Explaining Agro-Industrial Contract Breaches: The Case of Brazilian Tomatoes Processing Industry[1]

Decio Zylbersztajn[2]*
Lygia B. Nadalini**

Resumo: *Trezentos pequenos produtores de tomate no Nordeste do Brasil supriam uma indústria processadora. Em face do grande número de quebras contratuais, a indústria decidiu mudar-se para o Centro Oeste e operar com um número menor de contratos com empresários rurais de maior porte. Segundo a indústria, sua decisão foi motivada pelos altos custos de transação resultantes dos fracos mecanismos institucionais de proteção aos contratos. Os produtores, por outro lado, culparam a indústria pelo abuso na depreciação do preço pago pelo produto, com base na avaliação da sua qualidade. O estudo apresenta uma análise da arquitetura dos contratos e testa hipóteses com base na Economia dos Custos de Transação, explicativas das quebras contratuais. Um painel com 1523 observações foi utilizado e os resultados indicaram a significância de variáveis associadas aos incentivos para a quebra contratual por parte dos agricultores.*

*School of Economics and Business, University of São Paulo.
**School of Economics and Business, University of São Paulo.

[2] The first author is research associate of the National Council of Scientific Development-CNPq, member of the Program of Agro-Industrial Studies-PENSA and the Center of Studies in Law-Economics and Organizations. Correspondence address: dezylber@usp.br

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Classificação JEL: D23, L3

Abstract: Three hundred small tomato growers located in Brazilian northeast states, supplied a processing industry. In view of the large number of contract hazards and weak enforcement of clauses, managers have decided to move to the Midwest, where a reduced number of larger farmers have been contracted. The industry blamed high transaction costs due to the weak mechanism of public enforcement of property rights. The industry blamed some farmers of selling the product at the market for fresh consumption. Also, farmers blamed the industry for taking advantage of asymmetric information related to quality. This study presents an analysis of contract architecture and an evaluation of effects of transaction costs related variables on the likelihood of contract breaches. A panel data study with 1,523 observations and limited dependent variable models has been formulated to test hypothesis based on transaction cost theory. Results show that opportunism and the absence of courts guarantees of property rights precluded the possibility of achieving a stable contract relationship in the region.

Key words: agro-food governance, transaction costs and strategy, agro-industry contracts.

Jel Classification: D23, L23

1. Introduction

Most studies in agricultural economics explain the pattern of coordination from the point of view of the markets. Prices and quantities are the only variables required to perform the analysis, while the role of institutions is largely ignored. Recent literature has shown that this approach does not match the reality. Contracts instead of prices are the prevailing mechanisms of coordination between farming, food processing and consumers (MacDonald, 2006). Moreover, the institutional environment plays a fundamental role

in the formulation of private strategies and of public policies. Contracts prevail among farmers that form marketing cooperatives, farmers that sell genetically modified free commodities to traders, and farmers that supply organic food to supermarkets, just to name few examples.

Contracts perform as sophisticated coordination devices to handle complex arrangements for horizontal and vertical coordination. Contracts are common between farmers and processing industries or trading companies, especially when production of quality attributes depend on the cooperation among independent agents in the vertical production chain. Horizontal and vertical coordination devices are built – in to guarantee the regular supply of products as well as the standards demanded by consumers. In fact, complex network relations involving simultaneously vertical and horizontal contract relations represent how agriculture and industry relate to each other.

Coordination mechanisms of quality assurance have been studied by; Sauvée (2000), Farina and Reardon (2000), Raynaud E. Sauvée, L. and Valceschini, E. (2002), and complex vertical contract mechanisms have also been studied by Menard (1996, 2000), Maze(2005) pointing to the relevance of specific investments to explain the observed governance mechanism.

Technological variables cannot by themselves provide a meaningful explanation for the strategies of firms. Other explanatory tools are necessary to understand the complex mechanisms that rule modern agro-industrial relations (Menard, 2002).

Since contracts are such an important coordination device, it is expected that one will need both formal and informal institutional mechanisms to deal with contract coordination, among them the court mechanism. Production involving farmers and agro-industries are exposed to considerable variability demanding sophisticated coordination tools, including exclusion and dispute solving mechanisms.

The processing industry expects suppliers to offer quality and quantity in the produce needed. Usually mixed governance forms are found including markets, contracts and some degree of vertical integration. When an industry moves geographically, whatever the motivations for this decision may be, a number of specialized farmers will probably have to adapt, either by following the industry or by changing their

product. This adaptation might be costly to farmers, to the industry and also to the government, since it usually requires governmental support for the conversion of farmers. The level of asset - specific investments determines the cost of adaptation, including human capital.

