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Contractual Choice and Food Safety Strategy: Some Empirical Findings in Italian Poultry Sector

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Abstract

The analysis of contract choice is here related to the contracting nature of the hybrid governance structures. The approach of the empirical analysis is concerned with the transaction between farmers and processor in poultry supply chains and it is based upon a choice experiment to estimate the marginal values of contract attributes. Final remarks take into account the role of contract attributes in ensuring the degree of food safety and suggest a tentative organizational explanation of the degree of safety supplied.
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Keywords: *Hybrid form, food safety, contract choices, Choice experiments*

1. Introduction

The study investigates the relationship between the food safety strategy and the choice of the contractual arrangements in Italian poultry sector. Its main goal is to provide empirical evidences about the influence of food safety strategy on the organizational choice and to investigate the role of contracting in the hybrid form in poultry sector.
The contractual arrangements between the agricultural and processing stage are really able to influence the degree of safety of the product supplied to final consumers, thus food safety strategies adopted by companies could depend on the contract attributes. For examples, hygienic practices are frequently part of the set of the technological terms of the contract, whereas the cost may be so high that it prevents the processor from monitoring these activities.

The role of the contract between farmers and processors is then examined in order to analyze the transaction between farmers and processor in the poultry supply chains. The analysis aims at gathering information in order to enhance the comprehension of the role of contract choice in food safety strategies.Assuming that hybrid forms of organization may be efficiently chosen by the agents because of the opportunity they provide for improving safety standards, the analysis of contract choice is here related to the contracting nature of the hybrid governance structures (Ménard, 2004). The analysis is developed by the following steps. Firstly the shortly recall the theoretical results concerning hybrid organizations (Williamson, 1991; Ménard,

1996, 1997, 2004). The approach of the empirical analysis is based upon a choice experiment to estimate the marginal values of contract attributes (Hudson, Lusk, 2004; Roe *et al.*, 2004).

2. The theoretical framework

The safety standards of food products supplied depend on the behaviour of all the agents involved in the food chain. This is because the source of accidents - chemical, physical, microbiological, etc. - may occur at any stage of the system and because remedies and precautions intentionally implemented may fail due to technological flaws or human errors. The consequence is that coordination plays a crucial role with respect to safety questions. Transaction Cost Economics provides the bases for understanding the complex links between information, asset specificity, uncertainty, and organizational solutions and suggests that hybrid organizations (Williamson, 1991) are adopted because of the opportunity they provide for improving safety standards and, consequently, favoring firms' adaptation and the fulfillment of consumers' needs (Martino, Perugini, 2005). In the poultry sector the governance structure of the critical transaction between farmers and processor is usually a written contract establishing a complex set of technological, economic and financial terms. The processing company deals with a large number of farmers and it is usually able to substitute a supplier. On the other hand, agricultural contracts support the coordinating process. Physical and human capital investments are made both by the processors and the farmers in order to enhance the degree of efficiency of the production process. The processor has authority over both economic and technical farms'areas. According to Ménard (2004), three fundamental regularities emerge from empirical evidence in the field of hybrid organizations: the tendency toward aggregation of resources (pooling), the contractual basis (contracting), and the tendency toward competition (competing). Contracting characterizes many hybrid forms, since the contract signed by participants is frequently a simple framework where more or less ample room is allowed to everyone. Contract in poultry supply chains performs two basic functions: a) it provides a base for efficient coordination (Ménard, 1996; 1997): for example, the "price-formula", not price, is fixed, technical tolerance is admitted; intensive flows of information are supplied; b) it reduces the possibility of opportunistic behavior, since hold-up may occurs due to not adequate effort of farmers. The aim of this paper is thus to develop the study of farmers preferences for contractual attributes admitted within this hybrid structure. Under this view the paper also attempts to contribute to the empirical knowledge about the contracting nature of hybrid. In the empirical context faced here the contract provide a robust operational framework, in particular, in the field of food safety contractual attributes may be managed in order to optimize the alignment of transactions to the government structure.

4. Empirical analysis

4.1 The contractual attributes choice experiment

According to Raynaud et al. (2005) the relationship between a farmer and the processor here examined can be classified as a written bilateral contract (Raynaud et al., 2005). Empirical data about that are not presented for the sake of brevity.

