

## Voluntary standards as meso-institutions: A Bayesian investigation of their relationships with transaction governance and risks

Claudio Soregaroli<sup>1</sup> | Alessandro Varacca<sup>2</sup> | Elena Claire Ricci<sup>3</sup>  
| Silvia Platoni<sup>2</sup> | Pascal Tillie<sup>4</sup> | Stefanella Stranieri<sup>5</sup>

<sup>1</sup>Department of Agricultural and Food Economics, Università Cattolica del Sacro Cuore, Piacenza, Italy

<sup>2</sup>Department of Economics and Social Sciences, Università Cattolica del Sacro Cuore, Piacenza, Italy

<sup>3</sup>Department of Business Administration, Università di Verona, Verona, Italy

<sup>4</sup>European Commission, Joint Research Centre (JRC), Directorate for Sustainable Resources, Seville, Spain

<sup>5</sup>Department of Environmental Science and Policy, Università degli Studi di Milano, Milan, Italy

### Correspondence

Alessandro Varacca, Department of Economics and Social Sciences, Università Cattolica del Sacro Cuore, Piacenza, Italy.  
Email: alessandro.varacca@unicatt.it

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### Abstract

Meso-institutions offer a promising theoretical approach for assessing the way in which firms govern their activities and transactions while embedded in the macro-institutional environment. The concept of meso-institutions also offers theoretical support when evaluating a wide variety of voluntary standards that have been introduced within value chains in recent decades. Such tools can be considered meso-institutions because of their features, and because of their role in translating general normative rules into specific mechanisms that delineate the domain of activities of supply chain agents. While various aspects of meso-institutions have been investigated, little is known about their relationship with micro-level structures and the determinants of firm's voluntary participation. The present paper investigates the association between a private standard, different forms of transaction governance in the supply chain, and the role that internal and external risks play in voluntary participation in the standard. The analysis draws upon secondary data taken from a representative sample of firms that form part of the European soybean supply chain. Our findings show that firms that participate in

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this standard have fewer hybrid forms and higher levels of spot markets. This suggests that some of the functions of hybrid forms are fulfilled by the meso-institution. The results also show that risks associated with firm's behavioral uncertainty are more conducive to the participation in the standard than environmental-related risks.

**KEYWORDS**

Bayesian multilevel model, Meso-institutions, transaction cost economics, transaction governance, transaction risks, voluntary standards

**JEL CLASSIFICATION**

D23, L14, L15, Q13

The concept of meso-institutions is relatively new. It was first introduced by French economist Claude Ménard (2014) to fill what he considered an important gap in the theoretical literature grounded in transaction cost economics (TCE) (Williamson, 1985). According to Ménard (2014), certain aspects of the role of the institutional environment (macro-institution) have been amply discussed in the literature, such as the efficiency and distributional effects of property rights (drawing on Coase, 1960) and the role of the political system (drawing on North, 1990). However, little is known about the mechanisms through which macro-institutions interact with micro-institutional structures such as transaction governance. A better understanding of these mechanisms would offer important perspectives on the way transaction costs are generated at the micro-level, as well as on the consequent performance of organizational arrangements.

Ménard (2014, p. 578) defines meso-institutions as “devices that are in charge of actually implementing the general rules of the game through their translation into rules specific to sectors and/or geographic areas, thus framing and delineating the domain of activities of actors (individuals as well as organizational arrangements) operating within these rules.” Meso-institutions connect macro-institutions, for example, governmental regulations, which define the general rules concerning rights and their allocation, with micro-institutions that correspond to the organizational structure of firms. Meso-institutions can be of various types: they can be public, such as regulatory agencies or specialized courts, or they can be private, such as coalitions of firms or private standards. They include both the relevant coordinating and monitoring “mechanisms” and the “devices” allowing these mechanisms to operate (Ménard, 2018). What is crucial in terms of efficiency from an economic and organizational perspective is the interconnection of meso-institutions with the macro- and micro-institutional levels and their alignment with available technologies (de Oliveira, 2019). A mismatch could produce policy gaps, affect organizational effectiveness, and determine transaction costs (de Oliveira, 2019). For example, a meso-institution could fail to adequately implement a food safety policy because the mechanisms contain indicators that cannot feasibly be monitored using available technologies. This would result in weak policy enforcement, with firms organizing transactions in a value chain opportunistically based on this mismatch.

The literature about meso-institutions is very recent and concentrates on case study applications with a focus on the implementation of a meso-institution and performance considerations.

For example, Rouvière and Royer (2017) provide a discussion on the macro-meso linkages focusing on the characteristics explaining the functioning and participation in meso-institutions. de Oliveira (2019) studies the interlinkages between macro-, meso-, and micro-institutional layers assessing policy effectiveness and the overall firms' performance. de Vinholis Mello Brandão et al. (2021) focus on the meso-micro linkages investigating the effectiveness of meso-institutions in promoting farmers' adoption of new sustainable technologies.

Based on the existing literature, however, the link between meso-institutions and transaction governance has not been explored yet, even though Ménard (2014) calls for an important role of meso-institutions in explaining the coordination of vertical relationships. To address the above research gap, our study aims at achieving a deeper understanding of the connection between meso-institutions and the micro-institutional level focusing on a transaction governance and firm's perspective. We consider the creation and implementation of a meso-institution as exogenous, thereby assuming that the investigated actors have no power to influence the translation of the rules into specific mechanisms and devices. Conversely, the central theme of our investigation is the firm's participation in a meso-institution with predefined characteristics, where the firm's problem is to govern its transactions efficiently to coordinate vertical exchanges.