The location for a processing plant is usually decided based upon logistic and technological variables. The amount of product potentially available, the production and distribution costs are all relevant questions. The literature based on the transaction costs perspective, relates the choice of governance mechanisms to the transactions characteristics, allowing for the analysis of complex contractual arrangements.

From the 1970s to the 1980s, in the Northeast of Brazil, small farmers supplied tomatoes to a processing industry under pre-specified contractual conditions. In face of large number of ex-post contract breaches and in the absence of protection of property rights by local courts, managers decided to move to new areas where a reduced number of large farmers had been contracted to supply the industry. The processing industry faced high costs of production and transactions due to technological factors, aggravated by expensive private enforcement mechanisms and by the recurrent decision of public courts. It was observed that when market prices for fresh tomatoes steeped up some farmers behaved opportunistically, selling the product to the market for fresh consumption, instead of fulfilling the contractual clauses with the industry.

The contract arrangement was voluntary and the industry supplied farmers with inputs, including seeds and fertilizers in the form of ex-ante in – kind payments. In cases of breach of contract and when private mechanisms did not work, courts have been involved, however they did not perform as a cost reducing mechanism according to expectations nor did they provide signals to the players. The companies interviewed, on the contrary, reported that judges preferred to interpret the breach of contract as the outcome of the industry's opportunistic behavior and of the exercise of market power.

The study presents a qualitative analysis of the evolution of contractual architecture, complementing this analysis with a quantitative evaluation of variables based on transaction cost theory related to the likelihood of breaches of contract. It addresses effects of

the differences in the scale, origin of credit[3], distance between the farm and the processing plant, and farmers reputation. The relevant theory is presented in part two, based upon the concept of self-enforcing range presented by Klein (1992). Part three presents the historic evolution of the contract relationship. In part four, the panel data study is conducted with 1,523 observations of contracts between farmers and UNILEVER. Limited dependent variable and ordinary regression models were formulated to test the hypothesis based upon the transaction cost theory. Part five presents conclusions together with subjects suggested for additional research.

This study contributes to the literature of contract coordination in agro-industrial systems under three aspects: **First,** it explores effects of performance by the courts to guarantee the stability of private contractual arrangements. **Second**, and distinct from the predominant research, this study focuses on the analysis of arrangements which have been discontinued, thereby collecting important information from unsatisfactory performance while avoiding survivor bias. **Third**, it gathers historical analysis of contract design, of evolution and of quantitative analysis of contractual arrangements.
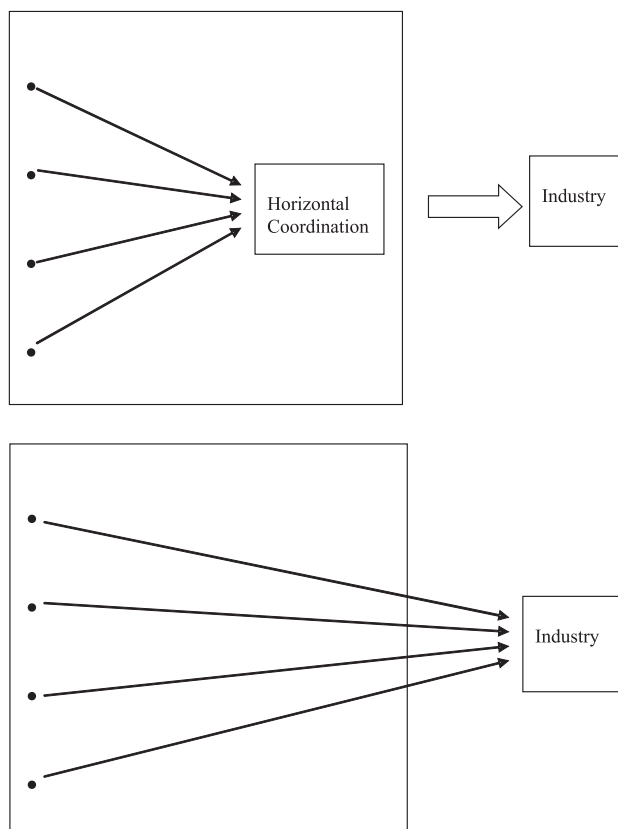
2. Theoretical Model

This paper studies the incentives to coordinate of short-term contracts between farmers and industry. Institutional environment and characteristics of transactions are the key determinants for efficient contract arrangement.

