Voluntary standards as transaction governance: drivers of adoption for non-GMO certification in Europe

S. Stranieri[1]; C. Soregaroli[2]; S. Platoni[3]

1: University of Milan, Department of Environmental Science and Policy, Italy, 2: Università Cattolica del Sacro Cuore, Department of Agricultural and Food Economics, Italy, 3: Università Cattolica del Sacro Cuore, Department of Business and Social Sc

Corresponding author email: stefanella.stranieri@unimi.it

Abstract:

The adoption of food standards to regulate product characteristics or its processing methods is widely widespread. Food economics literature has intensively explored the firm incentives for the adoption of safety and quality standards. A growing body of literature discusses on voluntary standards as alternative forms of governance of vertical relationships due to the increase of information transparency provided. There is a gap in the understanding of the determinants leading food firms to choose such alternative forms of transaction governance. The present study aims at exploring the significant drivers of voluntary standard adoption. To answer the questions we start from Transaction Cost Economic theory and we refer to an extended conceptual framework based on transaction risks, namely, risks arising from the opportunistic behaviour of economic agents (internal risks) and other risks related to unexpected changes in the economic environment (exogenous risks). Data was collected through interviews on an EU representative survey concerning the "non-GMO" voluntary standard in the soybean supply chain. The survey includes 363 companies from 15 EU countries. Preliminary results of the logit model suggest a positive relationship of transaction internal risks with the adoption of the voluntary non-GMO standard and a negative relationship of exogenous risks with the implementation of the standard.

Acknowledegment:

JEL Codes: Q13, Q18

#1934

Voluntary standards as transaction governance: drivers of adoption for non-GMO certification in Europe

Keywords: non-GMO standards, Transaction Cost Economics, transaction risks, logit analysis

JEL codes: L14, Q13, Q18

1. Introduction

The adoption of standards to regulate product characteristics or its processing methods is widely widespread. Also in the food sector it is possible to observe an increasing number of different standards which can be set up both by public and private institutions. Public institutions, i.e. policy makers, are mainly involved in the implementation of standards aimed at correcting market failures associated to food safety or environmental protection. Private institutions create standards which are mostly direct to the reduction of market inefficiencies related to information asymmetry of the stakeholders of the food value chains, like, for example, the provision of increased information to consumers on food quality characteristics or the reduction of unfair practices among supply chain partners and the management of liabilities in vertical relationships (Fischer et al., 2010).

In the last decades, there is a proliferation of voluntary standards set up by private institutions which lead to an increase of food product quality transparency or to an enhancement of public regulation when it is weak.

Food economics literature has intensively explored the firm incentives for the adoption of safety and quality standards. A growing body of literature discusses voluntary standards as alternative forms of governance of vertical relationships due to the increase of information transparency provided, and the transaction reorganization provided through, for example, the centralisation of economic activities or better liability distribution among supply chain agents (Grandori, 2015; Trienekens et al., 2012; Stranieri et al., 2017;; Hobbs, 2006). However, there is a gap in the understanding of the determinants leading food firms to choose such alternative forms of transaction governance.

The present study aims at fill this gap. More precisely, the main research question relates to the exploration of the significant drivers of voluntary standard adoption.

To answer the questions we start from Transaction Cost Economic theory (TCE) and we refer to an extended conceptual framework based on transaction risks, namely, risks arising from the opportunistic behaviour of economic agents and other risks related to unexpected changes in the economic environment (Henson and Humphrey, 2010).

We apply the conceptual framework using data from an EU wide representative survey concerning the "non-GMO" standard in the soybean supply chain. The survey includes 363 companies from 15 EU countries and/or operating in the EU market, including: traders of soybean raw materials, crushers, feed manufacturers, producers of animal products, and retailers.

The "non-GMO" standard is a quality standard aiming at preserving the absence of material from genetically modified organisms (GMO) in food and feed ingredients. This type of standard was introduced in the EU at the end of the last century following the consumers' negative attitude toward GMOs.

In the EU, data can be provided for the non-GMO soybean supply chain, which is also the most relevant one for this type of certification. In fact, in the EU, the absence of a regulation imposing positive labeling in products of animal origin created an incentive for retailers and food processors to certify that the food they offer to consumers comes from animals fed with non-GMO feed. As soybean is the main protein component of most feed produced, the soybean supply chain becomes the key unit of analysis. Although official statistics are not available, according to Tillie and Rodríguez-Cerezo (2015) in 2012 non-GMO represented, respectively, 8.3% and 11.3% of extra-EU soybean and soybean meal imports. Considering that the EU depends for more than 90% from soybean imports these numbers give an idea of the size of the non-GMO EU soybean market. This translates in non-GMO certified products of animal origin. In 2017, according to data in Germany, these products involve mainly the dairy and the poultry industries with a total of 4,500 products from 266 companies (Castellari et al., 2018) [1].

Our study is positioned within the TCE theory and contributes to the existing debate on the relationship between different types of transaction risk on the organisation of vertical relationships, by considering the role of such risks in the adoption of different voluntary standards. More precisely, the paper belongs to that strand of literature focused on the understanding of the role of standards for the reorganization of vertical relationships within

[1] In the US the standard grew only in the latest years under the "non-GMO Project verified" label: from less than 1,000 Universal Product Codes (UPC) in 2010 the products having the label reached 44,000 in 2017. The size of the US the market for non-GMO grew $8.5 billion in 2014 (Genetic Literacy Project, 2017), and $11 billion in 2015 (Greene et al., 2016).

the value chains and it contributes to existing knowledge in providing empirical evidence on the economic drivers leading to the adoption of voluntary standards by the firms. From a theoretical point of view, the analysis of the relationships between transaction risks and voluntary standard adopted contributes to the current debate on different types of risk and vertical organization (Wever et al., 2012). Moreover, it contributes to a better understanding of standards adoption. The dataset used is comprehensive of non-GMO certified firms and results can be considered as representative of the European certified firms.

2. Theoretical framework

2.1. Voluntary standards and vertical relationships within the supply chain

The improved information transparency within the supply chain provided by the adoption of standards has led to consider them as effective tools for the management of supply chain relationships (Stranieri and Banterle, 2017). Bosona and Gebresenbet (2013) describe quality and safety standards as systems that can reveal relevant data among economic partners and increase transaction transparency. Also Peres et al. (2007) stress the role of standards as tools to augment product and process information along the supply chain, like, for example, product origin, processing methods, and safety or quality characteristics of food.