Participating in a meso-institution requires adopting its mechanisms such as procedures, monitoring, and enforcement systems. According to the design of the meso-institution, relationships among actors in a supply chain might be different. Mechanisms could be so highly formalized and broadly adopted that they could reduce the relevance of the identity of transacting parties. Differently, complex procedures could require transaction-specific investments that could result in closer relationships among economic agents. This would lead to different ways of operationalizing transaction governance at the micro-level. We further investigate these aspects in our first research question (RQ1), where we look at the association between some of the characteristics of a meso-institution and the forms of transaction governance operationalized by the participating firms.

A second point of investigation relates to the determinants leading economic agents to participate in meso-institutions. According to de Oliveira (2019) and Royer (2016), one of the consequences of implementing meso-institutions concerns the improvement of information-related performances within economic exchanges and a reduction of transaction costs stemming from transaction uncertainties. As the literature has not yet explored whether and how the uncertainties associated with a transaction influence voluntary participation in a meso-institution, we take this aspect into consideration in a second research question (RQ2).

In this study, we provide a conceptual framework based on TCE. This framework examines one specific meso-institution, in the form of a voluntary standard, and investigates its relationships with the micro-level structures. We consider the micro-level referring to how firms govern their transactions according to the degree of vertical coordination. We categorize such forms of transaction governance using the classical dichotomy between spot markets and vertical integration, and defining "hybrids" as all of the intermediate forms where, unlike the spot market, the identity of the trading partner is relevant and, at the same time, partners keep distinct ownership of key assets. Moreover, our conceptual framework considers the role of transaction uncertainties in influencing both the voluntary participation in a standard and the observed forms of transaction governance. Specifically, transactions can take place under two different types of uncertainties, namely behavioral uncertainty and environmental uncertainty (Williamson, 1985). Behavioral uncertainty relates to the bounded rationality of economic agents and the inability to predict their behavior in the execution of transactions.

Environmental uncertainty originates from unexpected changes in the economic environment, such as market prices or availability of inputs. These uncertainties expose the transacting parties to risks, such as the opportunistic behavior of transacting parties and the one of maladaptation (Wever et al., 2012). These risks become relevant in the presence of asset specificity or, more generally, when the costs are sunk, that is, they are related to irreversible or adjustment costs in firm's investments (Wesseler & Zhao, 2019). In our work, we define the risk of incurring sunk costs because of behavioral uncertainty as "internal risks," while we refer to risks arising from environmental uncertainty as "external risks." To inform our conceptual framework and address the above-discussed research questions, we use data from an EU-wide representative survey conducted by the Joint Research Centre (JRC) of the European Commission concerning the soybean supply chain (Tillie & Rodríguez-Cerezo, 2015). An ample subset of questions in the survey covered aspects of transaction governance, and therefore, could be used as measures in our empirical analysis, which was framed using a Bayesian Multilevel Model (BMM).

The results provide evidence about the relationship between the voluntary standard and observed forms of transaction governance, where firms adopting the procedures of the standard show a lower incidence of hybrid forms and a higher incidence of spot markets. In addition, transaction risks determine a higher probability of participation in a voluntary standard. As discussed in the last sections of the study, these key findings suggest that the mechanisms to reduce opportunism provided in a standard can be perceived as (i) effective in reducing transaction costs, while at the same time (ii) overlapping with some of the functions of hybrid governance forms.

This paper is organized as follows. The next section introduces voluntary standards and their role as meso-institutions. We then provide a detailed description of the conceptual framework, followed by the research hypotheses for the study, and the description of the relevant voluntary standard, measures, data, and the empirical model. Two further sections on the results and relevant conclusions close the paper.

## VOLUNTARY STANDARDS AS MESO-INSTITUTIONS

Ménard (2014, 2018) discusses examples of meso-institutions in the form of regulatory agencies, specialized courts, public departments, competition authorities, and private international arbitration. The common feature of these meso-institutions is that they all implement the general rules defined by the macro-institutions, translating them into specific "mechanisms" defining their functions and "devices" allowing these mechanisms to operate. Ménard (2018) identifies three main functions of meso-institutions: (1) they translate and allocate rights, for example, the right to access a specific claim or label only upon meeting specific norms and procedures; (2) they implement rules and rights, for example, through the possibility of excluding non-compliant companies or imposing penalties; and (3) they monitor and incentivize compliance with the agreed rules.

In the following, we argue that voluntary standards can be added to the list of meso-institutions. Looking at voluntary standards as meso-institutions offers the possibility of further exploration of this concept, as well as providing several advantages in interpreting the role of voluntary standards in a value chain. Voluntary standards are relevant from a policy and managerial perspective and are receiving increasing attention in the economic and managerial literature. For example, standards are increasingly used to promote environmentally sustainable practices (e.g., ISO 14001) and, more generally, global environmental governance (Wagner,

2019). Focusing on the food industry, increasing consumer concerns about food safety attributes, and rapid changes in the demand for different quality attributes of food products have led to the introduction of a large variety of food standards into the market (Brown et al., 2020; Havinga, 2018).

The relationship between voluntary standards and macro-institutions has been discussed in the literature in various ways. Standards can be recognized by public authorities within a public-private coregulation framework (García Martínez et al., 2013) and can be used strategically to pre-empt the emergence of undesired public regulations (McCluskey & Winfree, 2009). Deregulation in public management has made the role of voluntary standards pivotal in many value chains. However, their role remains embedded in public regulations that set the general rules of the game. The relationship of voluntary standards with the micro-level is evident. Indeed, a voluntary standard introduces mechanisms to manage and control risks at the micro-level, mechanisms, which depend on the characteristics of transacting parties and on the economic context in which firms operate (Stranieri, Cavaliere, & Banterle, 2017; Wever et al., 2012). Voluntary standards define a set of rules and procedures that increase the transparency of information concerning product credence attributes (Henson & Humphrey, 2010). They can take various forms, such as traceability systems and quality schemes, and can help to assure the desired level of quality attributes. They often require a reorganization of supply chain relationships that can include the redefinition of contracts, the reorganization of supply chain management practices, and direct control or involvement of a third-party certifier for auditing and monitoring activities (Castellari et al., 2018; Hammoudi et al., 2015).