Usually farmers are geographically dispersed and this tends to increase the horizontal coordination costs. Figure 1 shows two typical models of agro-industrial relations, where the architecture in 1a shows the farmers' collective organization to transact with the industry and case 1b represents absence of horizontal organization.

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[3] Farmers' credit is supplied by commercial banks and by the processing industry.

Figure 1. Farmers – Industry Institutional Arrangements

Two typical structures have been studied in the literature of networks, as reported in Sauvée (op. cit) and Zylbersztajn and Farina (2003). The choice among the design options depends upon the costs of horizontal organization and upon the value to be added as a result of specific investments. Both industry and farmers make specific investments affecting product characteristics. The value of the final product rests upon investment incentives and the distribution of rights over residuals.

Problems of observation and measurement costs may occur in different degrees. First, at the farm level, it might be difficult to measure

a specific quality attribute. Second, prices are defined ex-post and asymmetries of information might also take place. If transaction costs are sufficiently high, incentives for total or partial vertical integration are expected, replacing the price coordination mechanism.

Further elaboration of hybrid forms is offered by Menard (op. cit.) when studying the alternative arrangements that explain and support complex coordination mechanisms. The author discusses four basic mechanisms to deal with the coordination problem, namely: adaptation mechanisms to deal with price and other non – anticipated changes, risk sharing mechanisms, information mechanisms and mechanisms for arbitrage.

2.1. Quasi-Rents and Hold Up

Considering that transactions correspond to a transfer of property rights and contract clauses are dependent upon future performance, the investment of one party will depend upon the other party's behavior (Alchian and Woodward, 1988). The joint effort of production involves the risk of future contract hazards. In the presence of incomplete contracts, parties might behave opportunistically, benefiting from contract incompleteness. The existence of specific assets generates transferable quasi-rents that must be in accordance with safeguards in order to control opportunistic behavior (Klein, Crawford and Alchian, 1978).

A variety of mechanisms are designed as safeguards, including the reputation effect and contract clauses against rupture. The efficiency of these mechanisms relies upon the reliability of the court mechanism and on the existence of recurrent transactions. In the presence of an efficient court system, if the parties of the transaction are identifiable and if the transaction is likely to be repeated in the future, incentives might emerge to comply with the contract clauses. North (1990) discusses enforcement mechanisms of contracts.

The concept of self-enforcing range is presented by Klein (1992), and it states that there are both costs and benefits in breaking the contract. Each party in the transaction will evaluate both these aspects and the probability of a contract hold-up, stems from this rationale.

The self-enforcing range is defined by the limits wherein the gains are smaller than the sanctions imposed privately or by the court system. So, the contract clauses sustained by law (legal coercion), in addition to the unwritten clauses, act to signal the sanctions imposed to the agents. In a world of uncertainty, unanticipated events can displace the transaction out of the self-enforcing range.

The case of tomatoes portrays a situation where neither private nor public mechanisms have been provided in order to economize transaction costs for the agents. On one hand, farmers lacked the incentives to organize horizontally for collective transactions with the industry. No attempts to add value through specific investments were reported. The industry had contracted the farmers to supply a given quantity of product, taking into account incentives for quality.

The relations between farmers and industry did not evolve on a relational basis. No evidence of trust and an absence of the reputation effect suggest that the farmers' perception of the relationship with the industry was short term oriented. Therefore private enforcement mechanisms performed poorly, restricting the self-enforcing range of contractual obligations.

On the other hand, as reported by the industry, the courts failed to enforce contractual obligations because judges considered this to be an inequitable relationship, one of a large multinational trading with small farmers, even under contract. Therefore the contract clauses were note deemed by the courts as enforceable, thereby further reducing the self-enforcing range of the contractual obligations.

The resulting increase in the transaction costs is anticipated by the theory. The benefits to hold-up are greater than the costs related to court enforcement or to private sanctions related to reputation. In conclusion farmers have lost and so has the industry.

2.2. Transaction Cost Analysis

Transaction Characteristics:

From the point of view of the quasi-rents branch of transaction costs analysis, relevant variables are asset specificity, the degree of uncertainty

that affects the transaction and its frequency. Time specificity takes place because the quality of the product deteriorates rapidly after harvest. Post contractual hazards arise, since at peak harvest trucks may have to wait in line for a long time, which is a common cause of tension between farmers and industry.

