FOOD SAFETY PRIVATE INVESTMENTS DRIVERS: A QUANTITATIVE ANALYSIS IN ITALIAN MEAT SECTOR

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Abstract
The objective of this study is to investigate the drivers of private investments aimed at sustaining food safety systems. In the empirical investigation we consider the influence of the law and economic drivers separately for the following food safety systems: HACCP, certification, geographical indication, brands and traceability. The knowledge of such an influence could provide a better comprehension of the micro-level motivations of food safety strategies adopted in Agri-Food chains. It could help to understand specific characteristics of the Agri-food governance modes and could also favour the elaboration of policy interventions and the design of private-public arrangements.

From an organizational point of view, two basic management issues influence the performance of the food systems in terms of safety: the coordination and the information issue, which give raise specific contractual hazards arise requiring the parties, in turn, to choose complex organizational arrangements. According to Gibbons (2005), the parties, in order to cope with uncertainty, can also negotiate *ex ante* the allocation of the critical decision rights to the party who is expected to maximize the total surplus. Namely, we consider the necessity to comply with law, and the allocation of decision rights among the chain partners. To deal with the uncertainty, *food chain partner request* is also a driver to invest in food safety. We particularly aim at addressing the question on how these three factors influence food producers' private investment in physical resources, human resources and organisational activities in the following systems: *Haccp system*, *Certification, Geographic Indications*, *Brand*, *Traceability*. The study firstly provides a conceptualizazion of the investment decision and then test its implications. Many investments are *polyfunctional*, in the sense that they may support many purposes beyond the safety goals. A second aspect to be underlined is that the investments aimed at supporting safety systems are chosen in the context of organizational change. First of all in the empirical analysis we test the selection hypothesis and then analyze the influence of the three drivers upon the investments in the five systems considered. We use data from a mail survey conducted at Italian meat sector. A postal questionnaire submitted to

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2036 Italian companies. 177 questionnaries were filled and returned back (response rate: 8.89%). We propose the estimates of probit sample selection models in order to test the selection hypothesis and we also estimate simple probit models, in order to analyze cases in which the selection hypothesis does not hold.

A complex picture emerges, in which the selection hypothesis holds for some of the safety systems and the investments. The investments drivers have a variable influences: beyond the law pressure, both the free search of economic gains from competition and the allocation of decision rights along the chains are influential. While the law pressure seems to induce investments in additional costs, complementary investments in human resources and additional costs seem to be induced by the allocation of rights among the chain partners.

Key words: decision rights, investments, food safety, governance modes

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1. Introduction

Food companies and agricultural farms pay a great and necessary attention to technologies and economic relationships and arrangements aimed at enhancing and ensuring the due degree of products safety. In all the chain stages, adequate technologies are needed in order to carry out the productive process according to the best prerequisites identified by health and food sciences. Policy interventions intended to prevent food safety crisis have shaped the institutional environment of food systems channelling the companies strategies and have induced, with the technological requirements, the raise of complex organizational forms (Hobbs, 2002; Mènard and Valceschini, 2005). The food chain actors elaborate complex strategies in which technological and organizational choices and institutional commitments assure the food safety level demanded by public and private safety regulations and strategies.

The chain organization sustains the implementation of the most of food safety management systems: Haccp, Certification, Traceability, Brands, and Geographical Indications. Although designed to multiple purposes, each of these systems includes specific sets of activities aimed at food safety objectives. These systems require dedicated investments, in physical resources, human resources as well as in re-organizing the production processes and control activities.

Although the process depicted has been widely investigated under economic and organizational views, a lack of knowledge still remains about the determinants of the investment in food safety strategic choices. There are several drivers of food safety oriented investments. Inducements arise because of existence of policy interventions and the law prescription related as well as because of companies' ethical and economic evaluations. For example, quality, labelling and brand policies rely on safety prerequisites, while traceability mechanism and procedures are adopted to channel the chain coordination process towards safety objectives (Lupien, 2005). A complex framework of law inducements and free choices triggers the technological and organizational choices about food safety.

In this study we aim to address the question on how much, on the one side, law compliance and, on the other side, economic and organizational inducements determine food safety investments. In more detail, we address the question on how both these factors influence food producers' private investment in physical resources, human resources and organisational activities.

