plus the short term profit that depends on y and on prices of variable inputs and outputs p . $\pi(p, y)$ is assumed linearly homogenous in prices p , non increasing and quasi-concave in y . This profit function also depends on exogenous characteristics of the farm and of exogenous determinants of transaction costs.

$$\text{Max}_{m,y} \{U(m, y); m \leq \pi(p, y) + q \cdot y; y \geq 0\} \quad (1)$$

The solution of the maximisation programme (1) is noted (m^*, y^*) , with $V(p, q) = U(m^*(p, q), y^*(p, q))$ being the indirect utility function. The vector y^* is the optimal combination of agro-environmental commitments which is selected by the farmer. Given the very high number of different practices, leading to many possible combinations of contracted practices, this decision making process is difficult to estimate directly.

In order to derive a tractable econometric specification, we assume a two stage decision making process, based on a partition Z of all possible combinations of practices distributed into J groups of combinations noted Z_j . The partition includes groups of non paid practices. These groups differ according to the asset specificity associated with the corresponding combinations of practices. Within each group, the maximal utility is:

$$V(p, q, Z_j) = \text{Max}_{m,y} \{U(m, y); m \leq \pi(p, y) + q \cdot y; y \in Z_j\} \quad (2)$$

It follows that:

$$V(p, q) = \text{Max}_j \{V(p, q, Z_j); Z_j \in Z\} \quad (3)$$

We consider the decision of the i^{th} farmer associated with the maximization programme (3).

Her/his maximal indirect utility for the group Z_j is noted V_{ij} which is her/his solution to programme (2).

The econometric specification then relies on a random utility model:

$$V_{ij} = b_j x_i + u_{ij} \quad \forall j = 1, \dots, J \quad (4)$$

Where x_j is the vector of explanatory variables describing the exogenous determinants, b_j are the corresponding parameters to be estimated, and u_{ij} a perturbation which is assumed to have a Gompertz distribution ($F(u_{ij}) = \exp(-\exp(-u_{ij}))$). Perturbations are assumed independent and identically distributed.

Let d_{ij} be the dichotomous variable describing farmer i 's choice over the different combination groups Z_j . In accordance with relation 3, the decision rule is:

$$\begin{aligned} d_{ij} &= 1 && \text{if } V_{ij} > V_{ij'}, \quad \forall j' \neq j \\ d_{ij} &= 0 && \text{otherwise} \end{aligned} \quad (5)$$

The relations (4) and (5) specify a multinomial logit model (Gouriéroux, 1989) where the probability of the i^{th} farmer to select a combination of the group Z_j is given by (6):

$$P_{ij} = \Pr\{d_{ij} = 1\} = \frac{\exp(x_i' b_j)}{\sum_{j'=1}^J \exp(x_i' b_{j'})} \quad \forall j \quad (6)$$

III. AGRO-ENVIRONMENTAL CONTRACTS: AN EMPIRICAL TEST

III.1. Characterizing asset specificity

In the agro-environmental transaction asset specificity may appear in three contexts. First in timely dependant issues. Indeed, for environmental outcomes to be gained, most of environmental friendly practices must be operated on proper periods as a function of meteorological conditions and natural cycles. Even if skills and assets necessary to perform these tasks are common, it is very difficult for the State to turn to an alternative supplier in place on short notice, which may introduce strategic hold up. In addition of being dependant on time aspects, environmental outcomes depends on agro-environmental practice localization too, which constitutes a second source of asset specificity. As for time specificity, skills and investments are easily redeployable, but environmental goals can't be reached if these tasks are implemented elsewhere. This is thus an other opportunity for hold up. Both hold up cases mostly concern the State in that he should not be bargaining from a position of strength. However, these time and site requirements bring the farmer to adopt his farming production system and may lead him to be required to improve his agronomic knowledge and his material park (Bougherara and Ducos, 2006). These new skills have currently no other uses outside the agro-environmental contract with the State, which put the farmer in a hold up position too. The third origin of asset specificity stems from human skills. Practices aiming at biodiversity or extensive management goals such as low pesticide inputs require advanced agronomic and ecological knowledge which does not find other valuable uses outside the transaction with the State. This constitutes an other hold up case as regard to the farmer point of view.