Site specificity is related to transportation: it affects logistics, monitoring costs and exposes the product to uncontrolled conditions. In turn, site specificity is affected by the existence of options to direct the production, which may include competing plants operating in the same region, or by the existence of alternative crops. Land ownership represents a higher level of asset specificity than rented land. Moreover the scale of operations related to a lower monitoring cost is generally preferred by the industry.

There is a choice of varieties either for multi-purpose or specific industrial use. The choice is determined by the available technology. The farmers favor flexibility while the industry prefers a reduced flexibility. Most contracts set forth the variety to be grown by the farmers.

Technological specificity is reported, since farmers have alternative crop options. The level of specialization is expected to constrain the portfolio of choices as well as the existing technologies for alternative crops. The same is true for the industry; once equipment is installed a shortage of supply causes losses due to idle capacity.

Brand specificity is important to the industry, because competition is strong and the industry values reputation to bear costs of supply shortages or of sub-standard quality. Uncertainty is present at the farm level, since uncontrolled weather conditions might affect both quality and quantity of produce. After processing, uncertainty is mostly related to market conditions.

Opportunism is potentially present in incomplete contracts, for many dimensions cannot be decoupled or anticipated. Prices were contracted ex-ante, positive monitoring costs precluded the adoption of technical controls, and quality standards are usually measured at the industry gate and are affected by transportation conditions. Contracts have been renewed yearly so no history of long-term contracts is reported.

The next section presents the analysis of the evolution of the surveyed arrangements.

3. Historical Development of Contractual Relations:

3.1. Case of Tomato Suppliers:

Due to specific quality standards, farmers grow tomatoes to supply the industry according to pre-specified technology. There are two processing stages after which the product is ready to be marketed as pulp, ketchup and dressings. Transactions are performed through the system showing different governance features, from spot markets to vertical integration. Horizontal coordination has evolved at the farm level because farmers tend to act collectively to negotiate downstream. The industry has the option of importing concentrated pulp and farmers have the alternative of supplying the industry or redirecting production to the market as a fresh product or to further change to another activity in lieu of tomato production.

Relevant characteristics of agro-industry relations are: First comes farming mobility. Production of agricultural supplies changes its location over time for reasons related to technology and transaction costs. In search of lower production costs, farmers move to regions with better conditions for production. The economy of transaction costs is another reason to explain the choices, with this approach largely ignored in the literature.

A second characteristic is that produce can be consumed either fresh or processed. Different degrees of specific technological developments, especially in genetics, are made in order to adapt the products to each target. Third, consumer preferences are important determinants for the makeup of the final product. Usually, the more rigorous the consumer, the more specialized is the processing industry and the less flexible the outcome. Brand emerges as an important asset.

A fourth characteristic is that as a consequence of government regulatory controls for food safety and consumers' awareness of quality attributes at different levels of observance, the coordination mechanism takes on greater complexity.

3.2. Evolution of Hybrid Forms

Historical evolution of contracts.
Italian immigrants organized the production of tomatoes in Brazil around 1920. In the beginning spot markets were sufficient to supply the

small processing plants or, instead, integrated stages of production were in the hands of families. As production grew in the state of São Paulo, industrial investments in equipment as well as in brand development took place and the market structure became more concentrated. Nowadays large multinational companies supply about 85% of the market. At the beginning of the seventies public investments in irrigation opened new agricultural frontiers in the semi-arid areas of the Northeast, especially in the states of Pernambuco and Bahia. As part of the agrarian reform program many small farmers were settled in the San Francisco river basin and were offered a new opportunity to produce tomatoes at low cost, with irrigation. The industry initially located in the State of São Paulo moved towards this new region. In the nineties the production area shifted towards the Midwest, followed by the processing plants, especially to the state of Goiás.

The strategy was motivated by technological as well as by transaction cost reasons. From the seventies through the nineties new options were made available to the farmers in the Northeast, especially the option of tropical fruits. The industry blamed farmers for holding-up contracts when market prices rose, selling the pre-contracted production for fresh consumption in the market, idling industrial capacity and bringing about coordination costs along the chain. Slowly the industry decided to contract with fewer farmers in the new areas, farmers who were farther from the consumption centers and therefore with less incentive to hold-up. Reputation mechanisms lost coordination efficiency as more options appeared and the courts failed to exhibit a balanced record of decisions. This historical perspective shows that mutual trust did not evolve, horizontal coordination mechanisms were weak and that both production and transaction costs evolved.