Our approach focuses on the allocation of the decision rights to invest. Our conceptualization integrates both the allocation of the decision rights among the chain partners and the influence of the public regulation of safety provision. Central to this perspective is the role of uncertainty, Uncertainty is one of the main problems to be overcome in implementing food safety strategies. Technology implementation might be affected by the influence of uncertainty due to lack of technological knowledge (Fielding *et al.*, 2011; Yapp, Fairman, 2006) or also to the inherent uncertainty of the production process (Mènard, 1997). Furthermore, agents may break the prescribed rules intentionally which is phenomenon known as behavioural risk (Hirschauer, Mussof, 2005; Fahre, Rouviere, 2009; Martino, Perugini, 2006). The technological (Walker, Weber, 1984) and behavioural (Williamson, 1985) uncertainties are thus among the main drivers of food safety coordination patterns.

According to Gibbons (2005), we contend that in order to cope with uncertainty, agents seek to allocate efficiently the decision rights to invest.

In the empirical investigation we consider the influence of the law and economic drivers separately for the following food safety risks management systems: HACCP, certification, geographical indications and brand. The knowledge of such an influence provides a better comprehension of the micro-level motivations of food safety strategies adopted and help to understand specific characteristics of the Agri-food governance modes and could favour the elaboration of policy intervention.

The paper is organized as follows: in the second section we introduce the analytical framework. The data analysis approach and the empirical results are presented and discussed in the sections three and four. The last paragraph is dedicated to conclusions.

2. Analytical framework

2.1 Food safety performance: coordination and information issues and uncertainty

In this paragraph we contend that the safety performance of the food systems crucially depends upon the organizational choices of the agents along the chains. We submit that an inherent uncertainty affect the search for food safety provision and we consider it in the light of coordination and information asymmetry issues. Therefore in our view the analysis of investments drivers requires to consider how the agents anticipate the role of uncertainty in building up the chain relationships. Theory states that the transaction parties cope with uncertainty by choosing to allocate the decisions rights to the parties who is more able to maximize the joint surplus of the relationship (Gibbons, 2005).

Under an organizational point of view, coordination and information issues influence the safety performance of the food systems. The safety level of food products supplied depends on the behaviour of all 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. Thus the safe foods provision involves a collective base of economic agents who pursue the same interests with respect to specific targets. As a consequence the safety level is an outcome of the coordination designed by the chain agents (Martino, Perugini, 2006; Lupien, 2005; Charlier, Valceschini, 2008; Hammoudi *et al.*, 2009). The most of the safety characteristics are credence in nature (Hobbs, 2002) therefore an unavoidable information asymmetry arises among the chains partners. The information asymmetry is a further important issue to be taken into consideration. The unequal distribution of information about food products characteristics requires the agents to bear specific costs and to carry out dedicated activities. Agents need to inform consumers about the characteristics of a food product, including aspects related to the agricultural raw materials used to produce it and about its processing (Elbasha, Riggs, 2003; Golan *et al.*, 2001). For example, specific mechanisms are often implemented to cope with liability problems caused by information asymmetry. Traceability systems contribute to identify diligent firms and to discriminate them from the negligent behavior of other agents. Thus, the burden of sanctions is placed on those who are truly responsible and less space is available for negligent free-rider behavior (Hobbs, 2004). Information asymmetry may also entail a reduction in the quality standards supplied or, if this supply is insufficient, excessive monitoring costs. Combined with contractual incompleteness, information asymmetry may require accurate responsibilities identification and chain leadership (Charlier, Valceschini, 2008). To cope with information asymmetry is a necessary objective in designing the coordination mechanism, Also under this perspective it comes to the light the critical importance of the organization arrangements for

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the supply of safe food. Both coordination and information issues deal with the uncertainty and require organizational solutions. The implementation of the effective technology is a key factor in safety performance. As a consequence, organization and technology ae strictly linked in the food safety provision. This point reflects the theoretical position of Transaction Cost Economics stating that technology and organization are jointly determined variables by choosing the governance structure (Williamson, 1988). The choice of the efficient governance structure allows the agents to carry out the planned transaction (Williamson, 1985, 1991). Namely the transaction parties seek to align the attributes of the transaction – asset specificity, uncertainty and frequency – to the characteristics of the governance structure (Williamson, 1991, Masten, 2000; Mènard, 2005). Normally, quality and safety strategies in Agri-Food Chains require to make highly specific investments and to deal with uncertainty, as a consequence hybrid governance modes became largely diffused (Mènard, Valceschini, 2005; Martino, Perugini, 2005). Uncertainty exacerbates the effect of asset specificity in choosing more centralized governance structure (Williamson, 1991) and determine the necessity to adapt the governance mode to unforeseen contingencies (Williamson, 1991, Gibbons, 2005; Gibbon *et* al., 2013)