Finally, in order to make a full description of the hold up problem in the agro-environmental transaction, uncertainty aspects and the two involved parties' characteristics require to be evoked. The uncertainty may be qualified as very high. Indeed, on the one hand, farmers are subject to several sources of "primary uncertainties" such as the climate, the very fluctuating market prices and political changes. On the other hand, "secondary uncertainty" stems from the opacity of public decision making process, which is a particularity of the agricultural sector. As regard to the characteristics of involved parties, and particularly of the rationality aspect, both the State and farmers have a very limited knowledge on the technology to implement to reach environmental outcomes. Agro-environmental technologies are highly interacting with the natural environment and call for very complex biophysical mechanisms. This does not allow the contracting parties to write a contract on environmental goals but on mean/media objectives only which are much more easy to observe and verify but places the State in a risky position since it has no guaranty to get environmental outcomes from the media it contracts on. High uncertainty and bounded rationality thus make the hold up problem to arise in the agro-environmental transaction.

III.2. Description of the different "contract types"

Concerning environmental friendly practices, we collected data distinguishing compensated practices, i.e. contracted measures, from non compensated practices.

Our survey includes 45 different contracted measures. Assuming a two stage decision process, we consider seven groups of environmental friendly practices combinations. There are five groups of contracted practice combinations, or contract types, and two groups of non compensated practice combinations. For non compensated practices, the group (C1) includes combinations of more than 4 specified practices, while the group (C2) includes combinations of less than 3 specified practices, including none. The 5 contract types were created with the Multiple Correspondence Analysis (MCA) developed by Benzécri (1969)³ and a classification method. Contracts A require non specific assets and contracts B require specific assets. The last column indicates the level of the compensation payments. Therefore, among contracting farmers, this classification allows to distinguish 2 groups of environmental friendly practices: those requiring a high level of asset specificity (B1 and B2), and those requiring a low level of asset specificity (A1, A2, A3). C1 farmers do not call for specific assets either. Next table presents these different contract types.

³ The MCA method reveals possible relations existing between qualitative variables and enables to create quantitative variables. From the data analysis point of view, the qualitative variable is a question and its modalities are the different possible answers. The new variables are sample observations coordinates on selected axis provided by the MCA, MCA axis being selected according to usual rules.

Table 2: Description of contract types

Contract types	Nb. of farmers	Environmental friendly tasks	Description	Average payment per farm
A1	43	Changes on arable lands and meadows	Reduce bare land in winter Extensive management of meadows	5683€
A2	28	Practice maintenance on meadows	Extensive management of meadows	6181€
A3	68	Changes on meadows and landscape	Reconversion towards grazing systems + Extensive management of meadows Landscape maintenance	6324€
B1	20	Fauna protection	Meadow management towards fauna and flora improvement	9966€
B2	12	Changes on arable lands	Reduce bare land in winter Reduce pesticide and fertilization input	7189€
C1	76	More than 4 non paid actions	Significant environmental effort	0
C2	81	Less than 3 non paid actions	Low environmental effort	0

It is important to note that we distinguish environmental friendly practices from their asset specificity level. However, they differ on other aspects too. For instance, contracts A are similar from the asset specificity issue but they differ from the technology they call. Indeed, contract A2 and A3 call for grassland farm technology whereas contract A1 calls for non grassland farm technology. As regard to contracts B, they differ on political issues. The European Common Agricultural Policy (CAP) favours environmental friendly practices close to contract type B2 for the next coming years. Finally, contract A and B differ on an other important aspect which is their implementation date. Except from contract B1, which originated in the 1992-reform of the Common Agricultural Policy, they all stem from the 1999-reform. Therefore, farmers with contract B1 could commit on a longer period than others.

