DETERMINANTS OF HYBRID FORMS OF GOVERNANCE IN THE BRAZILIAN BEEF CATTLE MARKET

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Abstract

A Transaction Cost Economics (TCE) framework was used to test hypotheses on the alignment of transaction attributes and governance structures using data from a sample of 84 beef cattle farms. A bivariate logit model was employed. It was found that the adoption of traceability certification and highly capital-intensive production systems, used here as proxies for asset specificity, plays a positive role in the choice of hybrid forms of governance.

Key words: beef cattle, contracts, transaction cost economics.

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1. Introduction

Cases of severe food contamination and the mad cow crisis of the 1990s have driven interventionist policies and many private regulations aimed at ensuring food quality and safety (KRIEGER and SCHIEFER, 2007; FULPONI, 2006; TRIENEKENS and ZUURBIER, 2008). These aims have become key to maintaining and gaining access to new foreign markets. The institutional environment has changed with the introduction of new technical regulations and other food safety mechanisms (LIRIO, 2007).

These changes in the institutional environment have led to an increase in investment in specific assets associated with the need for better coordination, alignment of strategies and redesign of contractual arrangements between agents of the production chain. As a result, different strategies and contractual arrangements designed for different markets now coexist (MONDELLI and ZYLBERSZTAJN, 2008). The spot market is no longer the only form of governance for transactions between cattle farmers and meat processing plants in Brazil. Forward contracts and relational contracts—which are classified as hybrid forms of governance, according to the concept by Williamson (1985)—are now used in transactions between meat processing plants and cattle farmers in Brazil.

In this context, it has become important to determine whether these hybrid forms of coordination for transactions are aligned with the attributes of the transactions, as suggested by Williamson (1985; 1991). The objective of this article is to identify whether these attributes—known as asset specificity, transaction frequency and uncertainty—determine the adoption of hybrids forms in purchase and sales transactions for finished cattle between cattle farmers and meat processing plants in the Brazilian state of São Paulo. For the investigation, data were collected from a sample of 84 producers located in the state of São Paulo, which were analyzed using a dichotomous choice model, known as the logit model. We then present the theoretical framework that supports the analysis, identifying the forms of governance in the finished cattle market in Brazil, the hypotheses regarding the determinants for adopting hybrid forms, the methodology used and the results obtained.

2. Theoretical framework

Transaction Cost Economics (TCE) was used to support the analysis presented in this article. In contrast to neoclassical microeconomic theory, TCE assumes that markets do not work exclusively through the price mechanism. There are costs involved in using the price mechanism that justify the existence of other modes of organizing economic transactions (COASE, 1937). The choice of the coordination mechanism depends on the cost of discovering current market prices (collection of information), cost of negotiating and drafting of contracts, and the cost of ensuring compliance with the terms of the contract. These costs are called transaction costs.

Agents should adopt governance structures that enable them to reduce transaction costs (NORTH, 1994). There are changes to the institutional, technological or economic environment for which the pricing system can convey all the relevant information and are sufficient to induce the adaptation of the agents. Other changes require coordinated responses between the agents and involve more complex contractual arrangements (WILLIAMSON, 1991). Williamson (1985) identified three basic forms of coordinating transactions, also called governance structures:

i. Spot market – adapted form of nonspecific transaction, where there is no effort made to repeat the relationship. In this format, the evaluation of the relationship by the parties is based on experience. It is the type that best approximates the neoclassical theoretical framework of pure competition;

ii. Hybrid forms – given the specificity of the assets and the recurring nature of the transactions, relationships of trust can be built. In this case, incentives sufficient to bring the transaction between the agents into the firm (vertical integration) were not found. Formal and informal contracts can be established, since the agents are inclined to establish and comply with their clauses;

iii. Vertical integration or hierarchy – coordination necessary for regular transactions and in the presence of highly specific assets. In this case, the transactions between agents are brought into the hierarchy of the firm.