Technological uncertainties are inherently associated to safety as the chain organization of the production process may fail in coping with technological unforeseen contingencies and human mistakes (Lupien, 2005). Technological uncertainty strongly influences the organizational choices (Walker,Weber, 1984; Robertson and Gatignon, 1998). On the other hand, due to the inherent information asymmetry and the attributes of transactions the agents face a behavioural uncertainty (Hobbs, 2004; Hirschauer, Zwoll, 2008) which may strongly influence the level of safety of the final product. Therefore, due to the critical influence of the coordination patterns and to the information asymmetry, specific contractual hazards may arise because of difficulties of monitoring the behaviour of the transaction counterparties. The implementation of the due diligence and best practices require high efforts by the agents. Furthermore, specific technology transfer process may be required in order to enhance the degree of safety of the final products. As a party may not implement correctly the due technology (Oxley, 1997), specific contractual hazards may arise which induce the parties to choose governance forms more centralized than the spot market mode (Martino, Perugini, 2006). In broad terms, the solutions of coordination and information issues rely on efficient organizational systems (Mènard, Valceschini, 2005; Martino, Perugini, 2006) as well as on the possibility of promoting positive agents behaviour by specific regulation interventions. Furthermore, several sources cause the arising of unexpected safety crisis, therefore the food safety strategies also require the chain agents adapt the governance structures chosen in order to deal with new threats. For example, new pathogens may start to affect the production processes or illegal behaviours in a stage may influence the whole system. The agents have to cope with the emerging problems adapting the governance modes to new circumstances (Williamson, 1991).
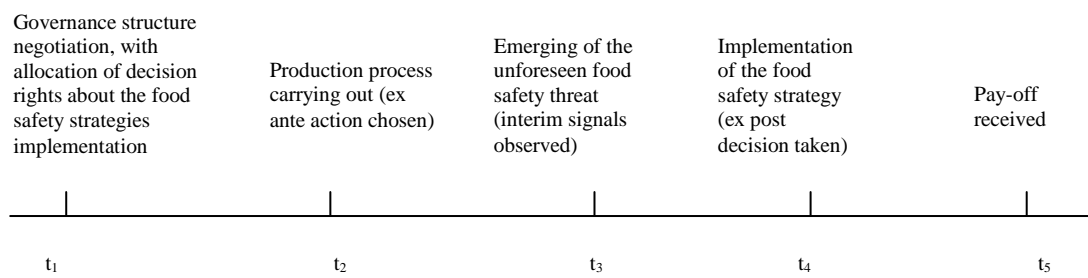
In sum, on the one, hand effective food safety provision systems (Haccp, Certification, Traceability, Certification etc) are based upon or provide solutions of both coordination and information issues; on the other hand, technological and behavioural uncertainty (Walker,Weber, 1984; Robertson and Gatignon, 1998; Hobbs, 2004; Hirschauer, Zwoll, 2008) require the agents to allocate resources to food safety systems intended to channel information along the chain and to favour the coordination among the agents (Hammaudi *et al.*, 2009; Hirschauer, Zwoll, 2008; Hobbs, 2004; Mènard, Valceschini, 2005; Dosman *et al.*, 2001;

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Unnevher, Jenson, 1999). In the following we elaborate on these points by focusing on the allocation of decision rights as critical step in building up effective safety provision systems.

2.2 Public intervention and allocation of decisions rights

Theory states that in order to cope with uncertainty, according to Gibbons (2005) the parties negotiate *ex ante* the allocation of the critical decision rights to the party who is expected to maximize the total surplus (dominant chain actor). Although the parties could not anticipate at the time of the contract outset all the future specific necessities which may rise due to inherent uncertainty of food safety, they may decide how to face these necessities by allocating the critical decision rights at the time of the negotiation of the governance structure. Drawing from Gibbons (2005) we contend that the coordination pattern among two parties in the chain may follow the following timing:

Figure 1: Allocation of decision rights about food safety strategy and timing of implementation

Governance structure negotiation, with allocation of decision rights about the food safety strategies implementation	Production process carrying out (ex ante action chosen)	Emerging of the unforeseen food safety threat (interim signals observed)	Implementation of the food safety strategy (ex post decision taken)	Pay-off received
t_1	t_2	t_3	t_4	t_5

The figure 1 indicates that the choice of the governance mode allow the parties to coordinate themselves to the purpose of safety provision. The allocation of the decision rights is aimed at allowing the parties to achieve the largest surplus, provided the uncertainty influence (Gibbons, 2005; Williamson, 1991). We contend that the relevant rights set includes also the right to decide the investments required to design and implement the investments needed to set up the safety provision systems.