Because of such increased transaction transparency among the agents of the supply chains, a growing body of literature is referring to standards as alternative forms of governance of vertical relationships, which can reorganize transactions (Grandori, 2015; Bain et al., 2013; Henson, 2011; Tallontire et al., 2011; Banterle and Stranieri, 2008).

The effectiveness in managing information and transactions within supply chains will depend on the type of standard applied (i.e. on the rules and procedures implemented). In general, the stricter the standards, the greater the precision of the amount of information provided and the complexity in managing transactions among the agents of the supply chain, which imply more coordinated transactions because of the high supply chain transparency involved (Stranieri et al., 2017).

The non-GMO standard is based on the absence of GMO ingredients in food originated from plant or, in the case of livestock products, to animals fed with non-GMO feed. In the EU, according to Regulation (EC) No 1829/2003, food and feed must be labelled as GMO if more than 0.9% of GMO material is present for any of its ingredients. Therefore, the absence of GMOs is at least intended as a content that is below the legal threshold. However, there is no harmonized public or private standard defining what is a non-GMO product. In the EU it varies according to member states legislation or private initiatives. In some countries, such as

The Netherlands or Finland, a public standard for non-GMO labels imposes a zero threshold of GMO adventitious presence. In other countries a 0.1 or a 0.9% threshold applies (Castellari et al., 2018).

Besides the definition of thresholds, the non-GMO standard defines the production process, including audit and qualification of the actors involved, the handling of the product, its sampling and control procedures, and the management of non-compliances and consequent liability. The standard must guarantee the Identity Preservation (IP) of the non-GMO ingredients, that is, the preservation of the unique characteristics of a product through its isolation and identification throughout the supply chain (Varacca and Soregaroli, 2016). This requires the implementation of traceability and segregation practices at each stage of the supply chain (Smyth and Phillips, 2002). The lower the admitted GMO thresholds, the stricter the IP practices and control procedures along the supply chain that must be implemented.

To the best of our knowledge, there is a gap in understanding of the determinants influencing food firms' choices of different kinds of voluntary standards; that is, the motivations leading firms to decide upon the decision to implement them. To fill this gap, we turn to TCE and the current debate on transaction risks, and we consider non-GMO standards as alternative forms of transaction governance.

2.2. Theoretical framework

TCE assumes that economic actors are affected by bounded rationality and opportunism (Simon, 1945; Williamson, 1975) and that, because of these constraints, they cannot predict in advance all possible contingences surrounding a transaction. Moreover, they will try to take benefits at each other's expense or claim misleading compliance with the conditions of existing arrangements (Ghosh and John, 1999; Williamson 1991).

These assumptions imply the presence of exchange risks for transacting parties – specifically, the risk of opportunistic behaviour and the shirking of an economic subject involved in a transaction. Thus, in this analysis, we consider transaction governance, like non-GMO standards, not only as a tool to reduce transaction costs but also as a tool to manage transaction risks (Wever et al., 2012). According to Williamson (1985), such hazards will be high in situations where the governance of the transaction is not effectively aligned with the level of transaction attributes – that is, the level of transaction frequency, asset specificity and uncertainty.

Transaction frequency relates to how often a certain transaction takes place (Williamson, 1991). In our study, we did not consider this transaction attribute because we refer mostly to recurring vertical relationships, which are managed by different non-GMO standards. Asset specificity refers to investments that are adopted uniquely to conduct a certain transaction. According to Klein et al. (1978), the specificity of assets occurs when their value decreases outside the transaction for which they have been adopted. Thus, asset specificity increases the bilateral dependency of economic agents and the risk of opportunistic behaviour. Finally, transaction uncertainty can refer both to the inability of economic agents to effectively measure the outcome of a transaction (behavioural uncertainty) and to unexpected changes in the economic environment (environmental uncertainty) (Williamson, 1985). The ineffective capacity of the agents to foresee the realisation of contractual obligations mainly depends on their bounded rationality and leads to the risk of opportunistic behaviour and shirking.

The unpredictability of variation in the economic context in turn implies the inability of economic agents to foresee variations in relevant aspects surrounding the vertical exchanges, which leads to a risk of maladaptation – that is, the risk that the investments and conditions established by the agreements fail because they are not suitable for adapting to environmental changes (Gulati and Singh, 1998). High-level environmental uncertainty involves an increased risk of maladaptation of the transacting parties and, consequently, a higher level of difficulty for economic actors to negotiate formal agreements (Artz and Brush, 2000). According to Miller (1992), managers have to face different forms of uncertainties, which lead to maladaptation risks. Such risks can be connected both to the specificities of the industry in which firms operate and to the general economic environment; for example, industry risks refer to uncertainties in demand and supply, prices, policy and technology, whereas general environmental risks may relate to political instability and macroeconomic, social and natural uncertainties.

On the basis of the risks identified above, it is possible to subdivide the transaction risks into internal and exogenous risks.

Internal risks refer to all the hazards which depend on the bounded rationality of economic agents and which relate to their behaviour in the execution of transactions (the risk of opportunistic behaviour and of shirking). Williamson (1991) defines such risks as internal, as they can be managed within the transaction through the adoption of a form of governance, which minimises such risks. In general, the higher the internal risks, the greater the probability of adopting forms of transaction governance with a high level of vertical coordination.

Exogenous risks refer to all those hazards that relate to unexpected changes in the institutional environment. These risks do not depend on the behaviour of economic agents, and they can be neither predicted nor managed in advance by specific arrangement conditions. Exogenous risks relate mostly to transacting parties' maladaptation. When risks depend on environmental uncertainty (risk of maladaptation), the debate on the type of governance to adopt is controversial.

TCE postulates that economic subjects will adapt better to exogenous sources of transaction uncertainty through hierarchical forms of transaction organisation (Williamson, 1991). However, recent theoretical developments (Miller and Folta, 2002) and empirical findings (Olmos, 2010; Geyskens et al., 2006; Das and Teng, 2001; Barney and Lee, 2000) do not confirm a positive relationship between the level of environmental uncertainty and hierarchical transaction governance. Moreover, for what concern the adoption of standards in the food sector, it is not clear if and to what extent such risks may influence the adoption and of the standard implemented.

2.3. Research hypothesis

Existing literature has identified different elements that contribute to the increase of internal and exogenous risks.