The emphasis placed by Williamson (1985) on the analysis of arrangements uncovered hybrid structures, which lie somewhere between the market and the hierarchy. Ménard (2004) stressed the need to develop a theory that explains these structures, in which the agents are completely independent of each other, but work together in some type of business. In arrangements of this type, the agents share technological knowledge, capital, products or services, without, however, becoming a part of activities within a single firm. The influence of price mechanisms is lower than in the spot market. Regardless of its format, the coordination of activities is based on cooperation between the parties and in the sharing of important decisions, such as investment decisions. This union creates a culture that encourages the joint pursuit of better performance and greater profitability for the whole. However, a poor distribution of tasks and gains can easily generate conflict, which can destabilize the arrangement.

TCE evaluates organizational efficiency based on alignment between transaction attributes and form of governance, under the assumptions that the agents have limited reasoning ability and are opportunists. The fundamental attributes of the transactions are: a) the specificity of the assets involved; b) uncertainty to which the transactions are subject; and c) the frequency with which the transactions are conducted.

Specific assets have special (not general) purposes that cannot be used in another way without a considerable loss of value (WILLIAMSON, 1991). Therefore the specificity of the assets is the most important determinant in adopting more cooperative forms of governance (MELLO and PAULILLO, 2008), which are associated with bilateral dependence (ZYLBERSZTAJN, 1995). The greater the specificity of the assets involved in the production of a good, the stronger the incentives to adopt a hybrid form of governance or even vertical integration. The specificity of an asset can be classified into six types: (1) site specificity, when the use of an asset in a certain transaction generates savings in shipping and storage costs; (2) physical specificity, when the assets are designed for a specific purpose (ex: specific inputs for the production of a certain product); (3) human specificity, which is based on the idea of "learning by doing"; (4) dedicated assets, when specific investments are made for a particular purpose, for a certain client; (5) brand name capital; and (6) temporal specificity (WILLIAMSON, 1989).

In agriculture, the specificities most important to the assets are site, physical and temporal. This last one, in general, is the result of perishability and climactic conditions that influence the quantity and quality of agricultural products (RAYNAUD et al., 2009). Another type of specificity comprises investments in knowledge, processes and equipment with a view to reducing variability in product quality.

Uncertainty introduces disturbances that affect the exchange process. Uncertainty can be both primary—when it is the result of random behavior and unpredictable changes—and secondary—when derived from the fact decision makers are unaware of the intentions of the other party (WILLIAMSON, 1985). The degree of inherent uncertainty in a transaction is another important determinant of the type of governance adopted. In fact, transactions that occur in a predictable environment are less complex than transactions carried out in a more uncertain environment and, therefore, more susceptible to unexpected changes. The greater the chances of unpredictable changes, the greater the need for the introduction of adaptation clauses in a contract, the greater possibility of there being gaps and the greater the potential for opportunistic actions, which would thus raise transaction costs. A highly uncertain environment can therefore lead a transaction toward the adoption of a hierarchical form of governance.

The frequency with which the relationship between the parties is established is another dimension of the transaction. This attribute is important because the more often a transaction is repeated, the greater the possibility of diluting the costs of adopting a complex governance mechanism. In this case, a reputation based upon reciprocity between the parties can be built.

Based on an alignment between the attributes of the transaction (specificity of the assets, uncertainty and frequency) and the governance structure adopted, an evaluation of the organizational efficiency becomes possible. A poorly chosen governance structure or one poorly adapted to the transaction leads to coordination difficulties.

3. Governance structures in finished cattle transactions in Brazil

The finished cattle market in Brazil has been traditionally characterized by a predominance of spot market transactions. The Brazilian cattle farmer is a price taker in the

market and, generally, trades the animals on the spot market, where there is no commitment to a continued relationship (PIGATTO, 2001; VINHOLIS, 2001). Also in 2004, Pitelli verified that most acquisitions of finished cattle for slaughter occurred through the spot market. However, verticalization of production has grown due to the establishment of farms belonging to large meat processing companies. By internalizing part of the production process, the meat processing company reduces information problems and the costs of measuring characteristics of the experiential goods, in addition to considerably increasing control over the quality of the raw material, thus reducing transaction costs.