IV. DATA AND RESULTS

IV.1. Description of the dataset and explanatory variables

328 farmers were face to face interviewed in 2005 in the French region “Basse Normandie”. Among them, 171 are contracting farmers and 157 are non-contracting ones. The sample is quite representative although contracting farmers are over represented on purpose in order to get better information on contracts.

Several types of variables were collected in order to capture the notion of the determinants previously described. They describe the farmer (education level, environmental awareness...), his production system (farm legal status, number of Full Time Equivalent workers...), his professional environment (involvement in agricultural organizations, administrative and

technical external services,...) and his relationship with his co-contractor, the State (trust in administrations, ...). In order to use relevant explanatory variables from the 634 variables collected in total, the primary data were gathered following different methods. 10 global variables were created using the MCA. Annex XX presents the composition of these variables. In addition, XX ratio variables were created such as the number of FTE workers variables or land use variables. XX continuous variables were added up. Finally, some other qualitative variables were gathered into classes of variables as general education levels (3 classes), age (3 classes). 18 classes of qualitative variables were added up.

These explanatory variables describe the determinants of asset specificity as follows.

Table 3: Explanatory variable definitions

Determinants of asset specificity	Related constructed explanatory variables
Bounded rationality	Agricultural education (AGRI EDUC) General education Age (AGE)
Trust	To trust the implementation process of agro-environmental contracts (TRUST IMPL) Goodwill trust in the State (GOODWILL)
Uncertainty	To regularly receive technical and administrative advices (ADVICES) To be involved in an agricultural organization (ORGA)
Similarity of transaction	Grassland share (GRASSLAND) Farm land area (UAA) Labor (FTE) Animal population
Utility	Children Environmental awareness (ENV AW) Free time dedicated in nature related hobbies
Evolving production system	Changes in the production system in the last 5 years (CHANGES)
Frequency	To have already enrolled an agro-environmental contract (EXPERIENCE)
Asset ownership status	Machinery ownership Land share in ownership Land share in long term tenant tenure Land share in short term tenant tenure

The similarity of transaction is measured from the characteristics of the farm production technology and the technology required by the different environmental friendly practices.

Table 4 presents descriptive statistics of these explanatory variables.

Table 4: Descriptive statistics

		A1 (%)	A2 (%)	A3 (%)	B1 (%)	B2 (%)	Non contractors (%)
UAA	<50ha	4,6	10,7	13,2	10,0	25,0	22,3
	50-100ha	53,5	57,1	48,5	50,0	16,7	49,7
	100-150ha	30,2	25,0	22,1	20,0	33,3	16,6
	>150ha	11,6	7,1	16,2	20,0	25,0	11,5
GRASSLAND	No grassland	2,3	0,0	1,5	0,0	41,7	8,9
	<55%	53,5	7,1	47,1	35,0	58,3	45,2
	55-100%	44,2	67,9	35,3	65,0	0,0	36,3
	Only grassland	0,0	25,0	16,2	0,0	0,0	9,5
FTE	<1	0,0	3,6	2,9	0,0	0,0	3,2
	1	16,3	35,7	19,1	10,0	41,7	28,7
	1-2	41,9	32,1	38,2	50,0	41,7	43,9
	>2	41,9	28,6	39,7	40,0	16,6	24,2
AGE	<40 years old	39,5	28,6	26,5	25,0	25,0	20,4
	40-55	51,2	46,4	51,5	45,0	50,0	54,1
	>55	9,3	25,0	22,1	30,0	25,0	25,5
AGRI EDUC	None	4,6	25,0	13,2	10,0	8,3	18,5
	Low secondary	32,6	25,0	30,9	50,0	41,7	25,5
	High secondary	44,2	35,7	36,8	30,0	25,0	35,7
	Higher educat ^o	16,3	7,1	17,6	5,0	16,7	11,5
	Other	2,3	7,1	1,5	5,0	8,3	8,9
ORGA	Not implied	18,6	32,1	21,0	25,0	16,7	28,0
	Rarely implied	16,3	32,1	22,1	35,0	25,0	24,8
	Sometime	39,5	17,9	26,5	20,0	25,0	23,6
	Always	25,6	17,9	30,9	20,0	33,3	23,6
ADVICES	Never	9,3	14,3	14,7	25,0	16,7	36,9
	Rarely	30,2	32,1	23,5	25,0	16,7	22,9
	Sometime	27,9	25,0	30,9	25,0	33,3	21,0
	Always	32,6	28,6	30,9	25,0	33,3	19,1
TRUST IMP	Weak	16,3	7,1	8,8	0,0	8,3	27,4
	Medium	32,6	10,7	23,5	15,0	16,7	27,4
	High	25,6	35,7	30,9	35,0	50,0	16,6
	Very high	25,6	46,4	36,8	50,0	25,0	14,0
GOODWILL	Weak	34,9	35,7	36,8	50,0	25,0	12,1
	Medium	25,6	25,0	26,5	10,0	33,3	25,5
	Good	25,6	32,1	23,5	30,0	16,7	22,9
	Very good	13,9	7,1	13,2	10,0	25,0	39,5

