## "Direct-Contracting and Brokers in the Producer-Processor Transaction: The Uruguayan Beef Industry Case"\*

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#### ABSTRACT

What are the determinants of contractual arrangements in producer-processor transactions in the Uruguayan beef industry? Coordination has become a strategic issue for this industry, which exports 75% of its production, not only to assure quality attributes of products but also to explore new market access opportunities. Two contractual arrangements coexist: direct-contracting (48%) and broker-induced transactions (52%). In addition, all processors and 46% of producers use both types of arrangements. Theory: Transaction Cost Economics offers helpful insights to understand reasons for the development and adaptation of different contractual arrangements. Method: we use a logit model with panel data to test the relationship between direct-contracting mechanism and asset specificity, site specificity and frequency. The panel contains population information of producer-processor transactions (77,458 transactions, 10,130 producers and 47 processors). Results: The probability of a transaction being aligned with the directcontracting arrangement increases in transactions with a greater degree of asset specificity (e.g., young steer), lower distance between producer and processor and higher frequency of transactions between the two parties involved. The direct-contracting arrangement is aligned with higher quality products. These results have implications for organizations in the beef industry and policy makers in terms of a "national strategy" focused on higher quality beef products.

Key Words: Contractual arrangement, Transaction Cost Economics, Vertical Coordination, Beef Industry. JEL: D23, L14, Q13

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#### **1. INTRODUCTION**

What are the determinants of contractual arrangements in producer-processor transactions in the Uruguayan beef industry? This question refers to the vertical coordination and production control problem. Food industries have experienced changes in the past 15 years toward a tighter vertical coordination mechanism and toward the promotion of cooperation for the development of new products, assuring quality standards and gains in logistic efficiency (Martinez 1996, Lawrence and Hayenga 2002, Schroeder 2000). Consumers demand better information about specific attributes in food products and are concerned about the social and environmental impacts of the production and processing stages.

Coordination has become a strategic issue for the Uruguayan beef industry, which exports 75% of its the production mainly to the U.S. and European markets (INAC<sup>1</sup> 2007). In 1996 Uruguay obtained access to the most value beef markets due to its sanitary status free foot-and-mouth disease, as declared by the World Organization for Animal Health in 1995<sup>2</sup>. Since then, Uruguay has faced better market opportunities but also had to abide by new regulations and food safety standards. The Uruguayan beef industry shifted from a long term stagnation period to a new stage characterized by a compound annual growth rate of 3.2% in production and 7.8% in exports tons (period 1996-2006, MGAP<sup>3</sup> and INAC). Uruguayan beef exports represent 6.5% (2006) of total word beef exports, a significant improvement compared with the 3.4% registered in 1996 (USDA).

Before 1996, strategies in the Uruguayan beef industry were characterized by low quality standards requirements and the producer-processor transaction was coordinated mainly by low coordination mechanisms that were based on information of live weight cattle and commodity price. By the end of 1990s new coordination forms emerged, such as agreements between producers and processors for higher quality beef attributes.

Two contractual arrangements coexist in the producer-processor transaction: directcontracting (48%) and broker-induced transactions (52%). In addition, all processors and 46% of producers use both types of contractual arrangements (DICOSE-MGAP<sup>4</sup> 2004-2005). This study focuses on the analysis of hybrid coordination forms between spotmarket and long term contracts.

The beef producer-processor transaction takes place in a context of institutional changes. Those changes lead to changes in the transaction cost in the different activities of the Uruguayan beef system, as well as new market opportunities. These two factors induce changes in the organization's strategies in direction to adaptation to the new environment and/or capture business opportunities. Among the new strategies we find new contractual arrangements that facilitate the cooperation between producers and processors. This process is represented in the conceptual scheme presented in figure 1. A more efficiently coordinated industry is important not only to assure the quality attributes of products, but also to enable the exploration of market access opportunities and the fast adaptation to international and domestic environmental changes.

This article is organized in 5 sections, including this introduction. Section 2 presents a transaction cost analysis of the producer-processor transaction. We derived hypotheses of the determinants of the contractual arrangement alignment. Section 3 summarizes the new strategies in the Uruguayan beef industry. Section 4 present an empirical test of the determinants discussed in Section 2. The final section concludes.

<sup>&</sup>lt;sup>1</sup> INAC: National Meat Institute of Uruguay (www.inac.gub.uy).

<sup>&</sup>lt;sup>2</sup> This sanitary status was lost in December 2000 but regained in May 2003. With regard to the bovine spongiform encephalopathy (BSE, mad cow disease) Uruguay is classified in the lowest risk group.

<sup>&</sup>lt;sup>3</sup> MGAP: Uruguayan Ministry of Agriculture, Livestock and Fisheries (www.magap.gub.uy).

<sup>&</sup>lt;sup>4</sup> DICOSE: Division of Livestock Control, Uruguayan Ministry Agriculture

<sup>(</sup>www.mgap.gub.uy/dgsg/DICOSE/dicose.htm).

#### **Figure 1 - Conceptual Schema for Changes in Contractual Arrangements**



Based on Williamson (1991b) and Muris, Scheffman, and Spiller (1992)

# 2. TRANSACTION COST ANALYSIS OF THE PRODUCER-PROCESSOR TRANSACTION

#### 2.1. The Uruguayan Beef Industry

The beef industry has been, and continues to be, among the most important economic sectors in Uruguay. Exports of beef started by the end of the nineteenth century as of 2006 represented 24% of the total country's exports ( $BCU^5$ ).

The year 1996 was an inflection point in the Uruguayan beef industry's development. The long term stagnated industry with cycles in beef producer prices aligned with speculative strategies of retain and liquidation stock was not longer observed. A new stage characterized by significant and sustained increases in production and exports began. Two contributing factors must be highlighted: (i) better market access due to sanitary improvements, and (ii) changes in the organization's strategies towards technological investments in production and processing activities. The beef industry became more export oriented.

Slaughter plants were modernized not only in the slaughter-deboned-cuttingpacking activities but also in the organization and training of employees. Improvements in safety standards where also made, in accordance with new protocols and regulation from the US and EU markets. In the production activities, improvements in the productivity indexes, such as production per hectare, percentage of improved pastures, and age of slaughter average, were observed. Additionally, the quality mix of the slaughter animals improved, e.g. the percentage of old steers (those more than four years old) was reduced from 80% in 1990 to 40% in 2005 (INAC).

The Uruguayan beef exports are very sensitive to shocks in the international and domestic environment. Figure 2 reports the evolution of the beef exports (frozen and fresh meat) from 1975 to 2005, the mean price per exported beef ton, and the main shocks observed in that period. We highlight the following characteristics of the Uruguayan beef industry. First, Figure 2 shows the high influence of sanitary issues. A positive shock occurred in 1996 when Uruguay got access to foot-and-mouth disease (FMD)-free markets, followed by a negative shock in 2001 due to suspension from FMD-free markets.<sup>6</sup> Since 2003, however, Uruguay had a comparative market access advantage to the United States (vs. the regional competitors Brazil and Argentina). Second, this industry is especially affected by the international shock, e.g. Brazilian big devaluation in 1999 (destination for

<sup>&</sup>lt;sup>5</sup> Central Bank of Uruguay (www.bcu.gub.uy)

<sup>&</sup>lt;sup>6</sup> Considering the importance of the sanitary factors, Uruguay managed to neutralize the effects of the FMD events in 2001 in a relative short period of time. By mid-2003 Uruguay re-gain access to EU, Canada and USA markets.

50% of the exports until then), sanitarian shocks in neighbors countries or destination markets respectively. Third, Figure 2 shows the conjoint evolution of frozen and chilled beef associated with low and high quality and value markets. Since 2003, total export volumes increase has been explained mainly by frozen beef for the US commodity market.



Figure 2 - Evolution of Uruguayan beef exports and shocks

The expansion in production and exports of the Uruguayan beef industry focused on the commodity -low quality- beef market. The next step for this industry will likely be to explore the market access opportunities for higher quality products. This is an important challenge for this beef industry and the analysis of the producer-processor transaction addressed in this paper aims to facilitate the meeting of this challenge. Higher quality products demand specific coordination mechanisms and, probably, more stable ones.