Public intervention and private strategies set up a complex network of rules and incentives aimed at achieving a enhanced degree of food safety (Garcia Martinez *et al.*, 2007). Food safety rules have influence upon the decision rights concerning the process implementation, the enforcement, and the monitoring and controlling activities as well as the design of entire food safety system. This implies that the parties to a transaction may agree upon a given allocation of decision rights in order to achieve the higher efficiency possible in coping with uncertainty. Nonetheless, based on the comparison of benefits and costs of effective safety strategies (Antle, 1999; Garcia Martinez *et al.*, 2007), the policy intervention may delimitate the right to decide the allocation of decision rights and may also force the parties to a adopt a given allocation. In sum, the public rules setting influences the decision rights of the agents. To the purposes of our analysis, we distinguish the *right to decide the allocation of the decision right to invest* from the *decision right to invest*. If the public regulation prohibits to make the productive operation *alpha*, then none of the parties to a transaction can make this operation. Furthermore, none can decide to allocate the decision right to invest, as this decision is made by the regulator. If the public regulation constrains a party to make the operation *alpha*, then the party has to invest and none can decide how to allocate the decision right to carry out the operation. Therefore it seems that public prohibitions and prescriptions

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share a common general trait, actually both of them deprive the parties of the right to decide the allocation of decision rights related to the objective of the regulation.
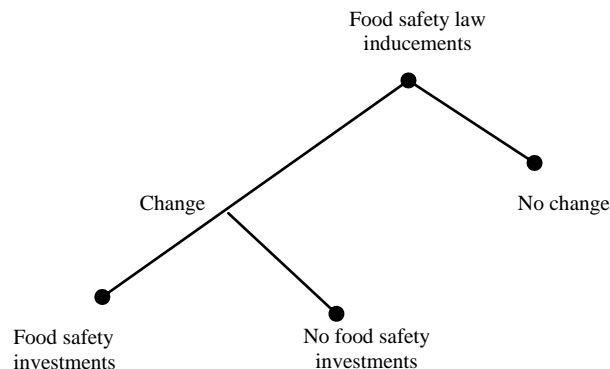
In terms of decision rights the first effect of the regulation we consider is to deprive or not the private agents to decide the allocation of decision rights. In the first case, the critical decision could be made by public officers or by private agents but strictly according to public prescriptions or prohibitions. As a consequence the investment decision would be made by the force of the law. We assume that the public choices are based upon a comparison of the costs and the benefits related (Antle, 1999) and we turn on this point in the light of the remediableness criterion (Williamon, 1999) in the discussion of the empirical evidence (par.3).

If the decision about the allocation of the decision right can be freely made according to the complete liberty of the private agents, the parties will choose the efficient allocation of the decision rights to invest (Gibbons, 2005). Therefore, under the point of view of a transaction party, we distinguish two cases: a) the decision rights is fully exerted according to the liberty of the transaction party ("Free choice"); b) the decision right is allocated to the transaction counterparty ("Partnreq"). We operationalize this conceptual approach by two step (par. 2.3): we first identify the types of investments drivers and then we introduce a selection hypothesis intended to capture the influence of the policy interventions on the decision patterns

2.3 Food safety investments drivers

To implement food safety strategies require companies and farms to invest in laboratories, monitoring procedures, enhancements of production processes, production protocols and so on. Under law prescriptions, a company maintain its own profile of activity, if its current resources allocation already fits the law requirement. Alternatively the companies are induced to change their technological and organizational frame and this causes the raise of a selection process (Greene, 2008) the companies that undertook the law-induced change process, have a greater probability to make investments aimed at food safety. In other words, we submit that companies which have been induced by safety law to modify the pattern of their activities are expected to be more interested to invest in food safety systems. Correspondingly, investments are more likely to be observed in companies and farms which have previously undertaken a law induced change. Examples are the physical investments made to sustain the Haccp or the physical and human resources invested in voluntary traceability systems. The selection process is also motivated by the fact that the food safety investments are often *polyfunctional*. Even though system like Haccp and Traceability, for example, are mainly dedicated to food safety objectives, they are frequently aimed at achieving also quality targets. Marketing strategies are often based on private brands adoption or certification which also emphasizes the ability of ensuring the product safety. Further example may be proposed which confirm that food safety investment are often multi-purposes in nature. The figure 2 illustrates the investment decision pattern motivating the selection process. If companies do not undertake any change under the food safety law pressure, potentially made investments cannot be held as explicitly aimed at food safety. The company holds that its current patterns of activities and resources allocation already fit the law requirements. Thus no investments are planned to achieve food safety pre-requisite, as they are supposed to be already achieved. Alternatively, if the company undertake a change, it may or may not make investments in food safety systems.