There is robust empirical evidence on the positive influence of transaction investment specificity on behavioural uncertainty and on the probability of internalising transactions (David and Han, 2004; Leiblein and Miller, 2003; Boger et al., 2001). This positive relationship is mainly related to the high transaction exit barriers due to such specific investments (Ziggers and Trienekens, 1999). Focusing on the agri-food sector, Young and Hobbs (2002) identify process attributes, such as biotechnology and information technologies, as important factors that affect tighter supply chain coordination. Moreover, different authors discuss the positive association between closer vertical coordination and specific investments for product quality attributes within the food supply chain (Ménard and Valceschini, 2005; Raynaud et al., 2005). Based on the existing empirical evidence we thereby hypothesise:

H1. Investment specificity influences positively on the adoption of Non-Gmo standards.

The unequal distribution of power and control among transacting parties, namely partner asymmetry, has been found to contribute significantly to internal risks (Boger et al., 2001). Such misalignment depends on several aspects, like asymmetric bargaining power between transacting parties (Sheu and Gao, 2014) and the related difficulty in assigning liability rules (Pouliot and Sumner, 2008). These can all be considered as situations that increase partner asymmetry. In such circumstances, closer vertical coordination is considered as a solution to minimise transaction costs and related risks (Gereffi et al., 2005). Thus, we hypothesise:

H2. Partner asymmetry influences positively on the adoption of Non-Gmo standards.

In the food sector one of the main sources of exogenous risks is related to consumer concerns on the quality and safety characteristics of food products. Food firms try to manage such uncertainties through the adoption of quality and safety certification strategies (Zhang et al., 2015). Thus, we test the following hypothesis:

H3. Consumer quality and safety concerns influence positively the adoption of Non-GMO standards.

The rapid growth of the complexity of the food normative framework have increased firms' uncertainties regarding the level of requirements to implement in vertical exchanges (Fulponi, 2006). As a consequence, an increasing number of different forms of voluntary standards has been registered within the market to facilitate the accomplishment of public regulations. However, rapid changes in the regulatory environment could also lead food firms to choose more flexible forms of transaction governance (Geyskens et al., 2006). Thus, we test the following hypothesis:

H4. The regulatory framework influences the adoption of Non-GMO standards.

Food firms have to manage also different kinds of market uncertainties, namely, exogenous risks which are common and shared across a set of firms operating in the same market, like, for examples supply and price volatility, demand uncertainty (Smit et al. 2017; McGrath et al. 1997) and competitive uncertainty (Iyer et al., 2014). Such risks have an effect on the organization of vertical relationships within the chains but it is still controversy the way they affect the coordination of economic exchanges. Thus, we test the following hypothesis:

H5. Market uncertainty influences the adoption of Non-GMO standards.

3. Methods

3.1 Data

Data result from a survey, conducted in May/June 2014, of 363 companies involved in the EU soybean supply chain. Out of these companies, 202 were involved in the non-GMO soybean supply chain. It should be noted that this high proportion of non-GMO operators does not reflect their proportion in the EU supply chain. Non-GMO operators were over-sampled in order to make the sampling representative of this sector which is relatively small compared to the entire EU soybean supply chain.

The survey was conducted in 15 EU countries with the main goal of creating a sample representative of companies involved in the non-GMO supply chain. In fact, countries were selected according to the following criteria:

- Significant demand for soybean or soybean derived products, measured by the trade balance of soybean and soybean meal, and/or;
- Significant demand for non-GMO IP soybean derived products, according to existing estimates (Tillie et al., 2012).

The 15 EU Member States included were: Austria, Belgium, Denmark, France, Germany, Hungary, Ireland, Italy, Netherland, Poland, Portugal, Slovenia, Spain, Sweden and United Kingdom. Together, they represent around 90% of total EU demand for soybean, and gather virtually all EU countries where some demand for a final animal food product derived from non-GM IP soybean exists. The sample countries represent approximately 97% of the total EU imports of soybean and 93% of imports of soybean meal over the 2009-2011 period.

Additionally, 15 traders involved in the supply of soybean and/or soybean meal to the EU but not located in an EU Member State were also surveyed as their views are also influenced by the EU markets for soybean or soybean derived products. Thirteen of them are located in Ukraine, while another two are based in Switzerland.

The sampling was first stratified by type of operators, based on an estimate of the number of operators by subsector of the supply chain, and then by country, based on data used as proxy for the activity in each subsector: imports of soybean/soybean meal as a proxy for trading activity, volume of crushing of soybean, consumption of soybean meal as a proxy for the production of feedstuffs containing soybean, consumption of industrial compounds as a proxy for the activity of producers of animal food, and country population for the activity of retailers. This resulted in the inclusion of almost all operators active in the supply chain (i.e. the universe) for the sub-sectors of traders and crushers (but some of them actually refused to be surveyed). The producers of animal products included in the sample were large processors, typically cooperatives or integrated companies producing eggs, poultry meat, pork meat or dairy product; livestock farmers were not included for issues of feasibility of the sampling. Therefore, the sample is only representative for those large companies that are producers of animal products which are also those that are the most likely to have develop an internal strategy regarding GM and non-GM soybean, but not for family farms. Animal product companies are the largest group in the sample (55% of surveyed companies). Overall, the distribution of the companies in the sample fits well the distribution of companies across countries and sub-sectors and can be considered as a representative sample. The survey was conducted in two different manners depending of the category of companies: traders, crushers and feed manufacturers' interviews were completed face-to-face, while producers of animal products and retailers were contacted by phone. The respondents were targeted in order to ensure that they had a good knowledge of the company's strategy regarding the use – or not – of non-GM IP soybean or derived products, including: owners of the company, executive, line manager or responsible person for purchase.

A specific questionnaire was structured around information on the company's activities in the soybean supply chain, its governance across the different stages, TCA determinants and information about the respondent. In January 2014, a pre-test survey was conducted with 6 companies in Germany, Hungary and France in order to validate and fine-tune the questionnaire.

3.2 Measures

The dependent variable is measured as the adoption of the non-GMO standard and consists of a dichotomous variable concerning the actual operation or not (1/0) of the firm in the non-GMO soybean supply chain.

The independent variables distinguish between internal and exogenous risks and they are measured as seven points Likert scale representing the level of agreement of respondents according to specific statements.

Internal risks

Investment specificity: The brand equity of the company, what Williamson (1991) calls brand name capital, is used as a measure of investment specificity. Companies that invested in brand equity that specifically depends on the soybean supply chain and derived animal products face an increased dependency upstream and downstream the supply chain with an increased behavioural uncertainty. Reputation losses and gains are specific of the company holding the brand asset. Therefore the company faces a brand specificity which calls for a greater vertical coordination (Chen, 2009). Voluntary private standards, such as non-GMO, serve both the need for greater coordination and the possibility to get specific gains from a quality-based differentiation strategy (Hammoudi et al., 2015). Therefore, the perception of the need to improve brand equity and reputation of the company is used as a measure of investment/brand specificity.