Among processors<sup>7</sup>, the traditional segmentation of a domestic versus export oriented group is no longer observed. The 10 biggest processors that account for 75% of the slaughter are similar in terms of technological standards, scale and market destinations (domestic vs. international)<sup>8</sup>. There are 50 processors taking part in slaughter and/or processing activities. Nineteen have habilitation for the most exigent (in term of sanitary standards) and value markets like USA and EU countries (Ordeix and Ferreira 2001).

Uruguay has 57,000 farms, 27,000 of which are classified as marketable livestock operations (over 20 ha.). Of the 27,000 ranches, 65% specialize in breeding (cow-calf operations), 21% are calf to beef type operations, and 14% specialize in finishing (DIEA, MGAP 2003). The biggest 5% of producers account for 30% of the production area and 38% of the beef production (DICOSE 2005).

Beef cattle are primarily grass-fed in pastures (open spaces). Grain breeding is used by some ranchers as a supplement to the pasture diet or for finishing purposes. North American-style grain feedlots are not common because of the relatively high cost of grain-

<sup>&</sup>lt;sup>7</sup> In Uruguay, the activities of slaughter, processing and packing are mainly integrated in the same location and firm.

<sup>&</sup>lt;sup>8</sup> Based on processed data from DICOSE and INAC for 2005.

based feed. Feeding or implanting artificial growth hormones and feeding antibiotics are not allowed in Uruguay (growth hormones were banned in 1978). Feeding meat and bone meal to beef-cattle and other ruminants was banned in 1996. This makes Uruguayan beef production aligned with the standards of "natural meat" used by USDA and also with the European EUREPGAP protocol for organic beef, which is a beef products characteristic with increasing global demand.

Among producers, increasing technological heterogeneity occurred in the 1990s. The increase in production was promoted by investments in pastures by some producers. Three groups of producers can be identified based on differences in technological standards, capabilities and attitudes towards adoption of technology as is shown by a cluster analysis in Mondelli and Picasso (2001). The increases in beef production was also promoted by increases in prairie lands available for beef production, due to an important reduction of sheep stock associated with the reduction of wool prices in the 1990s.

Table 1 summarizes the main destinations for Uruguayan beef exports and the average prices obtained by destination country in 2005. We identify two groups of countries, one associated with higher quality beef composed by EU countries and niches of Brazilian and Chilean markets. The second group is associated with a commodity beef group (lower degree of product specifications) composed by USA and Canada.

Destination	fresh beef	frozen beef	Total	US\$/ton *
USA	35%	75%	60%	1,446
European Union	45%	8%	19%	2,657
Canada	4%	6%	5%	1,713
Brazil	8%	1%	4%	1,820
Israel		4%	3%	1,707
Chile	6%	0%	2%	1,756
Total (%)	100	100	100	
Total (millions US\$)	182.6	568.4	813.3	1,599

 Table 1 - Uruguayan beef exports by destination (2005, in millions of US\$)

\* US\$/metric tons. Carcass Equivalent. This measure enables comparison of cuts with different specification of fatness, boneless, etc.

Source: URUNET and INAC

## 2.2. Contractual arrangements

We identify two broad types of contractual arrangements that coexist in the producer-processor transaction: direct-contracting (48%) and broker-induced transactions (52%). It is important to highlight that 46% of the producers use both types of contractual arrangements (see Table 2). Vertical integration is rarely observed, accounts for less than 5% of the total beef production<sup>9</sup> and has not been identified in previous studies as price distortion strategy by the processors in previous researches in the Uruguayan beef industry. Hence, we focused the analysis on the differences between direct-contracting and broker-induced mechanisms.

We define direct-contracting arrangement as transactions where the commercialization activities (searching, negotiation, monitoring and ex-post efforts) are undertaken by the producer and processor with no intermediary or broker services. Within the direct-contracting arrangement we find different types of arrangement as informal agreement base on reputation, formal agreements between groups of producers and processors.

Broker-induced arrangements are those transactions where the commercialization activities are executed by an intermediary that "performs an important 'middleman'

<sup>&</sup>lt;sup>9</sup> Based on DICOSE data based 2004/2005.

function by linking individuals and organizations that otherwise would not have been connected" (Peng and York 2001, p.328). There are two types of intermediaries that differ on the mechanism of compensation and whether they take title of the goods involved in the transactions.

Uruguayan beef intermediaries do not take title, rather, they are compensated by a commission of both parties (producer and processor) while remaining independent of both parties, meaning that they do not sell or buy beef-cattle of behalf on one party. We refer to these beef intermediaries as 'brokers'.

We argue that direct-contracting and broker-induced transactions are two particular contractual arrangements. Compared to the broker-induced arrangement, direct-contracting is approached as a tighter vertically coordinated mechanism where the commercialization activities are vertically integrated and held within the producer and processor organizations. In contrast, the broker-induced arrangement is approached as a lower vertical coordination mechanism where the commercialization activities are outsourced. This treatment of the two types of coordination mechanism (outsourced vs. vertically integrated commercialization activities) is aligned with other empirical papers, such as, Anderson and Schmittlein (1984), Anderson and Coughlan (1987), Peng and York (2001), Baritaux *et al.* (2005).

Types of contractual arrangements			Number of contractual arrangements used by producers					
Contractual	Transactions	Heads of	Use of	Producers	Transactions			
Arrangement	(n)	Cattle (n)	Arrangements <sup>/1</sup>	(n)	$(n)^{/2}$			
Direct-contracting	48%	50%	Both	46%	62%			
Broker-induced	52%	50%	One	54%	38%			
TOTAL	77,458	2,034,223	TOTAL	10,130	77,458			

Table 2 – Contractual arrangements	able 2 – Contractual arrangements*	
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\* Beef producer-processor transaction (Uruguay 2004/2005)

<sup>11</sup> Both: producers that used both types of contractual arrangements, One: producers that used the same arrangement in all the transactions held in 2004/2005 (direct-contracting or broker-induced).

 $^{/2}$  62% of the Uruguayan beef transactions in 2004/2005 were held by producers that use both types of contractual arrangements.

#### **2.3. Dimension of the Producer-Processor Transaction**

Producers and processors use different commercial channels for their transactions. What factors explain their contractual arrangement choices? In other words, what are the key attributes of the transaction determines the contract actual arrangement? We follow the contractual arrangement discriminating alignment hypothesis proposed by Williamson (1985, 1991) based on the existence of different transaction dimensions, namely; frequency, uncertainty and asset specificity. "[...] transactions, which differ in their attributes, are aligned with governance structures, which differ in their cost and competencies, in a discriminating (mainly, transaction-cost-economizing) way" (Williamson 1991, p.277).

Of these three key dimensions for analyzing transactions, "[...] asset specificity is the most important and most distinctive. Investments in durable, specialized assets that cannot be redeployed from existing uses except at a significant loss of productive value are transaction specific. Contracting for goods and services that are produced with the support of transaction specific assets poses serious problems" (Williamson, 1996, p.45). "[...] a condition of bilateral dependency builds up as asset specificity deepens. The ideal transaction in law and economics – whereby the identities of buyers and sellers is irrelevant – obtains when asset specificity is zero" (Williamson 1991, p.282).

Identity matters as investments in transaction-specific assets increase. The higher the level of asset specificity, the larger the quasi-rents generated, the more likely to observe tighter coordination mechanism as a form to protect non redeployable investments (i.e.: hybrid forms to vertical integration).

Figure 3 summarizes the discriminating alignment hypothesis of the transaction cost economics approach where the transaction is the observable unit of analysis and individuals follow a decision rule marked by the efficient alignment between the transaction characteristics and governance choice, given the institutional environment and the behavioral assumptions of bounded rationality and opportunism.