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Figure 2: Food safety investments decisions patterns

The investments aimed at supporting safety systems are chosen in the context of organizational change. The agri-food chain coordination patterns progressively change under the inducements of the co-regulation approaches (Garcia-Martinez *et al.*, 2007) as well as the increasing influence of the food standards' adoption (Swinnen, Vandermoortele, 2009; Hammoudi *et al.,* 2009). The implementation of safety oriented activities is associated with monitoring and controlling while signalling to consumers and chain partners the degree of safety of the products delivered is a critical strategic tool (Elbash, Riggs, 2003; Golan *et al.*, 2001). Beyond the compliance with the law, agents have identified specific objectives that concern private standards (Hobbs *et al.*, 2002; Trail, Koening, 2010; Hammoudi *et al.*, 2009; Henson, Reardon, 2006; Trienekens, Zuurbier, 2008), complex information management systems (Charlier, Valceschini, 2008; Heyder *et al.*, 2012) and signalling devices (Hatanaka *et al.*, 2005; Golan, 2003; Konefal, Hatanaka, 2011). The organizational change often entail the allocation of decision rights. As we have explained above the law inducements influence the related decisions of the agents. We maintain this perspective in identifying three possible investments drivers.

First we consider the *necessity to comply with law*. This reflects prescription or forbids which deprive the parties of the right to decide the allocation of the decision right to invest.

On the other hand, buyers and consumers expectation could induce companies to invest in order to ensure and to enhance the degree of safety of the products. The party to a transaction could decide to maintain the decision right to invest as she expect to maximize the total surplus of the transaction. The *free choice* is thus an additional investments driver often crucial in the implementation of marketing plan based on safety and quality (Martino, Perugini, 2006, Fulponi, 2006). Moreover, to deal with the coordination and information food safety management issue, a party may decide to allocate to the counterparty the right to invest. the drivers we identify thus corresponds to the possibilities presented in par. 2.2.

3. Empirical study

We consider five basic organizational systems that have been developed to achieve food safety and food quality objectives: *Haccp system*; *Certification*, *Traceability Geographic Indications*, *Brand*. We contend that especially three types of resources mentioned – physical resources, human resources and additional costs are due to specific organizational activities – involved in the food safety system settings. Therefore, we investigate in our empirical study how law compliance and economic reasons impact food producers' investment in physical resources, human resources and organisational activities under following food organisation

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systems implemented to achieve food safety: Haccp, certification, geographical indications and brand.

3.1 Data

The empirical analysis was carried out gathering data by using the data base built on in 2005-2006 by through a postal questionnaire submitted to 2036 Italian companies. The postal address were achieved from Posteitaliane – the company managing mail services at national level – and the selection of the companies was carried out by the unique criterion of "Field of activity". The companies selected were active in the field of animal products supply and were engaged in various stages of food chains (i.e., agricultural, processing and just trading activities). The instrument includes three sections: a) general information about the company, including the date of establishing, the size and the field of activities (production, trade); b) the relationships with other enterprises in the chains, the section focus of the type of contract (verbal, writtem, brief term, long terms) and related decision (procurement, selling, duration), the information related are not presented here, but are part of a further investigation; c) the activities undertaken in the field of food safety: the information concern with the typo of systems implemented (Haccp, Certification, Brand, Geographical Indication, Traceability, none) and the investments made in order to support the system built on (physical resources, human resources, addtitional costs); further information concern with: the sources of information on safety, the implementation of specific hygiene practices and the internal safety information management. 177 questionnaires were filled and returned back (response rate: 8.89%). The Graphic 1 illustrates the distribution of the respondents evaluation about the motivation to implement food safety management systems. We proposed four motivation: *imposition by law*, *customs requirements*, *price expectations*, *further motivation*. The respondents could assess the motivation expressing their own beliefs on a five point Likert scale (*I completely disagree, I disagree, I do not know, I agree, I completely agreei).* The results suggest that Law and custom requirements are highly valued.