Partner asymmetry: The power of the transacting partner can be measured evaluating the importance that the request from a partner could have on the decision to adopt the non-GMO standard. This was measured using two different questions distinguishing between willingness to satisfy upstream and downstream partner requests. Voluntary private standards, such as non-GMO, are often promoted by a focal firm in the supply chain, which is usually a retailer or a food processor (Passuello et al., 2015). Therefore, the adoption of the standard along the supply chain could be the coordination mechanisms allowing to minimize transaction costs and the risks under a captive supply chain (Gereffi et al., 2005).

The difficulty in assigning liability rules is measured using a self-assessment of the overall liability risk the company is facing. The standard also performs a risk management and liability function (Hammoudi et al., 2015) as it reduces the threat of legal actions against food safety failures (Hobbs, 2004). In case of quality-standard, and in particular for non-GMO, the greater coordination and control preformed with the standard responds to food safety risk as well as to a potential risk of civil actions by anti-GMO activists.

Exogenous risks

Consumer quality and safety preferences: This dimension was measured assessing the respondent’s perception of the consumers concerns about both the quality and the safety of the products containing GMOs. The higher these concerns the more uncertain is the future market position of the firm in the conventional market.

Regulation complexity: The perception of the regulation complexity of respondents was measured as a self-assessment of the regulation complexity in general and with a specific focus on labeling and traceability requirements.

Market uncertainty: This dimension is measured as the respondent's perception of the position of the company in the markets it operates. The higher the company is perceived as operating in very uncertain markets, the more a standard should be adopted.

Control variables

Non-GMO supply chain characteristics: The supply of a non-GMO ingredient imposes practices to preserve the identity of the non-GMO attribute of ingredients (Smyth and Phillips, 2002). These practices lead to segregation costs as the non-GMO ingredient needs to be handled separately from their conventional counterpart (Varacca and Soregaroli, 2016). Therefore, the perception of the magnitude of segregation costs can be considered as a measure influencing the profitability of the non-GMO standard and, therefore, of the adoption choice.

The perception of the difficulty to respect the non-GMO thresholds, defined as a consequence of regulations, is another measure that could influence the profitability assessment of the non-GMO standard. This perception could also depend on the resources and competencies of the company. The difficulty to respect thresholds increases the risk of opportunism also generating new transaction costs.

Finally, EU companies are largely dependent from overseas countries for the supply of non-GMO soybean, where the large majority of cultivated soybean is GMO (Varacca et al., 2014).

Perception of difficulties in regularly sourcing non-GMO soybean represents a measure of environmental uncertainty, which could again generate new transaction costs.

Company characteristics: Company characteristics include the stage of the supply chain where the firm performs its activity and the number of years dealing with the non-GMO soybean supply chain. Other data were also collected for validation purposes, such as the characteristics of the respondent (age, experience, job position) but are not used in the present analysis.

3.3 Empirical model

Related to the *internal risks* the independent variables are (1) specificity related to brand equity ir_equity (2) upstream partner asymmetry $ir\_upstream$ (3) downstream partner asymmetry $ir\_downstream$, and (4) liability risk $ir\_liability$; related to the *exogenous risks* the independent variables are (5) concerns about quality of product with GMOs $er\_quality$, (6) concerns about safety of the product with GMOs er_safety, (7) labelling and traceability requirements $er\_traceab$, (8) regulation complexity er_reg, and (9) operation in uncertain markets er_market; moreover, the *control variables* are (10) segregation costs $segreg$, (11) difficulty to respect the thresholds $treshold$, and (12) regular supply of non-GMO soybean $supply$.

With

$$\begin{aligned} z_i = \beta_0 \quad & + \beta_1 \cdot ir\_equity_i + \beta_2 \cdot ir\_upstream_i + \beta_3 \cdot ir\_downstream_i + \beta_4 \cdot ir\_liability_i \\ & + \beta_5 \cdot er\_quality_i + \beta_6 \cdot er\_safety_i + \beta_7 \cdot er\_traceab_i + \beta_8 \cdot er\_reg_i + \beta_9 \cdot er\_market_i \\ & + \beta_{10} \cdot segreg_i + \beta_{11} \cdot treshold_i + \beta_{12} \cdot supply_i + \beta_y \cdot \text{years}_i + \beta_s \cdot \text{subsector}_{s,i}, \end{aligned} \qquad (1)$$

where years_i is the number of years dealing with the non-GMO soybean supply chain[2] and $\text{subsector}_{s,i}$ are the dummy variables indicating the subsector the company belongs to (animal food producer, crusher, feed manufacturer, retailer, and international traders), a suitable function to model the relationship between the probability of entering in the non-GMO supply chain $\Pr(y_i = 1)$ and the independent variables is the logistic function:

$$y_i = \frac{e^{z_i}}{1 + e^{z_i}} = \frac{1}{1 + e^{-z_i}} \qquad (2)$$

Parameterizing z as a linear function of the predictors yields the Logit model:

$$\begin{aligned} \Pr(y_i = 1|\mathbf{x}_i) = (y_i|\mathbf{x}_i) = \frac{1}{1 + e^{-z_i}} = \frac{1}{1 + e^{-\mathbf{x}_i'\boldsymbol{\beta}}} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 \cdot ir\_equity_i + \cdots + \beta_s \cdot \text{subsector}_{s,i})}} \\ \Pr(y_i = 0|\mathbf{x}_i) = \frac{1}{1 + e^{\mathbf{x}_i'\boldsymbol{\beta}}} = \frac{1}{1 + e^{\beta_0 + \beta_1 \cdot ir\_equity_i + \cdots + \beta_s \cdot \text{subsector}_{s,i}}} \end{aligned} \qquad (3)$$

Nevertheless the estimation of model (3) is affected by missing data (see Table 1).

Table 1. Missing observations

variable	missing	non-missing	Total
ir_equity	69	173	242
$ir\_upstream$	65	177	242
$ir\_downstream$	66	176	242
$ir\_liability$	91	151	242
$er\_quality$	67	175	242
er_safety	65	177	242
$er\_traceab$	67	175	242
er_reg	91	151	242
$segreg$	92	150	242
$treshold$	91	151	242
$supply$	91	151	242

[2] Note that $\text{years}_i = 1$ if the number of years dealing with the non-GMO soybean supply chain is $0 < \text{years} \leq 10$, 2 if $10 < \text{years} \leq 20$, 3 if $20 < \text{years} \leq 30$, 4 if $30 < \text{years} \leq 40$, 5 if $40 < \text{years} \leq 50$, and 6 if $\text{years} > 50$.