Institutional Environment Characteristics of the Transaction Behavioral Transaction Costs Economizing Governance Choice Spot Market; Hybrid Froms Vertical Integration

**Figure 3 - Minimizing Transaction Costs Framework** 

Source: Zylbersztajn, D. (2005) based on Williamson (1991, 1985)

## 2.3.1. Specific Investments

(i) Physic and Human Assets Specificity

Assumptions

Consumers willing to pay higher prices for high quality beef products represent an incentive for investments in the different stages of the beef system. Producers and processors coordinate efforts to align their products with the new quality beef standards.

Producers invest in high quality pastures, management and technical assistance in order to improve their beef production according to the following attributes: lower slaughter age and homogeneous herd aligned with the demanded attributes of conformation and grading. Processors invest in technology to improve the slaughter, cutting and packing activities in order to fulfill the conditions established by export verification programs in the US, EU and other importing countries. Processors have modernized its facilities to get access to new and more exigent markets, but also to be able to explore business opportunities with new costumers in those markets.

The product involved in the producer-processor transaction is classified in eight categories based on age and sex of the beef-cattle. These categories reflect differences in the production process and particularly in the investments involved in the production and processing activities. Moreover these categories reveal differences in the degree of asset specificity involved in the transaction.

The production of young beef-cattle with desirable attributes of conformation and grading require investment in pasture and management. Producers that orient their operations to the production of beef with higher quality standards would suffer losses in their asset value if they produce lower quality beef-cattle (i.e., cows and steers with more than four years old). Some producers that oriented their operations to higher quality products have agreements with a processor where payment for slaughtered cattle is based on a mix of attributes observed in the category of cattle and its carcasses. Those producers would have losses if they had to sell to other processors with payment method based on live or carcass meat weight.

Processors that export to USA and EU markets need also to invest in physic assets and training of personnel to modernize their operations according to the market's standards of the higher quality and value market standards. Processors that want to capture the market opportunities (higher value markets or niches) depend on higher quality beef-cattle to fulfill the requirements on grading, PH and minimum size of the beef cuts'. We identify a <u>bilateral dependency</u> between the processors and producers aligned with a higher quality strategy.

We argue that the cattle categories classification<sup>10</sup> used by the Uruguayan Ministry of Agriculture (MGAP-DICOSE) is a proxy of the degree of asset specificity involved in the producer-processor transaction. Younger categories of slaughter cattle (young steer and heifer) involve higher asset specificity in the production and processing activities than old steers with more than three years old. The zero degree of asset specificity correspond to the production and processing of cows and bulls where any producer is able to produce and is commercialized as a commodity product based on live or carcass weight.

*Hypothesis* 1: *the higher the asset specificity, the higher the probability of the transaction being aligned with the direct-contracting arrangement.* 

#### (ii) Site Specificity

Distance between producer and processor determines the degree of site specificity. Lower distances interconnect the parties to reduce cost of transportation, inventory and monitoring. Shorter distances increase communication and information fluxes and facilitate direct producer-processor relations. Moreover, high transportation distances cause losses in quality attributes due to stress of the cattle, contusions and other damages. These factors are correlated with higher rejection of high value cuts and higher PH of the meat (undesirable). According to National Meat Institute of Uruguay these factors are associated with 5% losses of the beef-chain value (INAC-INIA-CSU 2003)<sup>11</sup>

The Uruguayan beef production is evenly distributed in all regions of the country, however slaughter plants are concentrated in the south region near the capital and port Montevideo. In some regions opportunity to reduce transportation cost and the quality losses involved in long distance transportation represent a relevant economizing issue for producers and processors.

Shorter distance leads to higher producer-processor dependence and facilitates a direct relation among the agents. We expect a negative relation between distance and the direct-contracting arrangement choice.

*Hypothesis 2:* the greater the distance between producer operation and slaughter house involved in the transaction, the lower the probability of the transaction being aligned with the direct-contracting arrangement.

#### 2.3.2. Frequency of Transactions

Higher levels of asset specificity involved in the production and processing activities of beef-cattle lead to higher bilateral dependency and higher transaction costs of all forms of governance. The larger the level of asset specificity, the more uncertain the transaction outcome, the more tighter coordination adds value to the transaction.

However, a specialized governance mechanism involves significant setup and maintenance costs. Anderson and Schmittlein (1984, p.388) argue that for rarely occurring transactions, losses from opportunism and inflexibility are likely to be lower than an integrated firm's incremental overhead. As transactions recur more frequently, a tighter coordination mechanism becomes more desirable since potential losses outweigh the setup and maintenance costs of the integrated governance.

The higher the frequency of transactions with non trivial levels of asset specificity, the more efficient a tighter vertically coordinated mechanism in a transaction cost

<sup>&</sup>lt;sup>10</sup> Young steer (1-2 year), 6 tooth young steer (2-3 years), steer (>3 years), heifer (1-2 and 2-3 years), cow (>3 year), veal, bull.

<sup>&</sup>lt;sup>11</sup> Joint research of National Meat Institute, National Research Institute and Colorado State University. We sum losses associated with transport issues like dark cuts, rejections, and contusions. Those losses are estimated in \$17.84 cents per carcass (5% of the \$1.5/carcass kilo producer's price in Dec, 2003).

economizing way. A higher frequency of transactions opens room to introduce reputation mechanisms between the producer and processor. We expect a positive relation between frequency of transactions and direct-contracting arrangement choice.

**Hypothesis 3:** the higher the frequency of transactions between the producer and processor involved in the transaction, the higher the probability of the transaction being aligned with the direct-contracting arrangement.

Brokers would have comparative advantages to reduce transaction cost (mainly searching and negotiation costs) in transactions that involve producers with low frequency of transactions. Those producers would face higher transactions costs if they used the direct-contracting mechanism and due to the low number of transactions the transaction cost could be prohibitive meaning that his best choice would be the broker-induced contractual arrangement. Same argument applies for the processors that face higher costs in a direct-contracting mechanism with low frequency transactions producers.

A reputation mechanism plays an important role as a guarantee mechanism in informal agreements between some producers and processors. Reputation is based on the stock of relationship that may add value to repeated transactions. Contractual arrangements that involve a reputations mechanism may occur within the direct-contracting mechanism. The reputation mechanism is partially captured by the frequency of transactions, meaning that transactions that involve reputation would have higher frequency of transactions between the producer and processor involved.

#### 2.3.3. Uncertainty

Two main sources of uncertainty play a role in the environment where beef producers-processors transactions take place. First, the macro-economic shocks, foot-and-mouth outbreaks, changes in consumer's preferences, new regulations required in export markets, and other kind of disturbance. These changes affect not only the cost and prices, but also affect investment decisions.

Moreover periods with high disturbances affect the contractual arrangements choices. "Although the efficacy of all forms of governance may deteriorate in the face of more frequent disturbances, the hybrid mode is arguably the most susceptible. That is because hybrid adaptations cannot be made unilaterally (as with market governance) or by fiat (as with hierarchy) but require mutual consent. Consent, however, takes time." (Williamson 1991, p.291). The emergence and/or continuation of contracts is less likely to occur in environments of high disturbances and as Transaction Cost Economics predicts, an increase in market and vertical integration is associated with an increase in the frequency of disturbances.

The second source of uncertainty could be the inability to evaluate attributes of each producer's products. Technology allows a precise classification of the carcass with low measurement costs. However, attributes related to the process of production (i.e.: feed system and use of hormones and antibiotics) are difficult to evaluate in the carcass. These attributes are subject of increasing concern among consumers in the destination markets and explain the emergence of certification mechanism with third party evaluation of the production process.

Periods with low disturbances promote medium-long term investment decisions and facilitate bilateral relations and the emergence of contracts and/or other mechanisms to protect investments in specialized assets.

These effects would be captured with a time series data set with 5-6 years observations. For the purposes of this research we focus on the contractual arrangement choice between direct-contracting and broker-induced mechanisms and we use a panel data set that contains all the transactions of all the Uruguayan beef producers held in 2004/2005 (a period with low disturbances). We do not identify uncertainty as determinant of the contractual arrangement choice (direct-contracting vs. broker-induced) in the period

2004/2005. However uncertainty should be included in future research focusing the analysis of the evolution of coordination mechanisms.