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Graph. 1: Belief about food safety management motivation (Likert cale)

3.1 Method of analysis

In order to test for the selection hypothesis depicted above (Figure 2), the method of data analysis is based on the estimation of a bivariate probit model with sample selection (Greene, 2008) . The model includes a selection equation and an outcome equation. The selection equation accounts for the decision based on the utility of undertaking the change under the inducements of the general law pressure. The outcome equation expresses the decision based on the utility of making the investments, having undertaken the change under the inducements of the general law pressure.

3.2 Variables

To the purpose of the empirical analysis we considered three types of investment mentioned for each system: a) physical resources; b) human resources; c) the additional costs of the internal organizational activities. Our models (we run model with the same specification for each of the selected organisational systems to be able to compare the investment drivers of the different systems) contains the following variables (each variable indicates if the companies interviewed made (1) or made not (0) the investment at stake):

The variables utilized in the analysis are illustrated in Table 2:

Table : Variables description and coding

Variable	Symbol	Code
Physical Resources (Haccp, Certification, Geographical Indications, Private Brands, Traceability)	PR	0, 1
Human Resources (Haccp, Certification, Geographical Indications, Private Brands, Traceability)	HU	0, 1
Additional Costs (Haccp, Certification, Geographical Indications, Private Brands, Traceability)	CO	0,1

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Investment Drivers			
Law duties	Law	0, 1	
Free choice	Free	0, 1	
Partner request	Partn	0,1	
Beliefs			
To ensure food safety is a law duty	Law	*I completely disagree*	-2
		I disagree	-1
		I do not know	0
		I agree	1
		I completely disagree	2
To ensure food safety increases the number of clients and the sales		*I completely disagree*	-2
		I disagree	-1
	Custom	*I do not know*	0
		I agree	1
		I completely disagree	2
To ensure food safety increases the prices of the products		*I completely disagree*	-2
	Price	*I disagree*	-1
		I do not know	0
		I agree	1
		I completely disagree	2
Sources of information			
Technicians	Tech	0, 1	
Public Health officials	Asl	0, 1	
Advertsing	Publ	0, 1	
Other entrepreneurs	Enterpr	0, 1	
Control variables			
Number of high level managers, as index of the capability to cope with technological uncertainty;	NDIR	0, 1	
Year of experience of the top manager, as index of the capability to cope with technological uncertainty;	EXPER	0, 1	
Volume of sales as an index of the size of the firm;	SALES	0, 1	
Dichotomous variable, indicating the stage of activity of the firm (production = 1; distribution = 0).	PROD	0, 1	

3.2 Results and discussion

In the following we briefly illustrates and discuss the results concerning the selection hypothesis (sample selection bivariate probit models) and the hypothesis of absence of selection process (probit models). The Table 3 illustrate the estimates for the sample selection bivariate probit model. The Table 4 summarizes the average marginal effects (AMEs) estimated for the drivers of the outcome equation: the AMEs indicate how change the probability to invest under the inducement of the driver considere. The selection hypothesis holds for all the systems investigated except than the following cases : investments in physical resources in Haccp, physical resources and human resources in traceability; we were unable to estimate any model in the case of investments in physical resources for Geographical indication and private brand.

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Table 3: Bivariate sample election models (part I)