A voluntary standard has all the characteristics and functions that define a meso-institution: firms can access “certified” supply chains, including their labels, only while meeting a standard’s requirements. This includes auditing and certification processes that qualify a firm as supplier of a specific products. This status is subject to continuous validation through a monitoring process. In the case of noncompliance, a firm can be suspended from supplying a product or, in extreme cases, even excluded from participation in the standard. These mechanisms can operate thanks to devices in charge of control, such as private consortia of large retailers, professional associations (e.g., national or local firms’ associations), or third-party certifiers.

Voluntary standards are also interesting when looking at the determinants of participation in a voluntary meso-institution by supply chain agents. According to Mazé (2017), adopting the procedures of voluntary standards reduces the level of transaction and measurement costs. The standard helps to reduce transaction uncertainty due to improved information about the product and process attributes during vertical exchanges. For example, in the case of traceability standards, Rouviere & Royer (2017, p. 141) state that “the partnership allowed supply chain agents to: decrease information asymmetry, increase trust among partners, and reduce costs associated with information search.” However, empirical evidence regarding the impact of the different types of transaction uncertainties and related transaction risks on the decision to adopt such procedures is so far scant.

## CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

Figure 1 illustrates our conceptual framework. The upper portion of the figure shows the relationship between a voluntary standard and forms of transaction governance, which corresponds to our first research question (RQ1). The bottom-left part of the figure depicts the role of transaction uncertainties in influencing the probability of a voluntary participation in a meso-

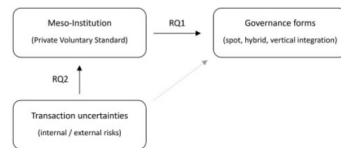


FIGURE 1 Conceptual framework

institution (RQ2). Finally, notice that this logical construct also allows us to examine the direct relationships between transaction uncertainties and transaction governance forms, as expressed by the dotted arrow.

To address RQ1, the specific set of mechanisms and devices that characterize a voluntary standard becomes important. A voluntary standard can be classified as “collective” when participation is open to several competing firms in a market. This standard can be public or private. For example, the British Retail Consortium standard can be considered collective because it includes a multitude of retailers and impacts supply chains at an international level. Such standards are “open,” in the sense that barriers to entry rely on technical requirements and not on legal privileges. Participation in these standards is open to a large group of firms, which is often the case for voluntary standards promoted by third-party certifiers (Hammoudi et al., 2015). Giraud-Héraud et al. (2012) show that standards, even if designed by a small group of firms—such as retailers—can be made open access to increase the number of certified firms as much as possible. In this way, leading firms can secure more competition in the upstream market and increase the availability of certified inputs. In the case of collective standards, “the vertical coordination is realized through intermediate markets and third-party certification rather than individual contracts between upstream and downstream firms” (Giraud-Héraud et al., 2012, p. 184). Reliable certification systems embedded in a standard could reduce transaction costs in supply chain relationships (Yu & Bouamra-Mechemache, 2016), standardizing these costs across suppliers and leading to a reduction in procurement transaction costs. Therefore, collective standards should reduce the relevance of the identities of transacting parties, favoring a lower degree of vertical coordination in a supply chain. Similar arguments can be found in Mainville et al. (2005), who argue that standards promoted by the public sector or by third-party certifiers are seen as favoring spot markets. Therefore, we can propose the following hypothesis:

**H1.** *Firms that participate in a collective voluntary standard have a higher probability of operationalizing governance forms with a lower degree of vertical coordination.*

A voluntary standard can also be individual in nature. In this case, the standard is necessarily private, and its setup and participation are limited to a specific firm and supply chain. In contrast with collective standards, a firm that designs and promotes its own voluntary standard (the “focal” firm) aims to differentiate its products based on several quality attributes (Hammoudi et al., 2015). The focal firm usually takes the lead and coordinates the implementation and monitoring of the practices required by the standard with supplying partners. These tasks imply a distribution of specific responsibilities to economic agents, with a redefinition of contracts and a reorganization of supply chain management practices along the chain. They

also require the centralization of information flows within supply chains (Banterle & Stranieri, 2008). These mechanisms can be better managed when there is a direct relationship between the leading firm and upstream suppliers (Hammoudi et al., 2015). This direct relationship often requires transaction-specific investments that increase asset specificity and bilateral dependency, further justifying expectations for a higher level of coordination along the supply chain (Banterle & Stranieri, 2008). According to Dolan & Humphrey (2016, p. 494), there are aspects that are “noncontractible” and can be best controlled through direct monitoring and relationships, especially when the activities of the firm are highly dynamic, as in the presence of continuous innovation strategies. Similarly, Mainville et al. (2005) consider second-party or internal certifications to be more closely related to a higher degree of vertical coordination. Based on this reasoning, the following hypothesis can be formulated:

**H2.** *Firms that participate in an individual voluntary standard have a higher probability of operationalizing governance forms with a higher degree of vertical coordination.*