## **3. NEW STRATEGIES AND COORDINATION MECHANISMS**

In this section we analyze the new strategies in the Uruguayan beef industry since 1996. These strategies are mostly aligned with high quality beef products and involve tighter vertical and horizontal coordination mechanisms. Hybrid organizational forms and networks have been established to handle contractual arrangements between diverse producers and processors-distribution firms.

International evidences reflect changes in the contractual arrangement aligned with higher quality beef products. Mazé (2002) analyzed the implementation of brand-name strategies in France based on high quality and guaranteed food products after the mad cow (BSE) crisis in 1996. "These retailers' brand name strategies have introduced two innovations. First, they communicate information to consumers on a fully quality controlled supply chain with an official third-party certification. Second, these branding strategies include the design of new forms of contractual arrangements based on tripartite contracts, which include agro-food firms and farmers' associations as direct contractors." (Mazé 2002, p.33)

These new branding strategies are a formalization of contracts substituting informal contracting that has long been dominant in many beef sector (Hobbs 1997). Mazé (2002), based on Klein (1992), argue that the contract formalization may serve as a mutual learning process, and thus may reduce misunderstanding between transactions.

Branding name strategies work as a credible signal to consumers for standardized products, which have a low variability of quality attributes. Beef products, as other agricultural products, present high variability of quality attributes and this could explain the limited development of branding strategies for beef products. Mazé (2002) argue that another possible explanation in the beef sector are the result of non-cooperative behavior in the vertical chain and of obstacles to defining new forms of contractual arrangements to support these quality strategies.

In Uruguay we observed since 1996 the implementation of new strategies aiming to produce and process higher quality beef. Those strategies involve hybrid coordination mechanisms that coordinate 20-25% of the total beef producer-processor transactions in Uruguay (Paolino *et al* 2004, Guardia *et al*. 2002, Chiara 2002). On the one hand, we observe new marketing contracts between producers and processors based on a grading system with "price premium" for better and homogeneous quality attributes and delivery quantities. On the other hand, new certification systems and branding name strategies are implemented.

Table 3 summarizes the new strategies in the Uruguayan beef industry. We classify these strategies by the vertical coordination mechanism involved, named marketing contracts, certification, brand name and vertical integration.

Coordination Mechanism	Program	Started / parties involved	Description
	CarneCREA	2003 / Producers of the CREA <sup>12</sup> groups and a processor	Collective contract with specification of volume and price differentials based on carcass quality attributes (age, conformation, and grading-fatness). By 2007 participated more than 60 producers and 2 processors.
Marketing contracts	Vaqueria del Este	1999 / 22 producers and NIREA processor	Collective contract with specification of volume and price differentials based on carcass quality attributes (age, conformation, and grading-fatness).
	Consorcio del Litoral	Producers group and a processor	Collective contract with specification of volume and price differentials based on carcass quality attributes (age, conformation, and grading-fatness).
Certification	Natural Meat Program of Uruguay	2001 / INAC-USDA, producers and processors	Developed by government agency National Meat Institute (INAC) with international certification of compliance with protocols in both the animal production and industrial phases of meat production. Since 2004 is "Process Verified" by USDA. Main issues of the protocol: source verification of animals and products; no added hormones; not fed antibiotics; no animal protein in feed; grass fed; open range. In 2006 there were 277 certified farms, 550,000 animals in certified farms, 10 certified slaughterhouses.
	Organic/ Ecological Beef	1988 / PUL slaughter firm, producers, SKAL certification	Certification of the farmers' production process. Destination: EU and Israel
	Organic Beef	2001 / Tacuarembó slaughter plant, producers, certifying organization	Certification of the farmers' production process. Destination: EU. In 2007 there were 150 certified organic ranchers in the program (420,000 hectares).
	"El Rancho"	1995 / Feed Lot Producers and NIREA processor	AUPCIN-NIREA. Certified beef. Destination: domestic and export market
Brand-name	"Angus Beef"	Aberdeen Angus Producer Association	Certified beef. Breed and quality attributes.
	"Hereford Beef"	Hereford Producers Association	Certified beef. Breed and quality attributes.
Vertical	PUL	1985 / Producers Cooperative with slaughter house	Producers bought slaughter house and became one of the biggest processors in Uruguay. The slaughter house was bought in 2002 by a Brazilian firm.
Vertical Integration	La Caballada – Kosher Beef	2004 / Vertical integration of processing plant- distributor	Distribution firm of Kosher beef in US bought 50% of slaughter house "La Caballada".

#### Table 3 - New strategies of vertical coordination in the beef industry (Uruguay)\*

\* We excluded the new strategies within the production stage (between cow-calf and finishing producers). Source: Authors based on programs' web-sites and Boland *et al. (2007)*, Paolino *et al.* (2004), Guadia *et al.* (2002)

Marketing contracts are short term agreement (one year), with clauses specifying a grading system based on quality attributes observed in the carcass and the price premiums over an average price reported by government agency-INAC. These contracts provide a general guideline and are renegotiated with minor adjustment on a yearly basis. Ménard (1996) analyses stables and efficient contractual arrangements in the French fresh poultry

<sup>&</sup>lt;sup>12</sup> A CREA group - Regional Consortiums for Agricultural Experimentation – is a private association of 10-15 farmers that share their experiences and knowledge to improve the abilities of the members and the economics results of their operations. There are CREA groups in Uruguay (40) and in Argentina (192) in different agricultural/livestock activities and regions.

CarneCREA is one of the most important contracts in the Uruguayan beef industry and involves some producers from the 20 beef-CREA groups in Uruguay and a processor. CarneCREA is managed through the CREA federation (FUCREA) that coordinates the transactions between a CREA producer and the processor. The number of CREA producers participating in this collective contract has increased since 2005.

industry that involve short term contracts, finding those types of contracts as efficient mechanisms to reduce opportunistic behavior and facilitating a relative equity in the share of appropriable rents.

These contracts have been renewed and expanded in volume and number of producers since 1999 (e.g., Vaqueria del Este producers and NIREA slaughter plant have been working for nine years). Three characteristic are identified among these producer-processor marketing contracts: (i) producers are collectively organized and most of these producers groups were formerly organized for other purposes than commercialization; (ii) these groups of producers are actively involved in the design and implementation of the contacts; and (iii) the producers involved in contracts are above the average in technological and managerial abilities, and in scale of production.

The certification programs of "organic" and "natural meat" coordinate transaction of "credence goods" that quality attributes can not be evaluated even after consumption. Certification mechanism support the transaction of these products providing information about specific credence attributes that relate to perceived food safety issues, such as enhanced food safety practices on the farm or in the processing plant (Hobbs 2003). Institutions arise to reduce the cost of measurement (Barzel 1982), in this case through credible quality signals provided by a third party certifying organization.

#### 4. EMPIRICAL TEST

We have hypothesized that the contractual arrangement choices in the beef producer-processor transaction in the Uruguayan beef industry are explained by three main determinants: the degree of asset specificity, the distance and the frequency of transactions between the producer and processor involved in the transactions. The dependent variable is the contractual arrangement and it is defined as direct-contracting=1 and broker-induced=0. Note that within these two groups there are multiple types of contractual arrangements like auctions within the broker-induced arrangements and different types of informal and formal marketing contracts within direct-contracting (discussed in Section 3). In the empirical test we focus on the differences between the direct-contracting and broker-induced arrangements.