This paper attempt to contract in the light of the approach of Hudson and Lusk (2004), which focuses the problem of choice of contract attributes under an empirical point of view. Roe, Sporleder and Belleville (2004) following a similar approach suggest that preferences for contract attributes may influence contractual price range, length but also may induce the choice of diversified supply chain relationships.

The empirical approach is based upon a choice experiment (CE) concerning the contractual attributes. The CE analysis has been extensively applied mainly in the field of consumer choices analysis and of the evaluation of non marketed goods (Adamovicz, Louviere, Williams 1994; Adamowicz, Boxall, Williams, Louviere, 1998; Louviere , 1991). Hudson and Lusk (2004) refer to this analytical field in order to examine the role of producers' preferences in defining contractual arrangements.

The study is based on a choice experiment involving 82 poultry farmers in Central Italy (summer 2005). A preliminary study has been carried out analyzing the current contractual relationship with the management of the company chosen. In this phase the focus was on the general contract attributes, the geographic distribution of farms, the history of the company. The goal of this phase is to define the relevant contractual attributes to be taken into consideration in the experiment.

The food safety strategy of the company examined supports the label and relies upon several factors: among them the farmers' technological commitments are of strategic interest. The processing company provides to farmers inputs and systematic technical assistance. The farmers should follow the technical directions in order to increase their income. Farmers have to shape the farm organization in order follow the technological rules. Thus, inputs provided by the company are allocated to production process together with other farm resources. Possible contracts have been submitted to farmers in order to elicit their preferences about contract attributes. The contract attributes chosen to design the experiment are illustrate in the following list:

	Level 1	**Level 2**	**Level 3**
Contract length	1	3	5
Production Cycle/Year	1	3	4-5
Degree of Autonomy	autonomous	in collaboration with the purchaser	only with direction of purchaser
Disinfection Practices	Chemical products	Heat	Fumigation
Variable Fraction of Price	20%	80%	100%

Contract Length has been considered in order to examine the duration of the link between farmer and the company affecting the hybrid stability (Mènard, 2004). **Production Cycles/ year** has been introduced as proxy of the annual income (the average annual net income is estimated equal to 15.000 euro/year/farm) in order to avoid bias in responding to question directly concerning the amount of income. Then the number of both chosen and not chosen alternatives has been multiplied by a scalar corresponding to the average income/cycle. **Degree of autonomy** has been included because of three reason. Farmers are involved in managing

agricultural firms not specialized in poultry production, then may be interested in shaping organization and technology in order to meet individual goals. Farmers have joined the company during the last years. Third, autonomy is an attribute clearly addressed in literature, pointing out its role in defining the contractual relationship (Hudson, Lusk, 2004). **Disenfection practice** has been chosen in order to take directly into account the role of food safety strategy in contractual arrangements. The food safety strategy in production stage has been considered under different views, but mainly in terms of internal technological and organizational change. Recently Yapp and Fairman (2006) have discussed several factors affecting the firm's quality/safety systems. Nespecta *et al.* (1997) have showed the need of correct specification of tools of inquiring. In this field there is a problem of adequate specification both of individual behavioral expectations and of technological commitments. An examination of these aspects has been conduct both with the company's technicians and with academic experts. Finally the simple specification of disinfection practice chosen would capture the link between commitment and behavior. **Variable fraction of price** has been introduced to take into consideration the role of the risk (Hudson, Lusk, 2004; Allen, Lueck, 1992). In the italian poultry sector the contractual arrangement of price is clearly stated ex ante. Price is linked to productive yield in a complex "price formula" included within the contract. Then the variability of price is (non linearly) correlated to the (technological) efforts of the farmers and depends upon on the not easily controlled technological variability. A higher contract price may be contrived whereas the variable fraction was high. The interaction effects between income and other variables have been considered. Attribute variable **Production Cycles** has been transformed into a new variable **Income** by multiplying each value by the scalar 15.000 euro/year/farm. Both **Income** and **Lenght** have been included in the model as continuous variables. Remaining attributes variables have been coded as effect codes (Hudson, Lusk, 2004; Adamowicz *et al.*, 1994; Adamowicz *et al.*, 1998. Thus the model includes: **Coll** (Degree of Autonomy: in collaboration) and **Aut** (Degree of Autonomy: autonomous); **Chemp** (Disinfection practices: Chemical Products) and **Heat** (Disinfection practices: heat). The variable fraction of price has been included continuous variables (**Qprice**). A noteworthy aspect of the approach chosen is that it provides estimates of Willingness to Pay (or Willigness to Accept if it is "negative") for each attributes. In the context of contracting nature of the organization these evidence may be of interest: a) to gain a more detailed comprehension of the organizational relationships; b) to delineate possible path of negotiating in order to reach specific goals, i.e. in the field of food safety strategy; c) to analyse the economimc role of commitment related to food safety strategy.