More recently, new cattle commercialization methods have emerged as a way of serving market niches. As Brazilian beef has gained market share abroad, coordination has become a strategic issue of major importance for this industry. Accordingly, the use of future contracts between cattle farmers and meat processing plants has also risen (VINHOLIS et al., 2010; CARRER et al., 2011). For the cattle farmer, a forward contract allows technical and financial scheduling of production and reduces the risk from the specificity of the asset and the uncertainty of price, ensuring the sale of the product at a known price and encouraging investments in improvements to production processes with possible gains in quality and productivity. For the meat processing plants, the forward contract ensures supply of raw material with pre-established standards of quality and enables better planning and control of supply and production with consequent gains in coordination and competitiveness. Table 1 summarizes the structures of governance found in the beef cattle supply chain in Brazil.

Table 1. Governance structures identified in finished cattle transactions in Brazil

Governance structure		Description
Spot	Spot market	Both meat processing company and cattle farmer are separate legal entities. There is no commitment to continue the relationship with a particular buyer. The negotiation of the price and the number of animals occurs sometime near the delivery date. There is no interdependence between the parties.
Hybrid forms of commercialization	Relational contract	Due to the trust established between the parties, an informal agreement can be negotiated between them. Both are separate legal entities. The scale of the delivery of the animals to the slaughterhouse units is established before the fattening phase on farms, with the number of animals and the delivery date pre-established. Price is determined by market quotation on the delivery date for the animals, and is established based on the ESALQ/BM&F index. Payment of a premium for quality and traceability can also be agreed upon. Reputation is responsible for mitigating opportunistic actions.
	Forward contract	This is a formal contract between the cattle farmer and the meat processing company, which maintain their status as separate legal entities. Pre-established in the contract are: future delivery date of the animals, number, weight, age, sex, in addition to the price per carcass weight in *arrobas* (1 *arroba* = 15 kg). The ESALQ/BM&F index is used for this last calculation, to which a premium can be added. This premium is determined depending on the demand and supply for quality and/or traceable animals. There are also contractual fines if one of the parties breaches the terms of the contract (CARRER et al., 2011).
Hierarchy	Vertical integration	Both meat processing plant and cattle farmer are part of the same legal entity. The transaction is internalized in the company. The meat processing plant has its own confinement farms for the production of animals that meet the specific characteristics required by certain market segments.

4. Hypotheses

The objective of this section is to present the hypotheses for determinants for the adoption of hybrid forms of governance in the finished cattle market. These hypotheses are presented in three subsections, and are associated with the influence exercised by the (1) specificities of assets, (2) frequency of transactions and (3) uncertainty, according to the theoretical framework presented.

4.1. Specificity of assets

The specificity of the assets used in the production of finished cattle in Brazil has increased due to the adoption of highly capital-intensive production systems, as well as the adoption of traceability systems. In the Central-West region of the country, more intensive production systems have spread due to deficient infrastructure that restricts access to cheaper land on the agricultural frontier, as well as growing restrictions imposed by environmental legislation on the use of these lands (CORREA et al., 2000). These barriers restrict the adoption of systems based on the use of large tracts of pasture and low density of animals per hectare of land. In the Southeast region, particularly in São Paulo, rising land prices and competition from other more profitable agricultural crops have contributed to the spread of more capital-intensive production systems (SOUZA FILHO et al., 2010). However, intensive production systems do allow for the raising of animals whose meat has the tenderness and flavor that are valued by some segments of the market, for example, barbecue restaurants and supermarkets located in high income areas and some export markets. Obtaining these characteristics in the final product depends on a set of factors, which include the animal's genetics, the production system and industrial processes. Cattle farmers who raise animals with these characteristics, in general, adopt fattening systems in confinement and produce a superior product.

The intensification of the use of inputs increases the risk and complexity of the production system. The cost structure is altered and requires greater disbursement of financial resources for the adoption of the technological package. This situation requires stricter production management, without which the profitability of the system would be compromised (CORREA et al., 2000). Precise control of inventory and production costs determines the success of the more intensive production systems, which require more highly skilled labor. In addition to investment in the training of employees, the highly intensive production system requires specific physical investments, for example, the construction of silos, pens or rotational grazing infrastructure to fatten the animals and electronic scales. Strict control over weight gain and time for slaughter of the animals is key to the success of the activity. Therefore, more capital-intensive livestock production systems are characterized by greater physical and temporal specificity of the assets, when compared with raising systems based on the extensive use of land.