We construct a logit econometric model that presents certain advantages over linear probability model using a binary dependent variable. We expect that  $\beta_1 assetsp > 0$ ;  $\beta_2 dis \tan ce < 0$ ;  $\beta_3 frequency > 0$ .

$$P(Contractua \ lArrangeme \ nt_{it} = 1 | \mathbf{X}_{it}) = G(\mathbf{Z}) = G\begin{pmatrix} \beta_1 assetspeci \ ficity_{it} + \beta_2 dis \ tan \ ce_{it} + \beta_3 \ frequency_{it} + \gamma \mathbf{K}_{it} + e_{it} \end{pmatrix}$$
  
where  $\mathbf{K} = vector \ of \ control \ variables$ 

#### 4.1. Panel

We use a panel data base containing population information of producer-processor transactions collected by the Uruguayan Ministry of Agriculture-MGAP (period: Jun-2004 to Jul-2005; 77,458 transactions between 10,130 producers and 47 processors). The data is collected by the *Division de Contralor de Semovientes* (DICOSE-MGAP) as a comprehensive national animal identification program aimed at animal disease control, quality beef production, and marketing. All cattle operations in Uruguay are required to have documentation on each animal in their herds and the program requires hide branding

and documentation each time an animal is brought, sold, or transported. Copies of each transaction are sent to the buyer, seller, local police stations, and DICOSE<sup>13</sup>.

We constructed a panel where the cross-section dimension (*i*) is given by the producer ID and the time dimension (*t*) is given by the sequence of transactions that each producer completed. We use data from year 2004/2005 in which each producer performed on average 9 transactions to 3 different processors.

Panel description and mean values of the variables by producer are presented in Table 4 and the description of each variable is presented in the Appendix. We describe three panels data constructed from the same data base. Panel I is the whole data base with 77,458 observations. This is an unbalanced panel due to high heterogeneity in the number of transactions that each producer made in the year 2004/2005. Based on Panel I we construct Panel II (second column) by randomly selecting five transactions per producer. This is also an unbalanced panel because some producers performed less than five transactions in the studied period.

In Panel III (third column), we dropped those producers with less than five transactions from Panel II, creating a balanced panel with 4,625 producers with five transactions each. We are aware of the introduction of a selection problem in Panel III, given that we dropped producers with low scale production operations that performed only occasional transactions. However, Panel III contains 50% of the Uruguayan producers that explain 86% of the total transactions in 2004/2005 and 89% of the volume produced.

Table - Tallel Of trailsac	Table 4 - I and of transactions descriptive statistics (reported by producer)								
		Panel I	Panel II	Panel III					
		Whole data	Producers with	Producers w/					
		base	≤5 transactions	5 transactions					
Obs (total)	Ν	77,458	33,085	23,125					
Producers (i)	Ν	9,294	8,171	4,625					
Producers with <5 transactions	Ν	4,669	3,546	0					
Contractual Arrangement /1	mean	0.42	0.42	0.44					
Asset specificity <sup>/2</sup>	mean	0.36	0.37	0.39					
Frequency of transactions	mean	6.73	7.44	11.12					
Distance (Producer-Processor)	mean	149	151	156					
N cattle per transaction	mean	21.77	22.61	25.13					
Producer scale <sup>/3</sup>	mean	356	397	617					
Processor scale <sup>/3</sup>	mean	210,223	211,884	217,112					
<sup>/1</sup> Direct-Contracting=1:	Broker-Ind	uced =0	$^{/2}$ Max=1. Min=0						

 Table 4 - Panel of transactions descriptive statistics (reported by producer)

<sup>/1</sup> Direct-Contracting=1; Broker-Induced =0 <sup>/2</sup> Max=1, Min= <sup>/3</sup> Total cattle produced/slaughtered in 2004/2005 (heads)

The dependent variable in our analysis is the contractual arrangement choice made by the producer and the processor involved in the transaction and we run a statistical test of drivers that explain this matching process. Figure 4 shows the percentage of producers who used direct-contracting arrangement in all transactions (21%), in some but not all of the transactions (46%), and in none of the transactions (33% that use only the broker-induced arrangement). Note that a high percentage of the producers showed variation of the type of contractual arrangement used.

<sup>&</sup>lt;sup>13</sup> The DICOSE traceability system made Uruguay one of the first countries able to track an animal to its origins and ensure that producers were complying with sanitary requirements. DICOSE collects this information since 1973, however the data is available in digital format since 2004. Future research will be enriched with several years of available information of Uruguayan beef transactions.

# Figure 4 - Use of contractual arrangement by producer

In percentage of total producers



Source: Based on Panel I. DICOSE-MGAP data base, Jul-2004 to Jun-2005

#### 4.2. Regressions

We report four regressions to test the three hypothesis of contractual arrangement alignment discussed in section (2.3) and the logit econometric model presented in this section. In order to minimize endogeneity<sup>14</sup> problems which would lead to inconsistent estimators of the parameters in the econometric model rely in two procedures. First, we include a set of control variables to capture correlation between the explanatory variables and the errors. Second, we use panel data to control unobserved time-constant variables that may be correlated with the explanatory variables. These unobserved effects are unobserved firm characteristics - such as managerial quality or structure - that can be viewed as being (roughly) constant over the period in question (Wooldridge 2002, p.248).

Panel data allow us to control for unobserved individual effects of the producers that could be associated for a higher preference for a certain contractual arrangement, and hence, the producer would have a higher propensity to use certain contractual arrangements independently of the characteristics of the product involved in the transaction. The control of those unobserved effects provides robustness to the estimated equations and the statistical test of the hypothesis.

The four regressions reported in Table 5 differ in the estimation methods and the Panel used (Panel I, II or III described in Table 4). Column (1) reports a logit regression using Panel I containing the whole DICOSE data base (pooled data) with the full set of transactions in 2004/2005. The regression in column (2) is estimated using logit fixed-effects (FE) and the Panel II data-set (unbalanced). Column (3) reports regression estimated also by logit FE and using Panel III (balanced panel with five transactions per producer). Finally, in column (4) we report a logit random-effects (RE) regression using Panel III.

We discuss here the advantages and disadvantages of each regression. The regression in column (1) does not control for the unobserved effects and we use in this regression the whole data base containing population information of the transactions in the Uruguayan beef industry. In the regression in column (2) unobserved effects are controlled for through the FE method and we work with the unbalanced Panel II. For the regressions in columns (3) and (4) we use the balanced Panel III and we control unobserved effect by two different methods: FE (col. 3) and RE (col. 4). Note that Panel III is the balanced version of Panel II and the producers included in this Panel (III) explain 86% of the total

<sup>&</sup>lt;sup>14</sup> In applied econometrics, endogeneity usually arises in one of three ways: omitted variables, measurement error, and simultaneity (Wooldridge, 2002, p.51). If an unobserved variable is correlated with any of the repressors, then so is the error term, and we have an endogeneity problem. We cannot expect OLS to consistently estimate any parameter (Wooldridge, 2002, p.62). The basic assumption  $E[\varepsilon_i/x_i]=0$  is violated.

transactions in Uruguay (2004/2005). However, to construct Panel III we may have introduced a selection problem (we dropped producers with less than five transactions).

Table 5 - Regressions								
DEPENDENT VARIABLE Contractual Arrangement (direct-contracting=1)		Panel I (Whole data base)	Panel II <sup>/a</sup>	Panel III <sup>/b</sup>	Panel III <sup>/b</sup>			
		Logit	Logit fixed-effects	Logit fixed-effects	Logit random-effects			
INDEPENDENT VARIABLES	Exp Signal	(1)	(2)	(3)	(4)			
asset_specificity	+	1.18 *** (7.56)	1.30 *** (3.83)	1.29 *** (3.36)	1.36 *** (4.43)			
frequency	+	1.02 *** (43.07)	1.05 *** (10.89)	1.05 *** (10.44)	1.06 *** (17.58)			
distance	-	1.00 *** (-31.27)	.99 ***	.99 ***	.99 ***			
CONTROL VARIABLES								
volume transaction		1.01 *** (7.77)	1.00 * (1.48)	1.00 (.56)	1.00 * (1.99)			
seasonality (seasonal low	=1)	.97 ** (-2.14)	.98 (38)	1.00 (.05)	.97 (58)			
producer scale		1.00 *** (3.25)			1.00 (-1.68)			
processor scale		1.00 *** (24.71)	1.00 ** (2.61)	1.00 *** (3.26)	1.00 *** (6.61)			
DUMMY REGION (inclusion)								
slaughter region		yes	yes	yes	yes			
production region		yes	по	по	по			
SUMMARY STATISTICS		0000	0000	0000				
Prob > chi2		.0000	.0000	.0000	.0000			
Number of observations		77,458	13,153	10,185	23,125			
Number of producers		9,294	3,002	2,037 <sup>/u</sup>	4,625			

Notes: \* Significant at the 10% level; \*\* Significant at the 5% level; \*\*\* Significant at the 1% level (i) The table reports the coefficients as odds ratios<sup>15</sup> and absolute values of *t*-statistics (in parentheses);

(ii) Most of the dummy region are statistically significant. Estimates are reported in appendix (Table A3)

<sup>*a*</sup> Based on Panel I we construct Panel II by randomly selecting five transactions per producer (unbalanced panel).