The design of experiment is thus based on five attributes with three levels. This generate a full-factorial design including 3^5=243 possible contracts. Since this number cannot be handle in the experiment, a fractional-factorial design has been determined (Kuhfeld *et al.*, 1994) including 54 possible contracts. These contracts have been randomly distributed obtaining 18 choice sets, each including three choice alternative. Each farmers has been then requested to chose one contract among three proposed.

4.2 Empirical results

The table 1 summarize the general characteristics of the sample.

Table 1. General characteristics of the Farmers and Farms

Characteristics	N. of respondents	Sample Relative Frequency (%)
A) FARMERS		
Education	**82**	**100,0**
Primary School	44	53,7
Secondary School	32	39,0
University degree	6	7,3
Frequency of technical training	**79**	**96,3**
Never	16	19,5
Rarely	44	53,7
Systematically	19	23,2
B) FARMS		
Poultry Houses (m^2)	**82**	**100,0**
1.000-1.499	16	19,5
1.500-1.999	9	11,0
2.000-2.499	15	18,3
2.500-2.999	9	11,0
3.000-3.499	14	17,1
4.000-4.499	6	7,3
4.500-4.999	13	15,9
Poultry Gross Product /Year (%)	**40**	**48,8**
0-49.9 of the total farm GP	13	15,9
49.9-59.9 of the total farm GP	19	23,2
>60 of the total farm GP	8	9,8

Source: Poultryflorgut WP5 - Database A

The table 2 illustrates the results of Conditional Logit Regression: interaction effects are not statistically significant, thus the following discussion concerns with only main effects.

Table 2. Conditional Logit regression - Main Effects Results

Variables	Coefficients estimated	Std. Err.	z	P>z	[95% Conf.	Interval]
income	0,0002099	0,0000512	4,1	0,00	0,00011	0,0003103
lenght	-0,6359422	0,2101822	-3,03	0,00	-1.047	-0,2239927
coll	0,2612168	0,486505	0,54	0,59	-0,6923	1.215
aut	0,739997	0,5204837	1,42	0,16	-0,2801	1.760
chemp	2.059	0,6031707	3,41	0,00	0,87729	3.242
heat	-0,9970692	0,4909752	-2,03	0,04	-1.959	-0,0347756
qprice	-0,2501433	0,8571282	-0,29	0,77	-1.930	1.429

N. obs.	246
LR c2	134.69(0.00)
Pseudo R^2	0,75
Loglikelihood	-22,74

Source: Poultryflorgut WP5 - Database A

The three contractual alternatives are “equivalent” in terms of exit option: a Hausman test has been then performed by simply excluding the first alternative in each choice set (Mazzanti, Montini, 2001). The test (χ^2=2.74(0.84)) indicates that of the IIA hypothesis is not rejected.