Brazil's entry into the international market has brought challenges and a need to adapt for agents of the chain to meet demand. Of the economic blocs and countries with which Brazil has trade relations for unprocessed beef, the European Union[1] (EU) has the strictest import regulations for this product. The European Union has demanded traceability as a condition for market access. This demand has had an impact on the national regulatory environment for food safety. In 2002, The Brazilian System of Identification and Certification of Bovine and Bubaline Origin (SISBOV) was created. The SISBOV certification is a necessary, but not a sufficient condition to be allowed to export to the EU market. The farm must also acquire TRACES (Trade Control and Expert System) certification. TRACES is a veterinary health network created by the EU which notifies, certifies and monitors trade in animals and animal products. However, the level of adoption of this certification is still low among Brazilian farms. A small number of farms have adopted this certification, but technological heterogeneity persists in bovine livestock production in Brazil.

Certification of the rural property in SISBOV, and subsequent publication by the EU in the TRACES list, assumes the adoption of operational and management technology for food safety in livestock raising. Specific investments in operational training, documentation and auditing of the traceability system are incorporated. Investment in training is carried out, generally, through the "learning by doing" approach. In addition to this initial cost, the certification process has other costs, including inspections and audits of the system and a fee per animal to be entered on the system. The incorporation of traceability prompts the adoption of information technology, such as electronic ear tags, optical readers and software for managing and issuing inventory reports and forms. These investments therefore increase the specificity of the assets, considering the human, physical and dedicated specificities established by Williamson (1989).

On the other hand, the cattle farmer that invests in SISBOV certification and in the necessary assets to be listed on TRACES expects that he will receive a premium above the market price for these animals. However, this premium varies according to the supply and demand of animals traced according to these certifications. Therefore, there is uncertainty with regard to their worth. In addition to this uncertainty, and the economic risk associated

[1] According to data from Secex, in 2010, exports of beef to the EU and EU candidate countries represent 15% of the total value of beef exports and 11% of the volume. In relation to the previous year, there was an 8.8% decrease in the total volume exported to that bloc, and a 6.2% increase in the total value exported.

with it, there are also significant uncertainties regarding the institutional environment. These uncertainties arise from the frequent, oftentimes unexpected, changes in regulations that determine the "rules of the game" for the adoption of the traceability system and certification.

ECT assumes the agents involved in the transaction will behave in an opportunistic manner. The possibility of post-contractual opportunism associated with investments in specific assets leads the agents to anticipate and mitigate post-contractual problems, by drafting precautionary measures as a way of ensuring appropriate returns on the investments made. Zylbersztajn (2005) cites as an example of the possibility of earning quasi-rents when a cattle farmer, in order to meet the demand of a meat processing plant, makes investments in assets with a level of specificity above zero. A price P is determined or expected before investments are made. In the absence of safeguards, the cattle farmer will be exposed to the possibility of opportunistic behavior, that is, there is risk in receiving—*a posteriori*—a lower price than that agreed to or expected, that covers their fixed costs, but does not provide the desired return. If this occurs, the difference is settled by the meat processing plant. Formal and informal institutional arrangements, supported by a long-term relationship, are mechanisms designed to ensure the expected return. In the case of beef cattle, one of the ways of safeguarding and mitigating uncertainty about receiving premiums is through a forward contract with the meat processing plant. This mechanism has risen in importance in the industry and can include a clause regarding a premium for a traced and certified animal.

In view of the above, the adoption of SISBOV/TRACES certification, associated with the adoption of capital-intensive production systems, implies investments in specific assets and, therefore, in the need to adopt hybrid forms of commercialization. In this sense, the following hypothesis can be formulated:

H1: The adoption of SISBOV/TRACES certification, associated with the adoption of capital-intensive production systems, increases the specificity of the assets and, therefore, the probability of the adoption of hybrid forms of commercialization for finished cattle.