<sup>/b</sup> In Panel III, we dropped those producers with less than five transactions from Panel II, creating a balanced panel with five transactions for every producer.

<sup>c</sup> In the fixed-effect estimation 5,169 producers where dropped (19932 obs) due to no variation in the dependent variable. <sup>/d</sup> In the fixed-effect estimation 2,588 producers where dropped (12940 obs) due to no variation in the dependent variable

We run Hausman test to compare the two methods to control the unobserved effects - FE (col.3) and RE (col. 4)  $-^{16}$ . We reject the null hypothesis that the FE and RE coefficients are not systematically different, meaning that FE has better estimators. It is important to highlight that apart from FE having better estimators, the FE estimation

<sup>&</sup>lt;sup>15</sup> Odds ratio=  $e^b$ , where b is the logit coefficient. We read odds ratio as: for an increase in one unit the explanatory variable, we expect a change in the probability of observe the direct-contracting arrangement given by the odd ratio or a percentage change given by [(odds ratio - 1)\*100]. Note that for a negative logit coefficient, the corresponding odd ratio would be contained in the interval (0,1). For a positive logit coefficient, the odd ratio is greater than 1.

<sup>&</sup>lt;sup>16</sup> The key consideration in choosing between RE and FE approach is whether unobserved effect and explanatory variables are correlated. RE is based on a stronger assumption that unobserved effects ( $c_i$ ) are uncorrelated with the explanatory variables ( $\mathbf{x}_{it}$ ). "Hausman (1978) proposed a test based on the difference between the RE and FE estimates. Since FE is consistent when  $c_i$  and  $\mathbf{x}_{it}$  are correlated, but RE is inconsistent, a statistically significant difference is interpreted as evidence against the RE assumption." (Wooldridge, 2002, p. 288).

method uses only those observations in which the dependent variable changes in the time dimension (sequence of transactions). In this case the estimation does not consider those producers that use the same contractual arrangement in the five transactions considered in the Panel (direct-contracting or broker-induced). RE estimation does not show this problem, and for that reason we report the regression in column (4).

#### 4.3. Results

The estimation results are presented in Table 5. Remarkably, in the first three rows (asset specificity, frequency and distance variables) the coefficients are very similar and robust across all the specification, they are statistically significant in the four regressions and consistent with our hypotheses discussed in section (2.3).

Our preferred estimates, presented in column (3) of Table 5, are the fixed-effects estimates. An increase in 1 unit in the level of asset specificity involved in the transaction, increases the probability of the transaction being aligned with the direct-contracting arrangement (versus the broker-induced arrangement) with 29%. This would be the case of a producer that breeds cows (asset\_specificy=0) for slaughter and switches his/her operation for the production of younger cattle categories, e.g. young steer (asset\_specificy=1), a change that would involve investments. In relation to site specificity, an increase in 100 km in the producer-processor distance increases the probability of the transaction being aligned with the direct-contracting mechanism with 45%.

## **5. CONCLUSIONS**

The aim of this study was to identify the determinants of the contractual arrangement choices in producer-processor transactions in the Uruguayan beef industry. Two sets of contractual arrangements coexist in this transaction: direct-contracting (48%) and broker-induced transactions (52%). Moreover, it is important to highlight that 46% of the producers use both types of contractual arrangements.

Our analysis and statistical test provides support for our model of the manifestation of direct-contracting versus broker-induced vertical coordination mechanism. The contractual arrangement alignment in this transaction is explained by the degree of asset specificity, the frequency of transaction and the distance (site specificity) between the producer and processor involved in the specific transaction. These results confirm the theoretical predictions stated in the transaction cost economics literature.

The probability of a transaction being aligned with the direct-contracting mechanism increases with higher degree of asset specificity (i.e.: young steer production and processing), higher frequency of transactions and shorter distance between the producer and the processor locations. The direct-contracting mechanism facilitates information exchange, personal relations and the negotiation of exchange scheme with price differentials based on carcass classification. Since 1998 we observe a growing number of new contractual arrangements like contracts between a group of producers and processors aligned with the production and processing of higher quality beef products.

These agreements play an important role in the coordination of transactions with high quality attributes carcasses, promoting and protecting producers and processor investments involved in the production and processing activities of these higher quality products.

The broker, on the other hand, has advantages to coordinate transactions of lower quality beef-cattle. The probability of a transaction being aligned with the broker-contracting arrangement increases with more generic – commodity – cattle like cows and older steers (lower asset specificity), lower frequency of transaction and greater distances between the producer's and processor's locations.

Changes in the institutional environment associated with new market access opportunities and more exigent regulations and quality standards, promote new strategies by producers, processors and other organizations in the Uruguayan beef industry. To explore market opportunities the agents have to achieve certain quality standards that have involved tighter vertical coordination mechanisms. Producers and processors get involved in closer relations and design mechanisms that allow for them a more efficient exchange of information and adaptation to changes in market destination and the market's required quality standards.

Uruguayan export market access represents an opportunity to add value to the beef products through higher quality products. Attempts to explore those opportunities with improvements in quality involves higher relationship-specific investments by producers and processors and, hence, higher bilateral dependency. These results have implications not only for producers and processors, but also for other organizations in the beef industry and public policies in relation to a 'national strategy' focused on higher quality and value beef products. Given the importance of the beef industry in the Uruguayan economy, an improvement in the performance of this industry would have an important impact on the national economy. However, in order to explore the Uruguayan market access opportunity with higher quality and value products in the EU, USA and other countries niches markets, coordinated efforts are necessary in direction to a tighter vertical coordination in all the segments of the beef system.

We find the following regularities in the vertical coordination arrangements in the Uruguayan beef system. Producers with higher degree of asset specific investments produce beef-cattle with higher quality attributes and tend to commercialize their products through the direct-contracting arrangement. Some of these producers, usually collectively organized, develop contracts with a certain processor with specification of volumes and price differentials based on carcass quality attributes (age, conformation, and grading-fatness). These carcasses supply a high proportion of the high value and quality specifications cuts for the European market and niches in Brazil and Chile.

Producers with low degree of asset specific investments produce generic or commodity beef-cattle, that are commercialized through the broker-induced arrangements and the main destination of the cuts is the US market as frozen low quality standard beef meat.

#### **APPENDIX**

#### **Table A1 - Variable Definitions**

Contractual Arrangement: direct-contracting=1 and broker-induced=0. We generated this variable using the code for type of activity (DicoseB) in the DICOSE data-base for each agent involved in the transaction (producer, processor, and intermediaries). We included in broker-induced the activity code 89 (broker) and 90 (auctioneer); otherwise was considered direct-contracting.

Asset Specificity: continuous variable (max=1 and min=0). We construct an index based on the mix of cattle categories in the transaction. We argue that the eight cattle categories classification in DICOSE data-base is a proxy of the degree of asset specificity involved in the producer-processor transaction. We classify the cattle categories in three groups (specificity 1; 0.5; and 0). We assign asset specificity=1 to the categories young steer (1-2 year), 6 tooth young steer (2-3 years), and heifer (1-2 and 2-3 years); asset specificity=0.5 to the category steer (>3 years) and yeal; and asset specificity=0 to cow (>3 year) and bull.