The historical evolution of contracts shows the adaptation of their design for purposes of the economy of the transaction costs. The coordination originally based on spot transactions has been replaced by hybrid mechanisms aiming to reduce uncertainty, to guarantee the delivery of quantity and quality at the lowest possible logistic and transaction costs. Complete vertical integration is not the solution due to high risks to locate the production in large areas and due to the high costs of land. Farmers have limited choices of technology (including

alternative crops) and of different markets for fresh and industrial products. Industry choices are centered on the supply of its needs through the smallest number of contracts from farmers that are as close as possible to the processing plant.

The first contract reported in the literature was found in 1971 in the State of São Paulo. Contracts are also reported between the industry and traders who were truck owners. They acted as middlemen by buying production straight from the farm offering future payments.

First Contract Design: As reported by Graziano Neto (1977) the original contracts in the State of São Paulo defined the expected amount to be traded and the price target for payment 90 to 120 days after delivery. Prices were defined ex-ante, before cultivation by a bureau formed by government and industry without farmer representation. No R&D investments took place and production risk was borne entirely by the farmers. Until the eighties, abundant farm credit allowed the industry to enjoy indirect benefits. Farmers lacked previous experience with the crop in question, and the activity generated just part of their income. While farmers became increasingly specialized a market for rent of land developed allowing for further specialization.

Disputes: Trust did not evolve between farmers and industry and relational contracts are not reported. Measurement costs were high due to the lack of standards. Graziano Neto (op. cit.) reports that contracts were not enforced. In high yield years farmers reported that industry acted in bad faith by delaying trucks in line for a long time adversely affecting quality and causing price penalties. Farmers also reported the need to redirect part of the product to the fresh market in order to guarantee higher average prices. Industries did not enforce the contracts in an effort to preserve the relation with the farmers. Whenever they elected enforcement the courts failed to perform. Bi lateral opportunism reigned.

Second Contract Design: In 1977 a new committee was organized, including farmers, the food industry and government agencies. A standard contract was defined and quality standards improved with the implementation of six levels of quality attributes, with price incentives applied to each level. It represents a clear move from design type a to type b, as represented in figure 1.

Clauses protected farmer' rights by limiting the waiting time of trucks. Penalties for breach of contract were made explicit and transportation and package ownership were defined. Nevertheless, weak performance of contracts persisted and post-contractual costs continued. Property rights concerning production incurred in high enforcement costs. Some new contract clauses set a 10% limit on the maximum amount of product to be marketed as fresh.

This standard contract survived with little change through 1984/1985, as reported by Farina and Cyrillo (1986, op. cit.). It defined price, area, expected productivity, including premiums/discounts with payment to be made through commercial paper. Subsidized credit for farmers persisted and the industry received an indirect benefit. Banks considered the formal contract collateral for the supply the credit. Farmers contracted the transportation of the product to the industry and technical assistance was predominantly public. Frequently the negotiations to define prices overlapped with the planting season. High transaction costs persisted and distrust remained, as reported by Hoffman (1985. p.80).

Third Contract Design: In the eighties governmental budget restrictions cut the level of rural credit, affecting the contracts between industry and farmers. The industry had to supply credit to farmers in order to guarantee regularity of supplies, this arrangement still being the rule. Inputs, including seeds and fertilizers, were supplied by the industry with costs discounted from the product. At the same time the public agricultural extension system collapsed and was also assumed by the industry. This introduced a new feature in the contract, namely the definition of property rights over the product. Farmers committed formally to deliver 100% of production to the industry. As reported by Hoffman (op.cit. p.83-85), "…farmers tend to be the good trustees of the production being responsible for it through delivery to the industry gate." Farmers could have all the production taken over by the industry in case of hold - up, enhancing contract enforcement power. In the nineties, several cases of court enforcement supported by this clause have been reported in Northeast.

In relation to quality characteristics the industry restricts flexibility with the growing advances in processing technology. The industry adopted farmers' selection based on technological capabilities as well

as strict limits of scale and distance from the processing plant. The industry increased monitoring efforts.

Fourth Contractual Design: Growers have been subjected to limited supply of credit and at the same time had to face a real constraint imposed by the planting season, resulting in tense relations with industries. Industries moved out from the Northeast in search for less risk, better product quality, and lower transaction costs. The industry idle capacity reached 70% in 1995, as reported by Oliveira (1996). Once settled in Goiás, payment for quality attributes was maintained, and the industry offered technical assistance, seeds and fertilizers to farmers. In the forth contractual design technology was strictly controlled including farm practices as choice of varieties and harvesting time. Farmers´ rights over the product were contractually restricted, being responsible for any deviation in the product. In case of mismanagement of technology by the farmer, the industry was no longer liable for any contractual clause.