Dong and Peng (2013) claim that "the impact of missing data on quantitative research can be serious, leading to biased estimates of parameters, loss of information, decreased statistical power, increased standard errors, and weakened generalizability of findings".

Multiple imputation (MI) provides a useful strategy for dealing with data sets with missing values. Instead of filling in a single value for each missing value, Rubin's (1987) multiple imputation procedure replaces each missing value with a set of plausible vales that represent the uncertainty about the right value to impute. The multiply imputed data sets are then analysed by using standard procedures for complete data and combining the results from these analyses.

The multiple imputation used to replace the missing values is an ordered logistic model:

$$\begin{aligned}\Pr\left(x_{k,i} = j \middle| \mathbf{w}_{k,i}\right) &= \Pr\left(\gamma_{j-1} < \mathbf{w}'_{k,i}\boldsymbol{\vartheta}_k + \mathrm{u} \le \gamma_j\right) \\ &= \frac{1}{1 + e^{-\gamma_j + \mathbf{w}'_{k,i}\boldsymbol{\vartheta}_k}} - \frac{1}{1 + e^{-\gamma_{j-1} + \mathbf{w}'_{k,i}\boldsymbol{\vartheta}_k}}\end{aligned} \quad (4)$$

where $\mathbf{w}_{k,i} = \left(w_{k,i,1}, w_{k,i,2}, \dots, w_{k,i,q}\right)'$ records values of predictors of $\mathbf{x}_k$ for the observation i, $\boldsymbol{\vartheta}_k$ is the $q \times 1$ vector of unknown regression coefficients, and $\boldsymbol{\gamma} = \left(\gamma_1, \gamma_1, \dots, \gamma_{J-1}\right)'$ are the unknown cut points with $\gamma_0 = -\infty$ and $\gamma_J = \infty$. Because $\mathbf{x}_k$ contains missing values that are to be filled in, let us consider the partition of $\mathbf{x}_k = \left(\mathbf{x}'_{k,0}, \mathbf{x}'_{k,m}\right)$ into the $n_0 \times 1$ and $n_1 \times 1$ vectors containing the complete and the incomplete observations and the similar partition of $\mathbf{W}_k = \left(\mathbf{W}_{k,0}, \mathbf{W}_{k,m}\right)$ into the $n_0 \times q$ and $n_1 \times q$ submatrices.

The multiple imputation ordered logistic model is implemented by the following steps:

1) fit in the ordered logistic model (4) to the observed data $\left(\mathbf{x}_{k,0}, \mathbf{W}_{k,0}\right)$ to obtain the maximum likelihood estimates, $\widehat{\boldsymbol{\psi}}_k = \left(\widehat{\boldsymbol{\vartheta}}'_k, \widehat{\boldsymbol{\gamma}}'\right)'$, and their asymptotic sampling variance, $\widehat{\mathbf{U}}$;
2) simulate new parameters $\boldsymbol{\psi}^*_k$, from the large-sample normal approximation, $N\left(\widehat{\boldsymbol{\psi}}_k, \widehat{\mathbf{U}}\right)$, to its posterior distribution assuming the non-informative prior $\Pr(\boldsymbol{\psi}_k) \propto \text{const}$;
3) obtain one set of imputed values $\mathbf{x}^1_{k,m}$, by simulating from an ordered logistic distribution as defined by (4): one of J categories is randomly assigned to a missing category, i_m, using the cumulative probabilities computed from (4) with $\boldsymbol{\vartheta}_k = \boldsymbol{\vartheta}^*_k$, $\boldsymbol{\gamma} = \boldsymbol{\gamma}^*$, and $\mathbf{w}_{k,i} = \mathbf{w}_{k,i_m}$;
4) repeat steps 2 and 3 to obtain M sets of imputed values $\mathbf{x}^1_{k,m}, \mathbf{x}^2_{k,m}, \dots, \mathbf{x}^M_{k,m}$.

The predictors considered for the multiple imputation of the independent variables ir_equity, $ir\_upstream$, $ir\_downstream$, $er\_quality$, er_safety, and $er\_traceab$ (MI1) are: $ir\_liability$,

er_reg, $segreg$, $treshold$, $supply$, and er_market. The predictors considered for the multiple imputation of the independent variables $ir\_liability$, er_reg, $segreg$, $treshold$, and $supply$ (MI2) are: ir_equity, $ir\_upstream$, $ir\_downstream$, $er\_quality$, er_safety, $er\_traceab$, and er_market (see Table 2).

Table 2. Multiple imputations MI1 and MI2 (20 imputations)

variable	complete	incomplete	imputed	**total**	non-missing	Total
ir_equity	81	74	74	**155**	192	266
$ir\_upstream$	85	70	70	**155**	201	271
$ir\_downstream$	84	71	71	**155**	204	275
$er\_quality$	83	72	72	**155**	197	269
er_safety	85	70	70	**155**	205	275
$er\_traceab$	83	72	72	**155**	201	273
$ir\_liability$	81	94	94	**175**	177	271
er_reg	81	94	94	**175**	178	272
$segreg$	79	96	96	**175**	178	274
$treshold$	81	94	94	**175**	176	270
$supply$	81	94	94	**175**	181	275

Therefore, after the multiple imputation the number of observations for the estimation of the model (3) increases from 73 to 242 (see Table 3).

Table 3. Number of observations ante- and post-MI

variable	complete	**MI2**	**MI1**	Total
ir_equity	73	100	**69 (28.51%)**	242
$ir\_upstream$	73	104	**65 (26.86%)**	242
$ir\_downstream$	73	103	**66 (27.27%)**	242
$er\_quality$	73	102	**67 (27.69%)**	242
er_safety	73	104	**65 (26.86%)**	242
$er\_traceab$	73	102	**67 (27.69%)**	242
$ir\_liability$	73	**91 (37.60%)**	78	242
er_reg	73	**91 (37.60%)**	78	242
$segreg$	73	**92 (38.02%)**	77	242
$treshold$	73	**91 (37.60%)**	78	242
$supply$	73	**91 (37.60%)**	78	242

Moreover, Table 4 allows to appreciate how after the multiple imputation all the subsectors can be considered in the estimation of the model (3).