For each transaction: [gen asset specificity=(steer1to2y/total\*1)+(steer2to3y/total\*1)+(heifer2to3y/total\*1)+

(heifer 1to 2y/total \*1)+(steer > 3y/total \*0.5)+(veal/total \*0.5)+(cow/total \*0)+(bull/total \*0)],

where total=volume of the transaction (heads)

The argument: The production of young beef-cattle with desirable attributes of conformation and grading require investment in pasture and management. Producers that orient their operations to the production of beef with higher quality standards would suffer losses in their assets value if they produce lower quality beef-cattle (e.g. categories cow and steer with more than four years old). A growing number of these producers that oriented their operation to higher quality products have agreements with a processor where payment for slaughtered cattle is based on a mix of attributes observed in the type of category of cattle and its carcasses. Those producers would also have losses if they sold to a processor that orient its strategy towards low quality-commodity beef with payment method based on live or carcass meat weight.

Processors that export to US and EU markets need also to invest in physic assets and training of personnel to modernize its operations according to the markets stands. Processor that want to capture the market opportunities that access to higher value markets or niches demand higher quality beef-cattle to fulfill grading. PH and weight beef cuts requirement. We identify a bilateral dependency between these processors and producers of higher quality beef-cattle and we capture those situations in this asset specificity variable.

**Frequency** of the transaction: number of transaction between producer ( $P_i$ ) and Processor ( $F_i$ ). For each match  $P_i$ - $F_i$  we sum the number of total transactions undertaken by those two firms between Jul-2004 and Jan-2006.

**Distance** between producer ( $P_i$ ) and Processor ( $F_i$ ): We calculated the Euclidean distance given by the lowest distance between the center points of producer and processor location. For producer we estimated a center point of the micro-region ("Sección Policial") and for processor we used the center point of the Province ("Departamento") -analogous to county in the USA. Uruguay has 19 Provinces and each province is divided in 10-20 micro-regions (total 275 micro-regions). For each center point we estimated the longitude (lon) and latitude (lat) coordinates and calculated the Euclidean distance given by the equation: Distance=SquareRoot[(lon 1-lon 2)<sup>2</sup> + (lat 1-lat 2)<sup>2</sup>]. We use the plane projection in Gauss format with datum "Yacaré" that incorporate the topography curvature.

Seasonality of the transaction: high season (=0) and low season (=1). Seasonal high =Jan to Jun; seasonal low =Jul to Dec.

Producer Scale: total beef-cattle in heads that the producer sold in the period Jul-2004 to Jan-2006.

Processor Scale: total beef-cattle in heads that the processor sold in the period Jul-2004 to Jan-2006.

Region of production and processor: We classify the 19 Uruguayan Provinces (Departamentos) into six regions guided by geographic proximity and natural quality of pastures. Regions: (i) South: Canelones, San José, Montevideo; (ii) Center (Cristalino): Flores, Florida, Durazno; (iii) Southwest (Litoral): Colonia, Soriano, Rio Negro; (iv) Southeast: Lavalleja, Maldonado, Rocha; (v) Northwest (Basalto): Artigas, Salto, Paysandú, Tacuarembó; (vi) Northeast: Rivera, Cerro Largo, Treinta y Tres

	Table A2 - Descriptive statistics and correlation matrix"										
		Mean	S.D.	1	2	3	4	5	6	7	8
1	Contractual_Arrangement	0.48	0.50	1							
2	asset_specificity	0.39	0.37	0.056	1						
3	frequency	22.87	39.17	0.270	0.064	1					
4	distance	155	108	-0.192	0.004	-0.097	1				
5	volume transaction	26.26	57.79	0.022	0.021	0.050	0.031	1			
6	Seasonality (low=1)	0.47	0.50	-0.005	0.064	0.008	-0.013	0.000	1		
7	producer scale	1,343	2,080	0.197	0.079	0.772	-0.028	0.085	0.022	1	
8	processor scale	215,619	100,756	0.036	0.164	0.053	0.243	0.045	-0.037	0.031	1

T-11. A2 Description of the second second of the second state \*\*

\* Reported by transaction (N = 77,458 transactions)

DEPENDENT VARIABLE Contractual Arrangement	DEPENDENT VARIABLE Contractual Arrangement		(Whole data base)		Panel II <sup>/a</sup>		[I <sup>/b</sup>	Panel III <sup>/b</sup>		
(direct-contracting=1)	=	Logit		Logit I fixed-effects fixe		Logit fixed-eff	Logit fixed-effects		it effects	
INDEPENDENT VARIABLES	Exp Signal	(1)		(2)		(3)		(4)		
asset_specificity	+	1.18	***	1.30	***	1.29	* * *	1.36	***	
		(7.56)		(3.83)		(3.36)		(4.43)		
frequency	+	1.02	***	1.05	***	1.05	***	1.06	***	
		(43.07)		(10.89)		(10.44)		(17.58)		
distance	-	1.00	***	.99	***	.99	***	.99	***	
		(-31.27)		(-15.26)		(-11.90)		(-16.75)		
CONTROL VARIABLES										
volume transaction		1.01	***	1.00	*	1.00		1.00	*	
		(7.77)		(1.48)		(.56)		(1.99)		
seasonality (seasonal low-	=1)	.97	**	.98		1.00		.97		
		(-2.14)		(38)		(.05)		(58)		
producer scale		1.00	***					1.00		
		(3.25)						(-1.68)		
processor scale		1.00	***	1.00	**	1.00	***	1.00	***	
		(24.71)		(2.61)		(3.26)		(6.61)		
DUMMY REGION		0.60	***	0.71	***	0.62	***	0.00	***	
South slaughter region		0.62		0.71		0.62		0.38		
(SR)		(-13.11)	***	(-2.92)	***	(-3.61)	***	(-9.03)	***	
Center SR		1.46		1.87		1.84		1.68		
		(12.08)	***	(6.83)	**	(5.79)	4	(5.52)		
Southwest SR		1.02		1.11		1.10	*	1.00		
		(1.73)	***	(2.50)	***	(1.96)	***	(04)	***	
Southeast SR.		1.28		1.48		1.4/		1.66		
		(16.09)	***	(8.87)		(7.32)		(10.85)		
Northwest SR		0.97		1.01		1.03		0.98		
		(-3.52)	***	(.55)		(.95)		(-0.84)		
South production region		0.78								
(PR)		(-6.14)	***							
Center PR		0.74								
		(-17.95)	***							
Southwest PR		0.91								
~		(-8.76)	***							
Southeast PR		1.11								
		(-11.32)	***							
Northwest PR		0.98								
		(-4.04)								
SUMMARY STATISTICS		0000		0000		0000		0000		
$\frac{\text{Prob} > \text{Cnl2}}{\text{Number of all survey}}$		.0000		12 152		10 195		.0000		
Number of observations		0 204		15,155 2,002 /c		10,185		25,125		
Number of producers		9,294		3,002		2,037		4,625		

# Table A3 – Regressions (with dummy region statistics)

\* Significant at the 10% level; \*\* Significant at the 5% level; \*\*\* Significant at the 1% level Notes: (i) The table reports the coefficients as odds ratios and absolute values of *t*-statistics (in parentheses);

 (ii) Most of the region dummy variables are statistically significant.
 <sup>a</sup> Based on Panel I we construct Panel II by randomly selecting five transactions per producer (unbalanced panel). <sup>*b*</sup> In Panel III, we dropped those producers with less than five transactions from Panel II, creating a balanced panel with five transactions for every producer.