Generally speaking, B2 contractors have a larger land area. A2 contractors have a very high grassland share whereas B2 contractors have a very low grassland land share. B1 contractors have the highest labor rate whereas B2 contractors have the lowest. A1 contractors are the youngest farmers whereas B1 contractors are the oldest. A1 and A3 have the highest agricultural education. The implication in agricultural organizations and advices are very heterogeneous among contract types. Finally, the two categories of trust show almost opposite farmers' positions. Non contracting farmers have a lower trust in the implementation process than contracting farmers whereas non contracting farmers have a higher perception of the State's goodwill than contracting farmers.

IV.2. Estimation results

The different parameter estimations are gathered in table 5. Significant variables are presented only. The model has kept every observations. The reference contract is C2, which is the category of farmers when the farmer does not implement any environmental friendly

practices. The reference farmer has an agricultural education level superior than the CAP⁴ and has not subscribed an agro-environmental contract in the past. As regard to continuous variables, we took average values (grassland share is 53.65%, farm land area is 93.69ha). The model adjustment quality is medium as the Mc Fadden R² is 33.55.

Table 5: Logit multinomial estimations

Variable	A1¹	A2¹	A3¹	B1¹	B2¹	C1¹
Constant	-2,30*** (0,91)	-6,17*** (1,75)	-1,91** (0,87)	-6,15*** (2,07)	-1,31/ (1,97)	-0,24/ (0,55)
UNCERTAINTY						
ADVICES	0,18/ (0,29)	0,98** (0,48)	0,28/ (0,29)	-0,13/ (0,56)	1,40** (0,76)	0,001/ (0,22)
ORGA	0,38/ (0,29)	-0,05/ (0,39)	0,49** (0,25)	0,22/ (0,50)	0,62/ (0,44)	0,10/ (0,23)
SIMILARITY						
UAA	0,008* (0,005)	0,01** (0,008)	0,01** (0,005)	0,01/ (0,009)	0,006/ (0,01)	0,007* (0,003)
GRASSLAND	0,01/ (0,01)	0,05*** (0,02)	0,01** (0,008)	0,02/ (0,02)	-0,15/ (0,11)	-0,005/ (0,006)
TRUST						
TRUST IMPL	1,26*** (0,31)	1,59*** (0,38)	1,61*** (0,31)	2,17*** (0,68)	2,20** (1,06)	0,22/ (0,22)
GOODWILL	0,44* (0,27)	0,45/ (0,38)	0,41* (0,24)	0,62* (0,41)	-0,18/ (0,79)	-0,06/ (0,22)
EVOLVING SYSTEM						
CHANGES	1,12*** (0,33)	-0,04/ (0,45)	0,52* (0,30)	1,60* (0,93)	-0,39/ (1,31)	0,39* (0,22)
UTILITY						
ENV AW	-0,48/ (0,46)	-0,24/ (0,34)	-0,23/ (0,21)	-1,10* (0,69)	-2,74/ (2,14)	0,22/ (0,19)
FREQUENCY						
EXPERIENCE	-1,84* (1,10)	-0,27/ (0,63)	-1,69*** (0,72)	1,89*** (0,83)	1,99/ (1,96)	-0,65/ (0,47)
BOUNDED RATIONALITY						
AGRI EDUC	0,86* (0,55)	0,19/ (0,72)	0,67* (0,48)	2,06** (0,91)	1,66/ (1,59)	0,29/ (0,42)
Nombre d'observations			328			
Log Vraisemblance			-424,15			
R ² de McFadden			33,55			
Coefficient d'Estrella			79,62			
Coefficient ajusté d'Estrella			64,21			