	prhaccp	hrhaccp	cohaccp	prcert	hrcert	cocert	hrgi	cogi	hrbrand	cobrand	prtrace	hrtrace	cotrace
MAIN													
lawhaccp	1.037***	0.727***	0.276										
freehaccp	0.211	0.0451	-0.202										
partnhaccp	8.117	-8.669	10.55										
lawcert				619463.9	-514.1	1.102**							
freecert				6.484	0.833***	0.564**							
partncert				6.607	0.613***	1.046*							
lawgi							-2.011	7.622					
freegi							0.630*	0.693					
partngi							8.704	-4.205					
lawbrand									-5.309	0.666			
freebrand									0.48	0.354**	*		
partnbrand									-5.283	0.615			
lawtrace											0.786	0.664	-3.745
freetrace											0.163	0.459	0.0542
partntrace											8.460	-5.698	-4.294
_cons			0.634***	-5.676	-1.518***						-1.285**	-2.153***	0.962
			-3024.65	(-0.01)	(-469.16)						(-3.02)	(-3.59)	
change													
law	-0.311	0.241	-0.0631	0.191	0.0703	0.217	-0.0884	-0.208	-0.143	-0.274	-0.0892	-0.235	0.0558
custom	-0.315*	-0.136	-0.452***	-0.232	-0.171	-0.184	-0.405***	-0.315*	-0.352*	-0.427**	-0.425**	-0.414**	-0.392**
price	0.266*	0.0902	0.302**	0.214	0.244	0.197	0.297*	0.283*	0.276*	0.380**	0.222	0.371**	0.248*
tech	0.0771	0.251	-0.0694	0.339	0.452	0.563	0.132	0.0958	0.0604	0.024	-0.0646	0.0965	0.367
asl	0.709	0.992	0.37	1.049	1.303***	1.050	0.142	0.756	0.298	0.475	0.494	0.591	0.896
publ	0.0868	0.364*	0.0932	0.134	0.0376	-0.0759	0.0802	0.0162	0.24	0.0877	-0.0163	-0.0593	0.218
enterpr	0.349	0.423	0.676*	0.348	0.372	0.672*	0.308	0.404	0.159	0.482	0.618*	0.4	0.649*
ndir	-0.0107	-0.00473	-0.00281	-0.00878	-0.0125*	-0.00539	-0.0104*	-0.0094	-0.0108*	-0.0104	-0.0052	-0.0096	-0.0057

Table 3: Bivariate sample election models (part II)

sales	-0.0000051	-1.51E-06	-2.71E-07	-7.32E-07	-5.54E-06	-2.38E-06	-4.33E-06	-5.55E-06	-10.24	-5.22E-07	-2.72E-06	-7.39E-06	-2.74E-06
exper	0.000328	0.00744	-0.00374	0.0131	0.0152	0.00933	0.00247	-0.00415	0.00115	0.00267	-0.00292	-0.00056	0.098
_cons		-2.398*		-2.324*	-2.568**	-2.554*							-1.840
N	112	112	112	112	112	112	112	112	112	112	112	112	112
Wald c^2	19.03	5.13+12	1989.77	.	1.6+11	19.97	1.97	3.6	2.39	199.39	6.82	112860.46	0.8
Prob > c^2	0.0003	0	0	.	0	0.002	0.37	0.3	0.49	0	0.08	0	0.85
r	-0.793	-1	-1	-1	1	1	-0.934	-0.939	-0.883	-1	1	-1	-0.696
c^2	4.17	0.19	5.42	165.55	6.67	40.53	26.28	29.34	16.01	35.46	8.55	0.3513889	0.5
Prob > c^2	0.041	0.67	0.02	0	0.0098	0	0	0	0	0	0.0035	0.005	0.477

* p<0.05, *   * p<0.01, **   * p<0.001

Table 4: Sample selection bivariate probit models - Average Marginal Effects

DRIVERS	HACCP			Certification			Gegraphical Indication	Brand	Traceability		
	PRHACCP	HRHACCP	COHACCP	PRCERT	HRCERT	COCERT	COGI	COBRAND	PRTRACE	HRTRACE	COTRACE
LAW	0.3308411***	0.2580928***	0.2131738	0.1767617	-0.1486792	0.3007149***	0.4779064***	0.2333774***	0.2245932**	0.1505724	-0.104501
	(2.46)	(16.68)	(1.38)	(1.73)	-(0.02)	(5.73)	(0.03)	(0.01)	(2.11)	(0.00)	-(0.68)
FREE	0.0504859	0.0140626	0.054774	0.2667722*	0.1627836**	0.190323***	0.2384853	0.1349967***	0.0501962	0.1459676	0.0157677
	(0.39)	(0.10)	(0.40)	(1.13)	(1.94)	(3.34)	(1.91)	(0.01)	(0.43)	(0.00)	(0.11)
PARTN	0.2030546	-0.7178617***	0.3062654***		0.1434112***	0.2714608***	-0.504545	0.2165653***	0.3710026***	-0.6812865	-0.7645945***
	(1.51)	-(8.92)	(2.28)		(18.40)	(3.43)	-(0.16)	(0.01)	(21.31)	(0.00)	-(2.80)

Source: the Authors

The significant coefficients in the case of physical resources investment in Haccp are *Law_Haccp*, *custom* and *Tech*. The marginal effect of *Law_haccp* indicates that the law inducements have a large influence: the probability to invest increases by 0.292 when *Law_haccp* = 1. The model for human resource investment and addtitional costs do not have statistically significant coefficient. In the case of the model for physical resources for brand systems *Law_brand* and *Free_brand* have significant and positive coefficients (it was necessary to omit *Partnreq* to obtain the estimates), with similar average marginal effects (0.265 and 0.223, respectively).