Table 4. Subsectors

subsector	**count ante-MI**	**count post-MI**
animal food prod.	0	147
crusher	15	18
feed manuf.	31	40
trader	27	37
Total	**73**	**242**

4. Results

Table 5 and 6 present the result of the logit regression models before and after MI. Results from the two tables confirm the significance of the effects related to two variables, both belonging to internal risks: the specificity related to brand equity and the downstream partner asymmetry. For both variables the sign of the coefficient is positive, which is aligned with theoretical expectations. Those companies presenting a higher need to invest in brand equity are more likely to adopt the non-GMO standard to gain from a greater coordination, preserve from reputation losses, and appropriate specific gains from a differentiation strategy. The partner asymmetry is confirmed only at the downstream level. This suggests that the direction of standard adoption moves from EU retailers up to overseas soybean producers, supporting the qualitative results of Passuello et al. (2015) and Ghozzi et al. (2016).

Exogenous risks present less significant results. In the post-MI model only the regulation complexity is influencing the non-GMO adoption when referred to labeling and traceability requirements. In this case, the sign is negative, meaning that those companies perceiving a higher risk prefer to keep more flexibility and are less likely to move toward a greater coordination form.

In terms of company characteristics, traders are more likely to adopt a non-GMO standard as compared to companies operating at other stages of the supply chain. This can be explained by the characteristic of the trading activity, where the number of operators is lower and they provide services to customers offering a diversified portfolio of available commodities. Finally, the years of experience in the soybean sector do not seem to influence the probability of adopting the non-GMO standard.

Table 5. Logit regression ante-MI

variable	description	estimates	
constant		-0.0982	
		(1.7318)	
internal risks			
investment specificity			
ir_equity	specificity related to brand equity	0.5039	*
		(0.2676)	
partner asymmetry			
ir_upstream	upstream partner asymmetry	-0.1597	
		(0.1686)	
ir_dowstream	downstream partner asymmetry	0.3689	*
		(0.1977)	
ir_liability	liability risk	-0.3232	
		(0.2133)	
exogenous risks			
consumer quality and safety preferences			
er_quality	concerns about quality of product with GMOs	-0.3259	
		(0.3208)	
er_safety	concerns about safety of the product with GMOs	-0.1705	
		(0.2949)	
regulation complexity			
er_traceab	labelling and traceability requirements	0.0046	
		(0.2359)	
er_reg	regulation complexity	-0.0264	
		(0.2364)	
market uncertainty			
er_market	operation in uncertain markets	0.0407	
		(0.1940)	
control variables			
non-GMO supply chain characteristics			
segreg	segregation costs	-0.3039	
		(0.2222)	
treshold	difficult to respect the thresholds	0.3991	
		(0.2512)	
supply	regular supply of non-GMO soybean	-0.0525	
		(0.1890)	
company characteristics			
years in soybean		-0.0962	
		(0.2161)	
feed manuf.		0.0722	
		(0.9047)	
trader		1.2612	
		0.8988	

Note: number of observations = 73; pseudo R^2 = 0.2744; *** 1% significance, ** 5% significance, * 10% significance

Table 6. Logit regression post-MI

variable	description	estimates	
constant		-3.2239	***
		(1.0411)	
internal risks			
investment specificity			
ir_equity	specificity related to brand equity	0.2863	*
		(0.1522)	
partner asymmetry			
ir_upstream	upstream partner asymmetry	0.0844	
		(0.1136)	
ir_downstream	downstream partner asymmetry	0.3559	***
		(0.1286)	
ir_liability	liability risk	0.0172	
		(0.1150)	
exogenous risks			
consumer quality and safety preferences			
er_quality	concerns about quality of product with GMOs	0.2161	
		(0.1692)	
er_safety	concerns about safety of the product with GMOs	0.0291	
		(0.1977)	
regulation complexity			
er_traceab	labelling and traceability requirements	-0.2276	*
		(0.1321)	
er_reg	regulation complexity	-0.1103	
		(0.1348)	
market uncertainty			
er_market	operation in uncertain markets	0.1019	
		(0.0915)	
control variables			
non-GMO supply chain characteristics			
segreg	segregation costs	-0.0600	
		(0.1059)	
treshold	difficult to respect the thresholds	0.1203	
		(0.1271)	
supply	regular supply of non-GMO soybean	-0.1039	
		(0.0990)	
company characteristics			
years in soybean		-0.0035	
		(0.1061)	
animal food prod.		0.0943	
		(0.5996)	
feed manuf.		-0.0182	
		(0.6643)	
trader		1.7722	**
		(0.7135)	

Note: number of observations = 242; *** 1% significance, ** 5% significance, * 10% significance

5. Discussion and conclusion

In the last decades a wide variety of voluntary standards have been introduced within the supply chains. Such instruments imply a reorganization of economic exchanges due to an increase in specific investments necessary to implement the standards. Food-related literature is increasingly considering standards as alternative forms of transaction governance. However, the decision of the firms to implement this alternative form of transaction governance is still under-investigated. The present paper deepens the understanding of the determinants leading to the adoption of food voluntary standards by analyzing the factor affecting the choice of the voluntary non-GMO standards among European food firms.

Our preliminary results give two main contributions to existing knowledge. First, the findings confirm that voluntary standards can be considered as alternative coordination mechanisms of vertical exchanges. The positive relationships between internal risks, i.e. partner asymmetry and brand specificity, and the adoption of non-GMO standard confirm that it can be considered as an instrument to manage costs related to transaction complexities, like the other forms of transaction coordination. Second, our results suggest that the decision to implement a voluntary standard depend on the evaluation of different kinds of risks, i.e. internal and exogenous risks. More precisely internal risks , i.e. partner asymmetry and brand specificity, seem to be positively associated to the adoption of the standards, in accordance with the TCE framework and confirming research hypothesis H1 and H2. Exogenous risks, i.e. the regulation complexity, seem to be related negatively to the adoption of the standard, confirming H4 and suggesting a negative sign. These finding add to the existing literature (Fischer et al., 2010) in explaining the situations in which voluntary standards can be considered as effective instruments to reach more sustainable vertical relationships, in terms of improved cooperative behaviour and transaction transparency. Moreover, it adds to the current debate on the role of existing exogenous risks on the reorganization of vertical relationships within the supply chains. Such finding suggests that when firms perceive an instability in the regulatory framework, they will prefer more flexible forms to manage transaction in order to adapt more easily to unpredictable changes. In the present analysis the research hypothesis H3 and H5 did not find an empirical support.