4.2. Frequency

The attribute frequency is not dealt with directly in the model by Williamson, but its effects are related to reputation. On one hand, recurring transactions enable the development of reputation and a relationship of greater trust between the agents (RODRIGUES and

MORAES, 2005). On the other hand, the more transactions there are, the greater the need for contractual safeguards to deal with unexpected events resulting from contractual incompleteness and opportunistic actions (WILLIAMSON, 1985). Therefore a positive relation between the frequency of the transaction and the adoption of closer contractual arrangements is expected.

In the Brazilian beef cattle market, transactions between cattle farmers and meat processing plants are recurrent. Informal relationships, based on trust between the cattle farmer and the purchaser, or the broker for the meat processing company, predominate (PITELLI, 2004). To meet the requirements of some segments of the beef cattle market, the meat processing plant selects certain cattle farmers. For this selection, information obtained from the history of the relationship with the supplying cattle farmers is used. In this way, the frequency of the transactions between the cattle farmers and the meat processing plant can be empirically measured by the number of years the trade relationship has been maintained.

H2: The higher the transaction frequency between the parties, the greater the probability that hybrid forms of commercialization for finished cattle will be adopted.

4.3. Uncertainty

Uncertainty is another transaction dimension in the model by Williamson (1985). The principal uncertainties in the production and commercialization of finished cattle are related to quality and price. The quality of the beef is an attribute made up of various factors, including the genetics of the cattle, age at slaughter and the production system. When the meat processing plant wants to reduce uncertainties related to the quality attributes of finished cattle, it can rely on information obtained from the history of the relationship with the cattle farmers. In this way, the meat processing plant will select those cattle farmers that, with greater frequency, deliver animals that have the desired characteristics, enabling them to establish relational contracts.

Another uncertainty in the transactions between the cattle farmer and meat processing plants comes from the variation in finished cattle prices, as well as the variation in prices for 9-month-old and 18-month-old calves for fattening. The relationship between these two prices establishes the cattle/calf exchange ratio, which is an important economic indicator for cattle

farmers that specialize in the fattening phase of cattle production.[2] For Arieira et al. (2007), the price of the calf for fattening represents an important part of the production costs in systems dedicated solely to the fattening of animals. Calves for fattening represent around 70% of the operational expenses of confinement. Cattle farmers that specialize only in the fattening phase use the spot market as a form of governance to meet their needs for calves. In this case, profitability depends largely on the exchange ratio, which varies according to the behavior of either the finished cattle market or the spot market for calves. With a very tight profit margin in these production systems, small variations in this relationship can significantly affect the indicators of economic viability. However, there are producers of finished cattle that internalize, totally or partially, their needs for calves for fattening. In this last case, verticalization allows them to offset the impact of the changes in spot market prices for calves. In fact, their costs are associated with their own management efficiency and the prices of necessary inputs for the creation and maintenance of pastures. Therefore, it is assumed that cattle farmers who are more dependent on the supply of third parties for their calf needs are more subject to abrupt changes in their profit margins than cattle farmers who adopt hierarchy as their form of governance to meet their needs for calves.

The present article will therefore use the percentage of animals (backgrounding cattle) acquired from third parties for the fattening phase as a proxy for the measurement of uncertainty. It is assumed that uncertainty increases as the percentage of backgrounding cattle acquired from third parties rises.

H3: The higher the uncertainty, the higher the probability that a hybrid form of commercialization of finished cattle will be adopted.

5. Method

A survey questionnaire was applied to a sample of farmers in order to collect information on governance structure, adoption of certifications, production system, size of the

[2] In Brazil, the cattle production cycle is traditionally composed of three production phases: pre-weaning, post-weaning and finishing. These phases can be carried out separately on different farms or on the same farm. The pre-weaning phase requires the largest amount of land per animal. Therefore this phase is normally carried out in regions where the land cost is lower. The finishing phase, on the other hand, can be more capital intensive and requires less area per animal, therefore, it is economically viable in regions where the cost of land is higher.

farm, relationship with the meat processing plant, income and calf purchase. The sample contains cross sectional data on 84 farmers from the state of São Paulo, Brazil.