The Average Marginal Effects of the significant variables provide a complex picture. We submit a sysnthesis in the following. We discuss the results with respect to:

a) the analytical capacity of the allocation of decision rights to study the safety performance;

b) the remediableness criterion (Williamson, 1999) that applies to the case of regulation of food safety.

Briefly summarizing the results, we see that the selection hypothesis holds unless than in the case of investment in: Haccp (human resource), physical resources for Geographical indications and Brand and addtitional costs in the case of traceability. The influence of the law is high for physical investments in Haccp, Certification and Traceability – as it may be expected because if the technical requirements of such systems -, but both certification and traceability investments are influenced by the allocation of decision rights among the parties.

The influence of law is negative in the case of investments in human resources, while the influence of the allocation to the partners is strong. Also the influence of law in investment in addtitional costs is expected. Because of the intrinsically necessity of exchange of information and coordination, it is unexpected the negative sign in the case of traceability.

Further information emerge if we look at the results by each safety systems. In the case of the Haccp we found a systematic influence of the law, as the marginal effects, even if their sign are different, are significant for all the types of investments, In the case of Human resource we can compare the marginal effects of the three driver and we found that the free choice has the predominant effects. The allocation of the decision right to the partners show its relevance in the case of Human and Cost investments.

A systematic influence is also exerted by law in the case of Certification, but the free choice and the allocation to the transaction party are systematic but also coherent because the drivers influence all the three types of investment with same positive sing and the predominance of the allocation to the counterparty.

In the case of geographical indication we found that for human resources and costs the three drivers have a systematic influence, but only the private decision to allocate the decision rights give raise to coherent effects. Notably the influence of the law increase the Cost and reduce the Human resources investments.

We can also note that if we compare the marginal effects for Human resources investments and costs for the systems Certification and Geographical indication (for which we have evidence), then we can see that in both the cases the law tend to cause investments in costs and this reflects the Henson and Hooker (2001) statements, while in the case of geographical indication the private approaches increases both the two types of investments (complemetary basis for compliance) while they appears to be slightly substitutes in the case of certification. The allocation of the decision rights can be held as a mean to deal with the costs of compliance (Henson, Hooker, 2001; Mensah, Julien, 2011).

The remediableness principle is stated by Williamson (1999, p. 316): it "holds that an extant ode of organization for which no superior feasible alternative can be described and

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implemented with expected net gains is presumed to be efficient". It can be applied to our investigation as: a) it deals with governance modes choices; b) it concerns the comparison among alternative modes of governance, namely public and private arrangements. This principle, when applied in terms of decision rights allocation, confirms the statements of Henson and Hooker (2001) as it shows how the compliance can be an outcome of the combination of law and private convenience provided the individual conditions of the firmsm included the characteristics of the transaction they want to undertake.

Furthermore the principles motivates the costs effects also in terms of transaction costs at individual level but regardless to the size (Mensah and Julien, 2011), fact that emphasizes the role of the transaction costs over the production costs.

Finally it allows to recognize the prediction of Fare and Rouviere (2011): in the case of the physical resources and costs investments for certification and geographical indication we found that privately decided investments are more probable when the law pressure is working. In the chain perspective of Fare and Rouviere (2010) the mandatory threat is a necessary but not sufficient condition, the combined effects of potential penalties and comparative compliance costs determine the decision of how privately comply.

4. Final remarks

The study addressed the question of how much law compliance and economic and organizational goals determine food safety investments. We focus on inducements to invest due to the necessity to comply with the law, to the individual free economic convenience and particularly on the allocation of critical decision rights to the party who is expected to be able to maximize the relationship total surplus. The decision to allocate the decision rights appear to be able to influence the choice of the investments as well as the remaining two drivers. The evidence indicates that the decision rights perspective is meaningful in order to investigate how public and private activities combine themselves in food safety provision. Furthermore, the role of public regulation (law) is concentrated in terms of food systems and types of resources. The allocation o decision right to the counterparty is evident, thus there is also a confirm of this organizational solution, as predicted by theory, This evidence contributes to shed light on the strength of the coordination devices associated by safety strategies. The knowledge of the pattern of influence may contribute to design public and private policies aimed at increasing the degree of product safety.

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