Our findings provide an interpretative base for managers, who have to estimate the risks associated with vertical relationships within supply chains and to give initial insights on the role of standards for the management of such risks. From a managerial perspective, the paper confirms that supply chain standards such as non-GMO standards, can be used by firms both as quality differentiation strategy and as effective tools to manage transaction risks.

More precisely, if exogenous risks are present, managers will prefer to do not adopt standard in order to respond more rapidly and effectively to unexpected changes in market dynamics. On the other hand, if the firms face internal transaction risks, the voluntary standard can be considered as tool to coordinate vertical relationships. Thus, in case of internal transaction risks, voluntary standards are adequate solutions for fostering an effective management of the supply chain.

The present study presents some limitations. The survey investigates perceptions of respondents concerning several variables. Although respondents were selected in a key managerial position of the company, these respondents may not reflect the perception of all decision makers in the managerial team. Moreover, the choice to enter in the non-GMO supply chain and the effectiveness of the standard in reduction transaction costs should be verified throughout performance indicators.

Although not directly measured, performances could be inferred from the results of this study considering the control variables related to the characteristic of the non-GMO supply chain. The fact, the incoming supply chain also present potential transaction costs deriving, for example, from environmental uncertainty or a behavioral uncertainty originating from the difficulty in respecting the GMO threshold. The non-significance of the effect of these transaction costs in the decision to enter the supply chain could be an indication that the standard is effectively controlling such transaction costs. Future studies will be dedicated to the development of a conceptual framework allowing to test the effectiveness of the standard to reduce transaction costs of quality-based supply chains.

References

Artz, K.W. and Brush, T.H. (2000), “Asset specificity, uncertainty and relational norms: an examination of coordination costs in collaborative strategic alliances”, Journal of Economic Behavior & Organization, Vol. 41 No. 4, pp. 337-362.

Bain, C., Ransom, E. and Higgins, V. (2013), “Private agri-food standards: contestation, hybridity and the politics of standards”, International Journal of Sociology of Agriculture and Food, Vol. 20 No. 1, pp. 1-10.

Banterle, A. and Stranieri, S. (2008), “The consequences of voluntary traceability system for supply chain relationships: an application of transaction cost economics”, Food Policy, Vol. 33 No. 6, pp. 560-569.

Barney, J.B. and Lee, W. (2000), “Multiple considerations in making governance choices: implications of transaction cost economics, real options theory and knowledge-based theories of the firm", in Foss, N. and Mahnke, V. (Eds), Competence, Governance and Entrepreneurship, Oxford University Press, New York, NY.

Boger, S., Hobbs, J.E. and Kerr, W.A. (2001), "Supply chain relationships in the Polish pork sector", Supply Chain Management: An International Journal, Vol. 6 No. 2, pp. 74-83.

Bosona, T. and Gebresenbet, G. (2013), "Food traceability as an integral part of logistics management in food and agricultural supply chain", Food Control, Vol. 33 No. 1, pp. 32-48.

Castellari, E., Venus, T., Wesseler, J. and Soregaroli, C. (2018), "Food Processor and Retailer non-GMO Standards in the US and EU and the driving role of regulations", Food Policy, forthcoming.

Das, T.K. and Teng, B.S. (2001), "Trust, control, and risk in strategic alliances: an integrated framework", Organization studies, Vol. 22 No. 2, pp. 251-283.

David, R.J. and Han, S.-K. (2004), "A systematic assessment of the empirical support for transaction cost economics", Strategic Management Journal, Vol. 25 No. 1, pp. 39-58.

Dong, Y and Peng, C.-Y.J. (2013), "Principled missing data methods for researchers", SpringerPlus, Vol. 2 No. 222, p. 17.

Fischer, C., Hartmann, M., Reynolds, N., Leat, P., Revoredo-Giha, C., Henchion, M., Albisu, L.M. and Gracia, A. (2010), "Factors influencing contractual choice and sustainable relationships in European agri-food supply chains", European Review of Agricultural Economics, Vol. 36 No. 4, pp. 541-569.

Fulponi, L. (2006), "Private voluntary standards in the food system: the perspective of major food retailers in OECD countries", Food Policy, Vol. 31 No. 1, pp. 1-13.

Genetic Literacy Project (2017) Non-GMO Project: Pro-organic group wants to 'shrink'market for conventional foods, kill biotechnology. [online] available at: https://geneticliteracyproject.org/glp-facts/non-gmo-project-labeling-group-wants-shrink-market-gmo-foods-limit-biotech-movement [accessed May 10th 2017]

Gereffi, G., Humphrey, J. and Sturgeon, T. (2005), "The governance of global value chains", Review of International Political Economy, Vol. 12 No. 1, pp. 78-104.

Geyskens, I., Steenkamp, J.B.E. and Kumar, N. (2006), "Make, buy, or ally: a transaction cost theory meta-analysis", Academy of Management Journal, Vol. 49, No. 3, pp. 519-543.

Ghosh, M. and John, G. (1999), “Governance value analysis and marketing strategy”, The Journal of Marketing, Vol. 63, pp. 131-145.

Ghozzi H., Soregaroli, C., Boccaletti S., Sauvée (2016). Impacts of non-GMO Standards on Poultry Supply Chain Governance: Transaction Cost Approach vs. Resource Based View. Supply Chain Management: an International Journal, 21(6), 743-758.

Grandori, A. (2015), “Improving organization forms in the agri-food industry”, British Food Journal, Vol. 117 No. 10, pp. 2418-2434.

Grazia, C., Hammoudi, A., Hamza, O. (2015). On the emergence of private standards: an industrial organization approach. In: Abdelhakim Hammoudi, Cristina Grazia, Yves Surry, Jean-Baptiste Traversac, dir., *Food Safety, Market organization, Trade and development* (p. 77-109). FRA : Editions Springer.

Greene, C., Wechsler, S. J., Adalja, A., and Hanson , J. (2016). Economic Issues in the Coexistence of Organic, Genetically Engineered (GE), and Non-GE Crops, EIB-149, U.S. Department of Agriculture, Economic Research Service, February 2016.

Gulati, R. and Singh, H. (1998), “The architecture of cooperation: managing coordination costs and appropriation concerns in strategic alliances”, Administrative Science Quarterly, Vol. 43, pp. 781-814.

Henson, S. (2011), “Private agri-food governance: conclusions, observations and provocations”, Agriculture and Human Values, Vol. 28 No. 3, pp. 443-451.