The Income’s coefficient estimated appears positive and significant, supporting the hypothesis that expectations about “Income” really contribute to shape the producers preferences in contracting. The Length’s coefficient is negative and significant: this contribute to the comprehension of the specific hybrid form and to the assessment of the its degree of stability (see below for further details). The coefficients estimated for Coll and Aut are not statistically significant: this suggests that in the contractual choice the degree of autonomy allowed is not critically focused. This does not correspond neither to relevant empirical evidence (Hudson, Lusk, 2004) nor to *a priori* knowledge of the economic relationship observed. There is a possible explanation of this evidence. Farmers who choice to link to a processing stage company, know that the company determines extremely precise bounds and scope. Thus they do not expect to be able to enhance their own degree of autonomy without changing company. Under a theoretical point of view, one could argue that the idea of dependence of preferences from both institutional environment, governance forms and individual introduced by Williamson (1996) could explain this evidence. Interestingly both Chemp and Heat show significant coefficients indicating that technological choices are of interest for farmers and that in particular they would prefer negotiate some technical prescriptions. The Qprice’s coefficient is not statistically significant. This evidence does not match existing literature and may suggest a more complex farmers’ view about price mechanisms. For the sake of brevity results

concerning a different (effect codes) specification of the attribute variable “Variable fraction of Prices” are omitted, even if they may suggest an role for risk. The table 3 illustrates the estimated Willingness to Pay or Willingness to Accept derived from the estimated model (Hudson, Lusk 2004).

Table 3. Conditional Logit Regression - Willingness To Pay/ Willingness To Accept

Variables	WTPA	Std. Err.
lenght	-3029,7	4105,1
coll	1244,5	9502,1
aut	3525,5	10165,7
chemp	9809433,1	11780,7
heat	-4750,2	9589,4
qprice	-1191,7	16740,8

Source: Poultryflorgut WP5 - Database A

Farmers would prefer to be compensated when the contract Length increases. Two-three years contracts are frequently chosen by farmers: the estimated WTA is nearly equal to (1/4) of the average income/cycles, thus one could suggest that farmers expect that the current contract length will not change. This affect the stability of the hybrid, since farmers may exit the relationship after the end of contract duration (i.e. reaching agreement with a different company).

The variable Chemp and Heat provide opposite evidences. The extremely large WTP for Chemp may indicate that changes in this field are really requested, but the respondents are not aware of the specific innovation path. This could also suggest a specific concern for the food safety strategy of the company. On the other hand, the large WTA for Heat suggest that change requested should be clearly negotiated and that the technical knowledge of farmers may play a role in defining the company food safety strategy. A need for information and training may be also suggested from this results. Even thought the IIA assumption is not violated, under an economic point of view the hypothesis of heterogeneity of preferences could be directly taken into account (Hudson, Lusk, 2004). A Random Parameter Logit model approach (McFadden, Train, 2000) has been used. First of all, the hypothesis that parameters are randomly distributed has been tested following the procedure illustrated by Hensher and Greene (2001). According to Hudson and Lusk (2004) the variable Income has been not included within the set of potential variables with randomly distributed parameters. Due to converge issues, testing together the remaining variable (Length, Coll, Aut, Chemp, Heat and Qprice) does not yield any readable results. Thus subsets of these variable have been taken into account in order to obtain significance test for artificial variables. The model including the artificial variable derived from Qprice shows that this variable is statistically significant indicating that the Qprice’s parameters may be randomly distributed. Nonetheless the results of the Random Parameters Logit (25, 50, 100, 200, 300, 350, 500, 1000, 2000) indicates that parameters are not statistically significant.

Thus, if the Conditional Logit model accounts for more acceptable results, one has to point out that the role risk shifting expressed in terms of price is not able to influence the producers preferences. This may be explained by the producers awareness about the impossibility of modify the contractual "price formula" or, in other words, in terms of preference endogeneity (Williamson, 1996).

5. Final Remarks and suggestions for future research

The study assumes that hybrid organizational forms may be efficiently chosen by the agents in order to enhance the degree of food safety supplied. The empirical analysis has taken into account the contracting dimension of hybrids in poultry sector. The choice experiment approach suggests that farmers pay attention to contract length and to critical technological variables, whereas the degree of autonomy and the risk linked to price-formula appear to be not relevant within the set of farmers' preferences. This evidence could be explained in terms of the dependence of preferences from the relationships between institutional environment, governance form and individual.
The study could be enhanced by increasing the size of sample, in order to take into account further groups of farmers. This may be helpful in achieving better results about the heterogeneity of preferences. Furthermore, the role of preference on the contracting process within hybrid forms should be examined under a theoretical point of view.

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