Moving to RQ2, a voluntary standard can include several mechanisms that respond to the need of reducing transaction risks. These mechanisms can help to manage risks originating from the uncertainties related to both transaction characteristics and the characteristics of the transacting parties. Regarding transaction characteristics, a voluntary standard usually requires enhanced information exchanges along the supply chain to reduce the risk that the actors will behave opportunistically. For example, a lack of transaction transparency can generate difficulties in liability distribution among transacting parties in case of product noncompliance (Pouliot & Sumner, 2008). Private safety, quality, and sustainability standards often rule in favor of the presence of a traceability system that allows for improved supply chain transparency (Stranieri, Orsi, & Banterle, 2017). In Italy, for example, the major retailers impose traceability systems with a high level of depth (in terms of the sectors involved), precision (in terms of identifying a product's flow), and breadth (in terms of the amount of information traced) in their private label supply chains (Banterle & Stranieri, 2013). Concerning the characteristics of transacting parties, a voluntary standard can contribute to a better management of any misalignments among actors that may arise from an uneven distribution of power and control. This imbalance could lead to asymmetric bargaining power, thereby increasing risk in transactions (Sheu & Gao, 2014). In this context, Boiral and Gendron (2011) highlight the role of ISO certifications in building trust among supply chain partners. Tuppura et al. (2016) observe that an improvement of collaboration among supply chain agents motivates the implementation of voluntary forest certifications and other environmentally friendly standards. The risks identified above can be classified as “internal risks” (Billitteri et al., 2013), as the probability of incurring irreversible or adjustment costs originates from the bounded rationality of economic agents and their behavior in the execution of transactions. Considering the potential role that a voluntary standard can play in reducing these risks, we formulate the following hypothesis:

**H3.** *The higher the internal risks of a transaction, the higher the probability of a voluntary participation in a standard.*

At the same time, the mechanisms of a voluntary standard are challenged by the economic context. Food firms need to manage risks originating from various kinds of exogenous

uncertainties, such as supply and price volatility, demand uncertainty (Smit & Trigeorgis, 2017), and competitive uncertainty (Iyer et al., 2014). Consumer concerns about the quality and safety characteristics of food products and rapid changes in consumer preferences regarding food quality attributes also contribute to uncertainty around the level of requirements to implement in vertical exchanges (Fulponi, 2006). Moreover, rapid changes in regulatory dynamics further increase the transaction risks associated with the level of requirements necessary to the exchanges. These uncertainties expose firms to what we call “external risks.” This category of risk relates to the probability of incurring irreversible or adjustment costs originating from unexpected changes in the economic environment (Ansink & Wesseler, 2009). External risks do not depend on the behavior of economic agents and could lead to maladaptation by the transacting parties. Whether a firm should decide to participate in a voluntary standard in the presence of external risks is controversial. Some authors state that such instruments may influence consumers’ quality preferences, trust, and increase their willingness to pay for food products (Del Giudice et al., 2018; Jaffry et al., 2016; Kolodinsky & Lusk, 2018; Lerro et al., 2018). Others (e.g. Khan et al., 2019) argue that a lack of consumer awareness around existing quality and sustainability certifications makes the participation in a voluntary standard ineffective. Moreover, in some cases, voluntary standards are perceived as instrument that decrease the flexibility of firms in a changing economic environment (Pérez & Gutiérrez, 2013). Therefore, we propose the following hypothesis:

**H4.** *The higher the external risks of a transaction, the lower the probability of a voluntary participation in a standard.*

## METHODS

### Selection and description of the case study

To identify a voluntary standard that was suitable for testing the hypotheses, initial validation criteria were required. One of the limiting factors in the assessment of this theoretical framework, which also explains the lack of quantitative validation in the literature, is the availability of publicly accessible datasets and the high costs of ad hoc surveys. Therefore, as a first criterion, the availability of a secondary data source was required. Relevance was a second criterion: the macro-institution framing the implementation of the voluntary standard had to be relevant from a policy perspective, and the voluntary standard itself had to be relevant to a supply chain. Finally, the participation in the voluntary standard needed to be sufficiently widespread to generate enough observations for a quantitative analysis.

As a secondary data source, we identified a dataset built by the JRC of the European Commission (Tillie & Rodríguez-Cerezo, 2015) as a good candidate for the analysis according to the validation criteria. The data refer to the “non-GMO” voluntary standard, which has been implemented by many retailers and food processing companies across the European Union. The macro-institution providing the starting point for the implementation of this voluntary standard is EU Regulation (EC) No. 1829/2003. Under this regulation, food and feed must be labeled as containing genetically modified organisms (GMOs) if more than 0.9% GMO material is present in any of the ingredients. The voluntary standard is based on the relative absence of GMO ingredients in food that originates from plants or, in the case of livestock products, from animals fed with non-GMO feed. The implementation of such a voluntary standard is



particularly relevant in the EU livestock sector, in which soybeans are a key protein source in livestock feed and the EU largely depends on imports for this product (Ghozzi et al., 2018). The JRC survey can be considered representative of the EU soybean supply chain. It includes 363 companies of different types in 15 different EU Member States. Companies participating in the voluntary standard are present in all Member States, highlighting a widespread adoption of its protocols that are characterized by a certain degree of heterogeneity across EU countries and supply chains.

Information about the required practices for achievement of this voluntary standard can be found in Varacca and Claudio (2016) and Passuello et al. (2015). One crucial aspect of the standard is the definition of the non-GMO threshold. In fact, different thresholds can be chosen, and values stricter than 0.9% can be used. The lower the accepted GMO threshold, the stricter supply chain practices must be. This choice varies according to Member State legislation or private initiatives. In some countries, for example, in Finland, a public standard for non-GMO labels imposes a zero threshold of adventitious presence for GMO material. In other countries, 0.1%–0.9% thresholds prevail (Castellari et al., 2018). The standard can be classified as being “individual” in nature. However, this definition is not straightforward. In fact, besides the definition of different thresholds, which substantially affect the required supply chain practices, the observed standards present some common procedural aspects. For example, soybean sourcing can follow similar paths involving the same third-party certifier in certifying the soybean input. Therefore, elements characterizing a “collective” standard also emerge. This makes an investigation of the relationship between voluntary standard participation and governance forms of particular interest from an empirical point of view.

### Measures and data

The survey distinguishes between firms that participate and firms that do not participate in a non-GMO voluntary standard, collecting information at the company level in many different areas. In our paper, we focus on the following: the governance of the soybean supply chain, transaction risk determinants, and supply chain characteristics. The respondents to the survey included owners, executives, line managers, and buyers, all of whom had extensive knowledge of the company's position in the soybean supply chain. The companies surveyed included traders of soybean raw material, soybean crushers, feed manufacturers, animal-based food producers, and retailers. The variables we use in our empirical analysis are reported in Table 1.