Also, the analysis of the survey data was performed with the estimation of a discrete choice logit model. This model has also been used by other empirical analyses on the alignment between transaction attributes and governance structures (MELLO and PAULILLO, 2009; MONDELLI and ZYLBERSZTAJN, 2008). The variable to be "explained" is the dichotomous choice: 1 – adoption of hybrid forms (relational contracts and forward contracts, as stated in Table 1); 0 – adoption of spot market.

In making the decision on whether or not to adopt the hybrid forms, it may be assumed that the farmer weighs the marginal advantages and disadvantages of the arrangement. As the parameters of this decision are not readily observable, for each farmer i we can define a latent variable, y*, as

$$y_i^* = \beta' X_i + u_i \quad i = 1,\ldots, N \tag{1}$$

where X denotes a set of explanatory variables. The observed pattern of demand can be described by a dummy variable, y, such that y_i=1 if farmer i adopts hybrid form, y_i=0 if he/she works in the spot market. These observed values of y are related to y* as follows:

$$y_i = 1 \text{ if } y_i^* > 0 \tag{2}$$
$$y_i = 0 \text{ otherwise}$$

and

$$Pr(y_i = 1) = Pr(y_i^* > 0) = Pr(u_i > -\beta' X_i) = 1 - F(-\beta' X_i) = F(\beta' X_i) \tag{3}$$

where F is the cumulative distribution function for u and a symmetric distribution is assumed. Using maximum likelihood procedures, estimates of the β parameters can be obtained. For the logit model, a logistic cumulative distribution function is assumed,

$$\Pr(y_i = 1) = \frac{e^{\beta X}}{1 + e^{\beta X}}$$

$$= \Lambda(\beta\ X) \qquad (4)$$

where Λ denotes the logistic cumulative distribution function.

6. Results

The definitions of the variables used in the model to test hypotheses on the adoption of hybrid forms are presented in Table 2. The dependent variable is equal to 1 if a farmer adopts either relational or forward contracts, which are assumed to be hybrid forms of governance; and it is equal to zero if the spot market is adopted. All individuals of the sample fall into these two categories. In the spot market, farmers negotiate their cattle a number of days, generally a week, before delivery. The price is determined in this negotiation. The identity of the parties is not relevant and the relationships are sporadic, without any commitment to repeating the transaction in the future. Among the hybrid forms, we found the use the relational contract, where trust between the parties is based upon a long-term relationship. The forward contract is used in transactions that occur over a pre-established period of time, in which the relationships are characterized by regular transaction volumes, consistency in the quality of the product and by prices based on future quotes on stock exchanges or spot quotes upon delivery of the animals.

Out of a total of 84 cattle farmers in the sample, 60 of them operated exclusively in the spot market. The other 24 cattle farmers operated using hybrid forms of commercialization. Of these, 10 cattle farmers worked exclusively with forward contracts and the other 9 negotiated over half of the volume of their herds through forward contracts and the rest on the spot market. Another three cattle farmers traded exclusively through relational contract. Another two traded using both relational contracts and the spot market.

Table 2. Definition of variables

Variable	Proxy	Description
Dependent		Hybrid forms (relational and forward contracts) = 1, = 0 Spot market
Asset specificity	TRACES and feedlot	Adoption of SISBOV/TRACES certification and feedlot as the production system = 1, = 0 otherwise
Frequency	Meat processing plant relationship	Years of relationship with the meat processing plant
Uncertainty	Purchase by third party	Percentage of purchase of third-party calves for the feedlot
Size	Farm size	Total number of hectares

Table 3 shows the results of the logit model. [3] The likelihood ratio (LR) was used to test the hypothesis that all the slope coefficients in the logit model are zero. The restricted log likelihood value is -50.2546. The unrestricted log likelihood value is -32.8578. The LR test statistics are therefore 34.79. With four degrees of freedom, the critical value at the 5% significance level is 14.86, and so the joint hypothesis that the coefficients on the full set of variables are all zero is rejected.

Table 3. Logit model.