¹ La catégorie non contractant (F2) est la référence.

F1 : Non contractant faisant au moins 4 actions environnementales

Ecart type entre parenthèses. *** : significativité au seuil de 1% ; ** : significativité au seuil de 5% ;

* : significativité au seuil de 10% ; / Pas significatif.

The variability of parameters is presented in the next table. As far as quantitative variables are concerned, we preferred Pseudo P-elasticity instead of marginal effects so as to be able to compare parameters between them.

⁴ Certificat d'Aptitude Professionnelle

Table 6: Pseudo p-elasticity for an increase of 10%

	A1	A2	A3	B1	B2	C1	C2
ADVICES	-0,104	1,256	0,122	-0,386	0,603	-0,751	-0,744
ORGA	0,180	-0,256	0,582	-0,008	0,105	-0,190	-0,410
UAA	0,094	0,468	0,281	0,094	0,000	0,187	-1,124
GRASSLAND	0,6	2,6	1,2	0,3	-3	-1,2	-0,6
TRUST IMPL	0,717	0,372	0,807	0,422	-0,219	-1,308	-0,793
GOODWILL	0,484	0,772	2,138	0,914	0,641	-2,086	-2,862
CHANGES	1,185	-0,601	-0,028	0,716	-0,264	0,120	-1,129
ENV AW	-0,222	0,001	0,081	-0,272	-0,425	0,661	0,178
EXPERIENCE	-10,62 (3,60)	1,86 <i>(4,18)</i>	-16,15 (4,07)	18,98 (5,13)	-2,31 <i>(1,98)</i>	-3,23 <i>(6,73)</i>	11,46 (5,85)
AGRI EDUC	3,03 <i>(4,58)</i>	-2,66 <i>(2,76)</i>	0,75 <i>(5,56)</i>	6,85 (1,92)	2,50 <i>(2,13)</i>	-2,86 <i>(4,27)</i>	-7,62 (3,91)

Preliminary remark:

Preliminary results (Ducos, Dupraz, 2006) on determinants of agro-environmental contract adoption using a probit model and the same data basis led to the conclusion that a large amount of variables were explaining farmers' behavior (26 in total), among which determinants of transaction costs such as "to regularly receive technical and administrative advice" or "to trust the implementation process of agro-environmental contracts" were predominant. In this present study, by distinguishing enrolled environmental friendly practices, we reduced the number of significant variables up to 10. The first observation is thus that the characteristics of enrolled environmental friendly practices have a major role in farmers' choice.

Let's now observe this results in the light of our propositions:

We observe that among the 10 significant variables listed in table 5, 6 have expected signs both in logit multinomial estimations and variabilities. Indeed, they allow to confirm determinants of transaction costs have a role in farmers' choice over asset specificity and they impact as the theory predict. They describe uncertainty ("to regularly receive technical and administrative advices" and "to be involved in an agricultural organization"), trust ("to trust the implementation process of agro-environmental contracts" and "Goodwill trust in the State") and the similarity of transaction ("grassland share" and "farm land area").