The company's situation is described in terms of supply chain governance variables at the time of the interview. The participation in the voluntary standard is defined using a binary variable that distinguishes adopters from nonadopters of the standards' protocols. Forms of transaction governance are categorized in terms of spot, hybrid, or vertical integration in input sourcing. They are defined based on the relevance of the identity of trading partners (which proxies elements such as coordination, knowledge, and task integration) and the presence of shared ownership (as per Jaspers & van den Ende, 2006). Notably, these forms of governance are measured as percentages of purchases under spot, hybrid, or vertical integration. This measure allows to identify whether the purchasing of a given input was homogeneous or whether plural forms of sourcing were in place (Ménard, 2013).

Questions proxying the dimensions of internal and external risk were developed and included in a set of multi-item latent constructs. The questions all refer to a specific moment in

TABLE 1 Description of variables

Variable name	Description	Scale	Mean	SD	<i>n</i>	Min	Max
<b>Governance variables</b>							
Participation in non-genetically modified organism (GMO) standard	Dummy variable identifying whether the company operates within the non-GMO soybean supply chain	0–1	0.59	0.49	341	0	1
Spot	Percentage of purchases in the spot market (immediate exchange of goods; identity of partners is not relevant)	0–100	32.9	35.8	245	0	100
Hybrid	Percentage of purchases that are formal or informal, where the identity of the partner is relevant but no shared ownership exists	0–100	62.0	37.6	245	0	100
Vertical integration	Percentage of purchases under shared ownership of production, processing, or distribution of assets, with parties that can remain legally independent	0–100	5.1	16.5	245	0	100
<b>Transaction-internal risks</b>							
Downstream partner asymmetry	Level of importance of “satisfying a downstream commercial partner” in the company’s decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1–7	5.5	1.8	204	1	7
Upstream partner asymmetry	Level of importance of “satisfying an upstream commercial partner” in the company’s decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1–7	4.5	2.2	201	1	7
Investment specificities in brand equity	Level of importance of the “need to improve brand equity and reputation of the company” in the company’s decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1–7	4.8	2.1	192	1	7
Liability risk	Level of importance of “liability risk” in the company’s decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1–7	4.1	2.2	177	1	7

TABLE 1 (Continued)

Variable name	Description	Scale	Mean	SD	n	Min	Max
<b>Transaction-external risks</b>							
Quality concerns	Level of importance of "concerns about the quality of products containing GMOs" in the company's decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1-7	4.6	2.3	197	1	7
Safety concerns	Level of importance of "concerns about the safety of products containing GMOs" in the company's decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1-7	4.6	2.3	205	1	7
Labeling and traceability requirements	Level of importance of "regulations on labeling and traceability (to avoid GMO labeling requirements)" in the company's decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1-7	4.4	2.4	201	1	7
Regulation complexity	Level of importance of "regulation complexity" in the company's decision to operate in the non-GMO market (1 = not at all; 7 = extremely)	1-7	3.7	2.1	178	1	7
Market uncertainty	Level of agreement with the statement "our company operates in very uncertain markets" (1 = not at all; 7 = extremely)	1-7	4.6	2.0	343	1	7
<b>Firm characteristics</b>							
Experience in the soybean supply chain	Measured in years of activity in the soybean market: years = 1 if the number of years dealing with the soybean supply chain is 0 < years ≤ 10, 2 if 10 < years ≤ 20, 3 if 20 < years ≤ 30, 4 if 30 < years ≤ 40, 5 if 40 < years ≤ 50, and 6 if years > 50	1-6	3.0	1.6	341	1	6
Soybean trader	Dummy variable identifying companies operating in the soybean raw material trading sector	0-1	0.1	-	363	0	1
Soybean crusher	Dummy variable identifying companies operating in the soybean crusher sector	0-1	0.1	-	363	0	1

(Continues)

TABLE 1 (Continued)

Variable name	Description	Scale	Mean	SD	<i>n</i>	Min	Max
Feed manufacturer	Dummy variable identifying companies operating in the feed manufacturer sector	0-1	0.2	-	363	0	1
Animal-based food producer	Dummy variable identifying companies operating in the animal-based food production sector	0-1	0.5	-	363	0	1
Retailer	Dummy variable identifying companies operating in the retailing sector	0-1	0.1	-	363	0	1

time: the moment of the decision about whether to participate in a non-GMO voluntary standard. Internal risks are proxied by questions in which respondents were asked to assess the level of importance to the company of satisfying the requests of upstream and downstream partners, which approximates the level of power asymmetry. The importance of reputational and liability risks is assessed in a similar manner. External risks are proxied by respondents' assessments of concerns related to the quality and safety features of products, the importance of labeling, traceability, and regulation complexity, and the uncertainty of the market in which the firm operates. All responses were given on a seven-point Likert scale.

Finally, to differentiate among firms, experience in the non-GMO business and supply chain positioning were considered. The first variable is measured by the number of years that the company has been dealing with the soybean supply chain. To establish the supply chain stage at which firms are operating, a set of five dummy variables is used to indicate the subsector that the company belongs to (crusher, animal food producer, feed manufacturer, international trader, or retailer).

Basic descriptive statistics for each variable included in the model are reported in the right-hand columns of Table 1. More specifically, for each variable, Table 1 reports the scale on which the variable is measured, the mean value, and the standard deviation. To provide a better picture of the sample of firms included in the analysis, Table 2 reports the percentage of firms in each supply chain stage that participate and do not participate in a non-GMO voluntary standard, along with the share of firms managing the product supply through spot, hybrid, or vertically integrated transactions.