Number of obs = 84		Log-likelihood = -32,8578		
$Chi^2(4) = 34,7948$		NagelKerke $R^2 = 0,4860$		
Variables	**Estimate**	**Std. Error.**	**Wald Stat.**	**p**
Intercept	-0,9059	0,7409	1,4950	0,2214
Asset specificity*				
TRACES and feedlot*	1,4970	0,4417	11,4889	0,0007
Frequency				
Slaughterhouse relationship	0,0159	0,0455	0,1220	0,7269
Uncertainty				
Purchase of third-party	0,3394	0,7683	0,1952	0,6586
Size**	0,0001	0,0001	6,4389	0,0112
Correct prediction: 79,59%				

* Significant at 1% level

** Significant at 5% level

The results of the estimated parameters of the model for asset specificity, frequency and uncertainty are in agreement with the theory. These parameters had the expected sign.

[3] Estimations were made using Statistica 11.0.

However, only asset specificity, measured by the adoption of SISBOV/TRACES certification and feedlot as the production system to fatten cattle, was statistically significant at the 1% level. Thus, hypothesis 1 is accepted. The variable for asset specificity has the greatest impact on the probability that farmers will adopt hybrid governance. The odds of adopting the hybrid structure significantly increases when farmers raise cattle using a feedlot system and adopt the SISBOV/TRACES certification. In fact, a highly capital-intensive production system requires specific investments, such as facilities and human resources. The time for selling cattle is restricted; otherwise profit could fall. The SISBOV/TRACES certification also requires specific investments in training and information technology equipment, besides the investment made in learning the certification process and the start-up cost. This result corroborates the proposal forwarded by Williamson (1989) in which the high specificity of the assets leads to the adoption of closer forms of coordination.

The percentage of animals acquired from third parties for the fattening phase was used as a proxy for uncertainty. Based on the assumption that cattle farmers that are more dependent on the supply of third parties for their backgrounding cattle for fattening needs are subject to strong fluctuations in the economic viability of their business due to changes in the finished cattle/calf exchange ratio. This type of economic risk is not faced by cattle farmers that internalize part, or all, of backgrounding cattle production. The parameter estimated for this variable was not statistically significant in the logit model. As a result, it was not possible to accept the hypothesis of the alignment of this transaction attribute with the form of governance, considering this variable as a proxy. However, hypothesis 3 cannot be fully rejected. In fact, other considerations regarding uncertainty must be made, for example, the impact of institutional environments of high or low uncertainty with regard to price. It was not possible to carry out this type of evaluation based on the current sample of cattle farmers, since all of the individuals are subject to the same institutional environment. Here, the possible conclusion is that this source of uncertainty is not sufficient to promote hybrid governance in the transactions between meat processing plants and cattle farmers.

The frequency with which the relationship between the parties is established is another transaction attribute. The parameter estimated for this variable was not statistically significant, despite signs indicating the expected effect on the mechanisms of governance adopted. Therefore, hypothesis 2 was also not proven.

Farm area was used as a proxy for size and is statistically significant at a level of 5%. The odds ratio of size shows that adoption of hybrid governance significantly increases when the total area of farms is higher. In fact, for the meat processing plants, establishing contracts with larger cattle farmers improves planning for the slaughter/processing capacity, enabling the purchase of more standardized animals and reducing transaction costs.

7. Final considerations

In general, the production of finished cattle and intensive systems, associated with the need for traceability certification for the European market, involves investments in specific assets and, consequently, the need for hybrid forms of coordination that ensure the earning of quasi-rents due to the specificity of the assets. On the contrary, in the transactions that involve the sale of untraced cattle there are fewer requirements and production can be carried out in less intensive systems that do not adopt traceability. In this case, the specificity of the assets is lower, making contracts or closer relations between the parties unnecessary, since the cattle farmer has more options for buyers in the market, without running the risk of a loss in value.

From the perspective of the meat processing companies, the need to ensure a certain level of regularity and volume of animals to serve their foreign market makes contractual governance a relatively strategic option. However, to meet less demanding markets, the purchase of animals on the spot market is perfectly adequate, considering the risks that the meat market offers at the end of the chain.

Therefore, it was found that the forms of governance employed to coordinate transactions between cattle farmers and meat processing plants are aligned with the principal attribute of governance proposed by Williamson (1985), the specificity of the asset.

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