Henson, S. and Humphrey, J. (2010), “Understanding the complexities of private standards in global agri-food chains as they impact developing countries”, The Journal of Development Studies, Vol. 46 No. 9, pp. 1628-1646.

Hobbs, J. E. (2004), Information asymmetry and the role of traceability systems. Agribusiness, 20: 397–415.

Hobbs, J.E. (2006), “Liability and traceability in agri-food supply chains”, in Ondersteijn, C.J.M., Wijnands, J.H.M., Huirne, R.B.M., van Kooten, O. (Eds), Quantifying the Agri-Food Supply Chain, Springer, pp. 85-100.

Iyer, K. N., Srivastava, P., & Rawwas, M. Y. (2014). Aligning supply chain relational strategy with the market environment: Implications for operational performance. Journal of Marketing Theory and practice, 22(1), 53-72.

Klein, B., Crawford, R.G. and Alchian, A.A. (1978), “Vertical integration, appropriable rents, and the competitive contracting process”, The Journal of Law and Economics, Vol. 21 No. 2, pp. 297-326.

Leiblein, M.J. and Miller, D.J. (2003), “An empirical examination of transaction- and firm-level influences on the vertical boundaries of the firm”, Strategic Management Journal, Vol. 24 No. 9, pp. 839-859.

McGrath, R. G. (1997). A real options logic for initiating technology positioning investments. Academy of Management Review, 22(4), 974–996.

Ménard, C. and Valceschini, E. (2005), “New institutions for governing the agri-food industry”, European Review of Agricultural Economics, Vol. 32 No. 3, pp. 421-440.

Miller, K.D. (1992), “A framework for integrated risk management in international business”, Journal of International Business Studies, Vol. 23 No. 2, pp. 311-331.

Miller, K.D. and Folta, T.B. (2002), “Option value and entry timing”, Strategic Management Journal, Vol. 23 No. 7, pp. 655-665.

Olmos, M.F. (2010), “The performance implications of ‘grow or buy’ decisions in the wine industry”, Food Policy, Vol. 35 No. 3, pp. 256-264.

Passuello, F., Boccaletti, S., Soregaroli, C., 2015. Governance implications of non-GMO private standards on poultry meat value chains. British Food Journal 117(10), 2564-2581.

Peres, B., Barlet, N., Loiseau, G. and Montet, D. (2007), “Review of the current methods of analytical traceability allowing determination of the origin of foodstuffs”, Food Control, Vol. 18 No. 3, pp. 228-235.

Pouliot, S. and Sumner, D.A. (2008), “Traceability, liability, and incentives for food safety and quality”, American Journal of Agricultural Economics, Vol. 90 No. 1, pp. 15-27.

Raynaud, E., Sauvee, L. and Valceschini, E. (2005), “Alignment between quality enforcement devices and governance structures in the agro-food vertical chains”, Journal of Management and Governance, Vol. 9 No. 1, pp. 47-77.

Rubin, D.B (1987), “Multiple imputation for Nonresponse in Surveys”, John Wiley & Sons, New York.

Sheu, J.B. and Gao, X.Q. (2014), “Alliance or no alliance –Bargaining power in competing reverse supply chains”, European Journal of Operational Research, Vol. 233 No. 2, pp. 313-325.

Simon, H. (1945), Administrative Behavior, The Free Press, New York, NY.

Smit, H. T., & Trigeorgis, L. (2017). Strategic NPV: Real Options and Strategic Games under Different Information Structures. Strategic Management Journal, 38, pp. 2555–2578.

Smyth, S., Phillips, P.W.B., 2002. Product differentiation alternatives: identity preservation, segregation, and traceability. AgBioForum 5(2), 30-42.

Stranieri S. and Banterle A. (2017). Traceability standards and vertical coordination. Gaetano Martino, Konstantinos Karantininis, Stefano Pascucci, Liesbeth Dries and Jean Marie Codron (Eds.). It’s a jungle out there – the strange animals of economic organization in agri-food value chains. Wageningen Academic Publishers, pp. 119 – 138.

Stranieri, S., Orsi, L., Banterle, A. Traceability and risks: an extended transaction cost perspective (2017) Supply Chain Management, 22 (2), pp. 145-159.

Tallontire, A., Opondo, M., Nelson, V. and Martin, A. (2011), “Beyond the vertical? Using value chains and governance as a framework to analyse private standards initiatives in agri-food chains”, Agriculture and Human Values, Vol. 28 No. 3, pp. 427-441.

Tillie P., Rodríguez-Cerezo E., 2015. Markets for non-Genetically Modified, Identity-Preserved soybean in the EU. JRC Science and Policy Report, Luxembourg: Publications Office of the European Union.

Tillie, P., Vigani, M., Dillen, K., Rodríguez Cerezo, E., 2012. Market for non-Genetically Modified Identity Preserved crops and derived products. Proceedings of a workshop, JRC Scientific and Policy Report. Publications Office of the European Union, Luxembourg.

Trienekens, J.H., Wognum, P.M., Beulens, A.J. and van der Vorst, J.G. (2012), “Transparency in complex dynamic food supply chains”, Advanced Engineering Informatics,

Varacca, A., Boccaletti, S., Soregaroli, C., 2014. Economic aspects of segregation between GM and non-GM crops in Italy. AgBioForum 17(2), 123-132.

Varacca, A., Soregaroli C., 2016. Identity Preservation in International Feed Supply Chains. EuroChoices 15(1), 38–43.

Vol. 26 No. 1, pp. 55-65.

Wever, M., Wognum, P.M., Trienekens, J.H. and Omta, S.W.F. (2012), “Supply chain-wide consequences of transaction risks and their contractual solutions: towards an extended transaction cost economics framework”, Journal of Supply Chain Management, Vol. 48 No. 1, pp. 73-91.

Williamson, O.E. (1991), “Comparative economic organization: the analysis of discrete structural alternatives”, Administrative Science Quarterly, Vol. 36, pp. 269-296.

Young, L.M. and Hobbs, J.E. (2002), “Vertical linkages in agri-food supply chains: changing roles for producers, commodity groups, and government policy”, Review of Agricultural Economics, Vol. 24 No. 2, pp. 428-441.

Zhang, L., Xu, Y., Oosterveer, P. and Mol, A.P. (2015), “Consumer trust in different food provisioning schemes: evidence from Beijing, China”, Journal of Cleaner Production, Vol. 134, pp. 269-279.

Ziggers, G.W. and Trienekens, J. (1999), “Quality assurance in food and agribusiness supply chains: developing successful partnerships”, International Journal of Production Economics, Vol. 60, pp. 271-279.