In Table 2 it can be observed that all five firm types are included in the sample, though the largest share is made up of animal-based food producers. This is in line with the structure of the overall soybean market. In percentage terms, firms in the sample are relatively evenly distributed between those that participate and those that do not participate in the standard. The exceptions are food retailers and traders, of which about three-quarters of the interviewed firms participate in the standard. Table 3 displays the proportion of firms at each stage of the supply chain that manages the supply of their product through spot transactions, hybrids, or vertical integration. Our data show that vertical integration represents a marginal option compared to pure market and hybrid transactions.

TABLE 2 Distribution of firms' participating–not participating in the nongenetically modified organism (GMO) standard by supply chain stage and type of organizational arrangement for the product supply

Participation in the non-GMO standard	Supply chain stage					Organizational arrangement				
	Soybean traders (%)	Soybean crushers (%)	Feed manufacturers (%)	Animal-based food producers (%)	Retailers (%)	Total (%)	Spot (%)	Hybrids (%)	V.I. (%)	Total (%)
No	8	10	22	56	3	100	28	70	2	100
Yes	25	7	15	53	0	100	37	56	6	100

TABLE 3 Distribution of firms by supply chain stage and type of organizational arrangement for the supply of product

Organizational arrangement	Supply chain stage				
	Soybean traders (%)	Soybean crushers (%)	Feed manufacturers (%)	Animal-based food producers (%)	Retailers (%)
Spot	47	22	28	31	63
Hybrids	50	76	70	61	36
V.I.	3	2	2	8	1
Total	100	100	100	100	100

### Empirical model

We address the four hypotheses introduced in the previous section through a BMM. Because two of the key features that we aim to investigate (internal risk and external risk) are latent characteristics, we need a principled probabilistic framework relating these unobservable attributes to the available measurements displayed in Table 1. In this context, adopting a BMM has two main advantages: first, BMMs allows us to set out a bespoke probabilistic relationship between survey items, type of vertical coordination, choice of participating in a meso-institution, and latent characteristics through any sensible theoretical construct; and second, these methods allow uncertainty to carry over across modeling levels, thus removing the need for variance corrections throughout the hierarchy. We carefully illustrate our modeling strategy in the Appendix S1 provided for this paper, where we thoroughly describe each block of our three-level BMM. Conceptually, our approach builds upon earlier empirical TCE papers attempting to analyze the determinants of integration through survey data (see e.g., Masten, 1984; Masten et al., 1991). However, our methodology expands upon these econometric approaches by carefully defining the latent quantities elicited through survey data and integrating multiple modeling stages into a single probabilistic construct. Following Stranieri et al. (2021), we begin by relating the polytomous survey data to the two unobserved features of interest: internal risk and external risk. Next, the levels of risks enter the conditional mean of a compositional data (Dirichlet) model that links the share of spot market, hybrid, or vertically integrated product sourcing to a vector of covariates, plus the previously defined latent characteristics. Finally, we set up a Bernoulli response model in which the probability of participating in a non-GM supply

chain depends on a set of firm characteristics, including exposure to internal and external risk. Model estimation via Markov Chain Monte Carlo, post-estimation convergence statistics, and posterior model checking are addressed in the Appendix S1.

## RESULTS

The compositional data level of the BMM outlined in Section 3 allows us to evaluate hypotheses H1 and H2. The model includes the following firm characteristics: (i) a two-level factor capturing participation in a meso-institution; (ii) a set of indicators regarding the stage of the supply chain at which the firm operates; (iii) the number of years of participation in the soybean supply chain; and (iv) the latent variables of interest, internal risk and external risk. As these variables enter the model's conditional mean through a nonlinear transformation, we facilitate the discussion by calculating predicted proportions of spot transactions, hybrids, and vertical integration for each covariate and then plot them against the variables of interest (Douma & Weedon, 2019; Maier, 2014). Figure 2 depicts how these proportions differ when firms participate in a non-GMO standard (red histogram) or when they do not (gray histogram) at different stages of the supply chain.

Our estimations show that, regardless of the supply chain stage, participation in the meso-institution is associated with a higher share of spot transactions, while the opposite is true for

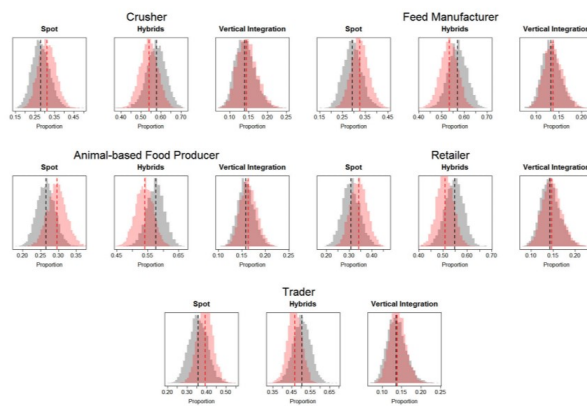


FIGURE 2 Posterior distributions of predicted proportions for firms that participated in a nongenetically modified organism standard (red histogram) and firms that did not (gray histogram) [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

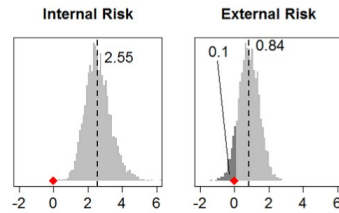


FIGURE 3 Posterior distributions for the internal risk and external risk parameters. The overlaid values indicate the posterior median of the two distributions, while the shaded area in panel 2 represents the proportion of posterior draws lower than zero [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