<sup>*/c*</sup> In the fixed-effect estimation 5,169 producers where dropped (19932 obs) due to no variation in the dependent variable. <sup>/d</sup> In the fixed-effect estimation 2,588 producers where dropped (12940 obs) due to no variation in the dependent variable

#### REFERENCES

- Alchian, A., R. Crawford, B. Klein. 1978. "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process." *Journal of Law and Economics* 21: 297-326.
- Anderson, E., A. Coughlan. 1987. "International market entry and expansion via independent or integrated channels of distribution." *Journal of Marketing* V. 51, 1:71-82.
- Anderson, Erin, David Schmittlein. 1984. "Integration of the Sales Force: An Empirical Examination." *Rand Journal of economics* 15(3), 385-395.
- Baritaux, V, M. Aubert, E. Montaigne, H. Remaud. 2005. "Matchmakers in wine marketing channels: the case of French wine brokers." MOISA, WP N.2/2005. Article presented to the 2nd Annual International Wine Marketing Symposium, 8-9 July, Sonoma State University, CA-USA.
- Barzel, Yoram. 1982. "Measurement Costs and the Organization of Markets." *Journal of Law and Economics* 25(1):27-48
- Boland, M.A., L. Pérez, J.A. Fox. 2007. "Grass-Fed Certification: The Case of the Uruguayan Beef Industry." *Choices* (publication of the American Agricultural Economics Association) 1st Quarter 22(1).
- Chiara, G. 2002. "Contratos de coordinación en la cadena cárnica." Proyecto Instituto de Investigación Agropecuaria de Uruguay (INIA/LIA 049). Montevideo.
- Coase, Ronald. 1937. "The Nature of the Firm." Economica. v. 4, p. 386-405.
- Farina, E.M.M.Q., P.F. Azevedo, M.S. Saes. 1997. "Competitividade: mercado, estado e organizações." São Paulo: Ed. Singular.
- Guardia, V. E, N. Zefferino. 2002. "Contratos de comercialización en la ganadería vacuna uruguaya." Tesis Grado. Facultad de Agronomía. Universidad de la República. Uruguay.
- Hobbs, Jill. E. 2003. "Traceability in Meat Supply Chains." *Current Agriculture, Food and Resource Issues*. Proceedings of CAES 2002 workshop "Identity Preservation of Agriculture and Food Products"
- Hobbs, Jill. E. 1997. "Measuring the Importance of Transaction Costs in Cattle Marketing." *American Journal of Agricultural Economics*, Vol. 79, No. 4 (Nov.), pp. 1083-1095.
- Hobbs, Jill. E. 1996. "Transaction Costs and Slaughter Cattle Procurement: Processors' Selection of Supply Channels." *Agribusiness*, Vol. 12, No. 6, 509-523.
- Joskow, P. L. 1995. "The New Institutional Economics: Alternative Approaches." *Journal* of Institutional and Theoretic Economics. 151: 248–259.
- Klein, B., 1992. "Contracts and incentives: the role of contract in assuring performance." In L. Werin and H. Wijkandre, eds., *Contract Economics*. Cambridge, Blackwell, pp.149-172.
- Klein, Peter G. 2005. "The Make-or-Buy Decision: Lessons from Empirical Studies." In Ménard, C., and M. Shirley, eds., *Handbook on New Institutional Economics*. New York, NY: Springer, pp 435–464.
- Laens, S., M. Mondelli, C. Paolino, and N. Perelmuter. 2004. "Estudio de Competitividad de Cadenas Agroindústriales: Cadena Carne Vacuna (Uruguay)." CINVE-BID, Montevideo.
- Lawrence, J. D., M. L. Hayenga. 2002. "The U.S. pork and beef sectors: divergent organizational patterns, paradoxes and conflicts." In: Anais. *Paradoxes in Food Chains and Networks*. Noordwiik: Management Studies Group, Wageningen University.
- Machado Filho, C. A. P., and D. Zylbersztajn. 2003. "Competitiveness of meat agri-food chain in Brazil." Supply Chain Management, England, v. 8, n. 2, p. 155-165.
- Martinez, S. W. 1996. "From farmers to consumers: vertical coordination in the food industry." An Economic Research Service Report. USDA.

- Mazé, Armelle. 2002. "Retailers' branding strategies: Contract design, organizational change and Learning." *Journal on Chain and Network Science* volume 2, number 1.
- Ménard, C. 2004. "The Economics of Hybrid Organizations." *Journal of Institutional and Theoretical Economics*. JITE 160, 345–376.
- Ménard, C., and P. G. Klein. 2004. "Organizational Issues in the Agrifood Sector: Toward a Comparative Approach." *American Journal of Agricultural Economics* 86, no. 3: 750-55.
- Ménard, C. 1996. "On Clusters, Hybrids and Other Strange Forms: The Case of the French Poultry Industry." *Journal of Institutional and Theoretical Economics* v. 152, p. 154-183.
- Mizumoto, F. M., and D. Zylbersztajn. 2006. "Strategy of multiple-coordination in distribution channels." 7th Chain Conference, Wageningen University.
- Mondelli, M., V. PICASSO. 2001. "Trayectorias tecnológicas en la ganadería uruguaya: un enfoque evolucionista." Tesis de Grado. Facultad de Agronomía. Univ. de la República. Uruguay. 121pp.
- Muris, Timothy, David Scheffman, and Pablo Spiller. 1992. "Strategy and Transaction Costs: The Organization of Distribution in the Carbonated Soft Drink Industry." *Journal of Economics and Management Strategy*, 1, (1), Spring, pp. 85-128.
- Ordeix, M., and G. Ferreira. 2001. "Competitividad y coordinación en la Cadena de carne vacuna." INIA, Série de Actividades de Difusión 277, 2001.
- Ordóñez H. A., P. Zuurbier, S. Senesi, and H. Palau. 2006. "Do food quality assurance systems demand complex governance structures?" 7<sup>th</sup> Int. Conf. on Management in AgriFood Chains and Networks.
- Paolino, C, M. Mondelli, and N. Perelmuter. 2004. "Competitividad de las cadenas agroindustriales en el MERCOSUR ampliado: carne vacuna, oleaginosos y aceites, y textil algodón." Informe Final. Centro de Investigaciones Económicas (CINVE) – FAO. Montevideo.
- Paolino, C. 2004b. "Elementos para una evaluación del proyecto de desarrollo ganadero en el Uruguay." 1º South American Agriculture Economics Conference (AAEA), 3-5 Nov., Mar del Plata, Argentina.
- Peng, Mike, Anne York. 2001. "Behind intermediary performance in export trade: transactions, agents and resources." *Journal of International business Studies*, 32, 2 (2<sup>nd</sup> quarter).
- Schroeder, T. 2000. "Reasons for and impacts of changing Fed Cattle Procurement Practices." Kansas State University, Department of Agricultural Economics.
- Uruguay, MGAP, Dirección de Estadísticas Agropecuarias. 2003. "La ganadería en Uruguay. Contribución a su conocimiento." Montevideo.
- Uruguay, INAC, INIA, CSU. 2003. "Auditoria de calidad de la carne vacuna." National Institute of Agricultural Resesearch (INIA)-FPTA.
- Williamson, O. E. 1996. *The Mechanisms of Governance*. Oxford University Press, Inc. 429p.
- Williamson, O. E. 1991. "Comparative economic organization: the analysis of discrete structural alternatives." *Administrative Science Quarterly*, n. 36, p. 269-296, June.
- Williamson, O. E. 1991b. "Strategizing, Economizing, and Economic Organization." *Strategic Management Journal*, Vol. 12, Fundamental Research Issues in Strategy and Economics, pp. 75-94.
- Williamson, O. 1985. *The economic institutions of capitalism: firms, markets, relational contracting*. New York: Free Press.
- Wooldridge Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT, 2002.
- Zylbersztajn, D. 1996. "Governance structures and agribusiness coordination: A transaction costs economics based approach." In Ray Goldberg, ed., Research in

Domestic and International Agribusiness Management. Graduate School of Business Administration. Harvard University. Vol. 12.

- Zylbersztajn, D. 2005. "Measuring Costs and Transaction Costs Perspectives of the Firm: Two Views About the Same Subject." ISNIE Conference, Barcelona.
- Zylbersztajn, D., and S. Lazzarini. 2005. "On the Survival of Contracts: Assessing the Stability of Technology Licensing Agreements in the Brazilian Seed Industry." *Journal of Economic Behavior and Organization* 56(1): 103.
- Zylbersztajn, D., and E.M.M.Q. Farina. 1999. "Strictly coordinated food-systems: exploring the limits of the coasian firm." *International Food and Agribusiness Review*, v.2, n.2, p.249-65.