If we look closer and observe the magnitude of their coefficient, "to trust the implementation process of agro-environmental contracts" shows higher coefficients for the two specific contracts B, and "farm land area" have similar effects on the B non specific contracts and C1 which is also non specific technology practices. These two variables support the following two propositions. First, the higher the farmer trusts in the State, the higher the probability he chooses specific assets. Second, the more the agro-environmental transaction is similar to ones the farmer he is already engaged, the higher the probability he chooses non specific assets.

The 4 other variables support our propositions too and the proposition "the more uncertainty surrounds the agro-environmental transaction, the lower the probability the farmer chooses specific assets, *ceteris paribus*". However, they have a "discontinuous" effect. For instance, "to receive regularly technical and administrative advices" has a higher effect on the specific contract B2 than the non specific one A2, but it has no significant effect on the other specific

contract B1. This is explained from the fact that contracts in the same asset specificity level category are not homogenous on other significant aspects. Indeed, contract B2 requirements correspond to the Common Agricultural Policy (CAP) orientation for the next coming years whereas the future of contract B1 requirements seems more uncertain. It is thus normal to observe that well informed farmers will prefer to enroll environmental friendly practices whose payment is less uncertain for a longer period. Concerning “grassland share”, which has no effect on the non specific contract A1, the explanation is to be found in other characteristics of environmental friendly practices than asset specificity too. As illustrated in section III.2., Contracts A differ in the technology they call. It is thus non surprising to observe contract A1 which call for non grassland farm technology is not enrolled by farmers with a high share of grassland.

As regard to non expected variables, namely “environmental awareness”, “changes in the production system in the last 5 years”, “to have a lower agricultural education” and “to have already enrolled an agro-environmental contract”, we will only consider marginal effects which are assumed to be more rigid. The farmers’ utility in the agro-environmental transaction, described with his “environmental awareness”, does not have any significant effect on his choice over compensated environmental friendly practices. However, it increases the probability he implement non compensated environmental friendly practices. The value he gives on environmental services he would produce with an agro-environmental contract is thus very low.

Evolving production systems, “changes in the production system in the last five years”, have a lower probability to enrol contract A2. The explanation has to be found in the contract technology requirements which correspond to farm production systems already existing: farms with high a grassland share. The variable “grassland share” support this observation showing these farms have a higher probability to enrol contract A2. It is thus expected these farms are not in a dynamic of change since what contract A2 requires is what they are already doing.

To have a lower agricultural education has no effect on contracting farmers and a positive one on B1 contractors. This is explained from the characteristics of the agricultural education which used to be oriented towards productivity and did not give much attention to “green” production technologies. The positive impact observed in B1 contracts, is explained from farmers’ age. Indeed, this contract type gather old farmers who did not receive any agricultural education.

Finally, the negative effect of the variable describing the frequency of the transaction, namely “to have already enrolled an agro-environmental contract” is easily explained from contract implementation dates. Indeed, contract B1 only could allow a commitment renewal.

V. CONCLUSION

The purpose of this paper has been to test some propositions on conditions favouring the choice to invest in specific assets. Results clearly support that trust in the co-contractor and the similarity of transactions have a major role in farmers’ choice over asset specificity. The higher the farmer trusts in the State, the higher the probability he chooses specific assets. The more the agro-environmental transaction is similar to ones the farmer he is already engaged, the higher the probability he chooses non specific assets. They also support the effect of uncertainty but in a less rigid way. Non expected results were explained from the heterogeneity of environmental friendly practices classes. Indeed, these classes are

homogeneous on the asset specificity aspect, but they remain heterogeneous on technological, political and implementation calendar issues.

Keeping as an objective the production of environmental services in rural areas and low production costs, i.e. to enhance the adoption of environmental friendly practices involving specific assets, these results enable to identify significant factors of farmers' choice and to direct the State towards actions on these factors. For instance, knowing that farmers' trust in the implementation process has a major role, the State agricultural agencies may work on their image and reputation. As regard to the uncertainty aspect, the State could improve its communication policy in order to reduce the opacity of its political actions.

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