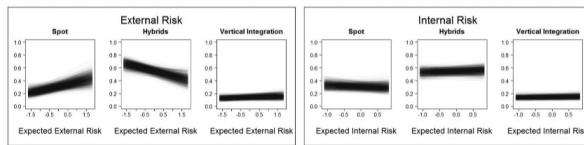


FIGURE 4 Posterior distributions of predicted proportions for firms experiencing different levels of internal and external risks

exchanges through hybrid forms. This pattern is consistent across all five stages of the supply chain, with larger differences for food processors and retailers. On the other hand, when soybean is purchased through vertically integrated systems, both the posterior medians and the corresponding parameter distributions tend to overlap considerably. Overall, the results presented in Figure 2 support hypothesis H1, which predicts a lower degree of vertical coordination when firms participate in a collective voluntary standard. However, this pattern does not seem to hold for vertically integrated transactions. The behavior postulated in H2, which predicts a higher degree of vertical coordination in cases in which firms voluntarily participate in the individual standard, does not emerge from our analysis. Therefore, as well as confirming an association between the meso-institution and micro-institutional arrangements, our results suggest that the non-GMO standard investigated has more collective than individual characteristics.

Figure 3 reports the posterior distributions of the regression coefficients related to the latent risk characteristics in the Bernoulli response model. We use these two parameters to inform hypotheses H3 and H4, thereby addressing the role of both internal and external risk in driving the decision about whether to participate in a non-GMO voluntary standard. The first panel supports H3, indicating that internal risks are positively associated with the decision to participate in the meso-institution. Greater external risks are also associated with higher chances of participating in the standard, although the coefficient is considerably smaller and noisier.

Finally, we consider the change in predicted proportions of spot transactions, hybrids, and vertically integrated transactions for different levels of internal risk and external risk, thus investigating the direct relationships between transaction uncertainties and transaction governance forms. We obtain the partial dependence plots in Figure 4 by (i) sampling from the posterior distribution of the regression coefficients for the (latent) risk covariates and (ii) calculating the fitted shares of spot, hybrid, and vertically integrated transactions. As Figure 4 suggests, with an increase in internal risks we observe fewer firms choosing spot market purchasing, while the opposite is true for firms that are organized through hybrid contracting forms. However, the relationship appears rather weak, as highlighted by the flatness and the high variance of the line plots. On the other hand, there is no change in the share of integrated transactions when comparing firms across the full spectrum of the internal risk latent attribute.

We find the opposite results when investigating the corresponding proportions for firms exhibiting contrasting levels of external risk. As shown in Figure 4, firms facing high levels of external risk tend to privilege purchases through the spot market. Conversely, transactions with hybrid forms are less frequent among companies that operate under significant external risk. However, as for sensitivity to internal risk, the share of purchases through vertical integration appears robust to perturbations in the latent variable of interest.

## DISCUSSION

### Theoretical implications

The set of research hypotheses investigating the relationship between a voluntary standard and various forms of transaction governance offers interesting theoretical insights to the literature concerning meso-institutions. A first consideration emerges directly from the formulation of the testable hypotheses: the mechanisms and devices that characterize a meso-institution can be crucial in predicting the way in which the governance of a supply chain is operationalized. For example, a collective versus individual nature of a voluntary standard generates opposite predictions on the relationships with the degree of vertical coordination. This highlights the importance of considering the heterogeneity of strategic approaches among companies in evaluating the operationalization of a meso-institution at the micro-level.

Our results suggest an association between the investigated voluntary standard and different transaction governance forms, which supports the idea that meso-institutions are operationalized in specific transaction governance forms (RQ1). Focusing on the posterior medians and the full parameter distributions for the spot market and hybrid forms in the compositional data model (Figure 2), we can draw some interesting insights. In particular, the actors participating in the voluntary standard seem to substitute the spot market with hybrid forms. This negative relationship between a meso-institution and hybrid transaction forms poses several challenging theoretical considerations.

Hybrids include a variety of "nonstandard" arrangements such as subcontracting, strategic alliances and partnerships, and franchising, as well as joint ventures and quasi-vertical integration. The way in which assets, decision rights, and payoffs are distributed among partners is central in the definition of hybrids (Baker et al., 2008). Ménard (2013, p. 1066) defines hybrids as "arrangements in which two or more partners pool strategic decision rights as well as some property rights while simultaneously keeping distinct ownership over key assets, so that they require specific devices to coordinate their joint activities and arbitrate the allocation of



payoffs.” He proposes a model whereby hybrids are categorized based on the combination of two dimensions: (1) the degree of centralization of coordination and control, which concerns the allocation of decision rights, and (2) the pooling of strategic resources and the associated property rights. Firms pooling decision rights will have higher the degree of centralization of coordination and control. Similarly, pooling strategic resources and property rights reduces the degree of autonomy of firms up to the point where they vertically integrate. In a context of high uncertainty and complexity, hybrids allow more flexibility and better incentives than a total integration of assets, while providing more coordination and control than spot markets.

Ménard (2014) discusses meso-institutions independently from the concept of hybrid forms, as meso-institutions do not detail the way in which firms organize transactions. Governance forms are the result of the “operationalization” at the micro-level of the mechanisms defined within a meso-institution (de Oliveira, 2019). In fact, considering the case analyzed in this study, a voluntary standard cannot be considered an alternative to the “make or buy” decision. However, upon examination of the functions of meso-institutions, some overlap with hybrid forms emerges. Decision rights are partially decentralized in a meso-institution such as a voluntary standard. The standard sets protocols and enforcement mechanisms to be followed. For example, it limits input procurement to qualified suppliers and defines some of the monitoring activities. The pooling of strategic resources and property rights can also be involved. For example, the increased transparency of information provided by a standard requires that some of the firm’s internal knowledge be shared (Ghozzi et al., 2016). In other cases, the implementation of a standard requires the pooling of resources in the creation of a third-party in charge of monitoring and control (Hatanaka et al., 2005). Consequently, a meso-institution in the form of a voluntary standard can have some of the coordinating functions observed for hybrids, as recently discussed by Menard et al. (2021). This could result in a situation where firms participating in the standard have less need to operationalize a hybrid form, which could explain the observed substitution effect between hybrids and the spot market. Moreover, the positive association between the probability of participating in the voluntary standard and the level of internal transaction risks further supports this reasoning, indicating that the standard could be perceived as a tool to reduce opportunism.

Notwithstanding this overlapping of functions, meso-institutions and hybrid forms remain two distinct concepts pertaining to two different levels of institutional governance. These arguments suggest that theoretical advances would be needed to clarify the boundaries of meso-institutions and formalize their relationships at the micro-level with hybrid forms of governance.

### Practical implications

Viewing voluntary standards as meso-institutions provides a different perspective when interpreting their role within a value chain. On the one hand, the relationship between the voluntary standard and the macro-level raises relevant questions about its effectiveness in stimulating the implementation of the general rules of the game, with the objective of reaching the desired policy goals. On the other hand, looking at the relationships between a voluntary standard and micro-level processes offers relevant insights into actors and stakeholders in a value chain. Our results and conceptual framework highlight the importance to stakeholders of considering the strategic role of a voluntary standard to better understand the dynamics of vertical relationships and the competitive structure of an industry.

Moreover, we find that vertically integrated transactions are essentially neutral to the introduction of the voluntary standard, while a higher probability of spot market use is associated with a lower incidence of hybrid forms. This suggests that meso-institutions, if properly designed, could reduce the need for complex contractual arrangements represented by hybrid-type relationships. For example, in the agri-food context, Oliveira (2019, p. 70) discusses how his results “present a private meso-institution as a valuable mechanism of inclusive growth, and also show how small firms can obtain higher performance when they possess clear information and achieve a more transparent and fair environment.” For a producer association or cooperative, firm performance becomes a central consideration in assessing the role that meso-institutions can play. The answer is likely context- and transaction-specific, and more theoretical and empirical support is needed in this direction.

On a different note, the findings we present in this work confirm that transaction uncertainties and related risks affect firms' choices regarding the voluntary standard (RQ2). Specifically, transaction-internal risks seem to be positively associated with participation in the standard, as the TCE theoretical framework would suggest. More care is needed in interpreting the transaction-external risks, as their positive association with standard participation is less clear. From the perspective of stakeholders or firms promoting a voluntary standard, considering these results becomes important for successful participation. This is relevant in the context of designing voluntary standards. These results support the findings of Rouvière and Royer (2017), who, looking at standards as meso-institutions in the form of public-private partnerships, recommend that standards should be very adaptive and tailored to operators to maintain their attractiveness. Our findings also contribute to the existing literature (Fischer et al., 2009) in explaining the situations in which the mechanisms of voluntary standards can be considered effective instruments for the attainment of more sustainable vertical relationships, especially in terms of improved cooperative behavior and transaction transparency. There is a possible trade-off here: the design of a standard responding to internal risks would require mechanisms that promote greater coordination and control, while high external risks call for higher flexibility. Therefore, the challenge for the design and implantation of the standard is to find a balance between the two forces that would maximize its participation.

## CONCLUSIONS

Meso-institutions offer a promising theoretical approach for assessing the ways in which firms govern their activities and transactions while embedded in the macro-institutional environment. They also offer theoretical support when evaluating a wide variety of voluntary standards that have been introduced within value chains in recent decades. Such tools can be considered meso-institutions, due to their features and their role in translating general normative rules into specific mechanisms that delineate the domain of activities of supply chain agents (Ménard, 2014; Rouvière & Royer, 2017). At the same time, they are a relatively new concept, and much more empirical support is needed for more complete theoretical development.

The present paper focuses on the relationship between a meso-institution and the ways in which firms govern their transactions. It is among the first attempts to conceptualize the consequences of the voluntary participation in a meso-institution at the micro-level (i.e., from a firm's perspective) and examine the determinants of standard participation. By using an available secondary data database released by the JRC of the European Commission, which captures a representative sample of firms that are part of the European soybean supply chain, the paper

investigates the association between a non-GMO voluntary standard and the forms of governance in the supply chain, including the role that internal and external risks to firms play in the voluntary participation in the standard.

The present analysis is also among the first attempts to provide a quantitative analysis of the implications of a meso-institution such as a voluntary standard at the supply chain level. Our empirical findings reveal a significant association between standard participation and vertical coordination: firms with the voluntary standard have a lower incidence of hybrid forms, tending to favor the spot market, while vertical integration is not affected. This association with transaction governance forms leads to a set of interpretations and future investigations. The theoretical distinction between “individual” and “collective” standards appears to be an important element that could help us to better interpret the governance dynamics within a supply chain. The results also suggest that internal and external transaction-related risks significantly affect the probability of a voluntary participation in the standard. There is a clear positive association between participation in the voluntary standard and the risks associated with a firm’s behavioral uncertainty, and a less clear association between participation and unpredictable environmental change-related risks.

The present study has several limitations. The first limitation is related to the external validity of the presented results, as empirical results are focused on a particular meso-institution and supply chain. This can be seen as a first empirical test and a case study for the proposed framework. In future studies and surveys, extending the sample to encompass other supply chains and voluntary standards would yield benefits in terms of the generalisability of the results. A second limitation is that the data used to empirically validate our conceptual framework are drawn from a survey that investigates the perceptions of respondents. Although respondents are in key managerial positions in their companies, their answers may not reflect the perceptions of all decision-makers in the managerial team. Finally, the choice regarding participation in a voluntary standard and its effectiveness in reducing transaction risks should be verified using performance indicators. Future studies could attempt to verify the results presented here through an ad hoc survey that addresses a set of different voluntary standards in different supply chains. This type of survey would also allow us to better tailor the measures used in the empirical analysis to the proposed conceptual framework.

#### CONFLICT OF INTEREST

We have no conflict of interest to declare.

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