The industry bears bore a larger share of production risk. There were productivity premiums as well as cumulative price premiums for continuity, introducing an important reputation effect. Anecdotal evidences showed a lower level of contract breaches in the Midwest contrariwise to earlier experience.

Some contractual dimensions changed with time. The trend was toward the definition of specific property rights and the resulting expected impact was to reduce the enforcement costs of contractual clauses. Private mechanisms were upgraded in response to the absence of reports on any evolution of public court enforcement.

A study by Thame and Amaro (1987) reported that neither farmers nor the processing industry went to court to resolve contract problems. This bears evidence to the fact that both parties expected costs to outweigh benefits in the short term, where one-year contracts were the rule.

4. Quantitative Analysis of Contractual Breaches:

4.1. The Data

Contracts between the industry and tomatoes suppliers in the region of Petrolina/Juazeiro in the Northeast, between 1996 and 1999 were

studied. An unbalanced panel model was designed encompassing five years of observations, generating 1,523 observations of contracts. The study of the contracts allowed identification of the variables presented in table 1, defined as: Year of the contract, area contracted in hectares, quantity contracted in tons, distance from production area to processing plant in kilometers, quantity effectively delivered, quality standard effectively reported, price contacted, market price for fresh product, source of credit, bank or industry.

4.2. The Model: *A panel model with random effects has been applied*

Two model specifications have been designed. Model 1 used qualitative dependent variables Logit and Probit as described by Greene (1993) and Gujarati (2000), to capture the occurrence of breach of contract. Contract breach was defined when the production effectively delivered was less than 50% of the contracted amount. This limit was set considering that the average for the period was 40.9%, based upon the expected losses of production due to technological conditions.

Model 2 defined the dependent variable as the percentage of product delivered with relation to the total stipulated in the contract, thereby generating a continuous variable allowing for the use of standard regression models. Therefore the signals of the estimates are expected to be the opposite from model 1.

Explanatory variables are; log of distance (dist), quantity under contract (quant), origin of credit (bank or industry), price difference which captures the difference between the prices defined in the contract and the price of the product *in natura* at harvest time. Explanatory variables are described in table 1.

Dummy variables have been used to capture the effects of scale and of distance from the plant. Four categories have been created; G1 are small farmers close to the plant, G2 are small farmers distant from the plant, G3 are large farmers close to the plant, and G4 are large farmers distant from the plant.[4]

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[4] We define small farmers up to 5 hectares and 150 Km as the distance limit.

Table 1 – Descriptive Statistics

	OBS	AVERAGE	S. D.	MIN	MAX
ANO	1523	1999,89	0,9881	1996	1999
AREA_CONTR	1523	6,661	22,638	0,500	500,000
QUANT	1523	333,070	1131,885	25,000	25000,000
DIST	1523	89,450	82,708	10,000	425,000
PREV_FAT	1523	20.083,38	70.174,38	1.450,00	1.525.000,00
ENTREGA	1523	164,370	858,112	0	18578,330
ENTR_CONTR	1523	0,409	0,347	0	3,663
PREÇO_ESTIM	1523	62,062	5,875	40,566	90,073
BANCO	1523	0,059	0,236	0	1,000
DIV_1997	494	1848,430	1991,480	5,640	21179,940
DIV_1998	664	2012,370	2278,425	5,000	21179,940
DIV_1999	709	2483,440	8085,713	5,000	202826,700
ENTR_50	1523	0,647	0,478	0,000	1,000
DIFER	1523	289,770	65,144	199,887	425,232
LDIST	1523	3,89	1,2210	2,30	6,05
ENTR_CONTR 1996	706	0,40	0,34	0	2,142
ENTR_CONTR 1997	390	0,52	0,3385	0	2,592
ENTR_CONTR 1998	304	0,26	0,2623	0	1,592
ENTR_CONTR 1999	123	0,46	0,4265	0	3,663
AREA_CONTR 1996	706	5,36	10,4900	0,5	245,000
AREA_CONTR 1997	390	6,84	21,1600	1,0	300,000
AREA_CONTR1998	304	7,64	33,9800	1,0	500,000
AREA_CONTR1999	123	11,10	37,8000	1,0	345,000
DIST 1996	706	75,70	95,2000	10,0	425
DIST 1997	390	110,13	70,8000	10,0	425
DIST 1998	304	95,54	66,9000	10,0	247
DIST 1999	123	87,75	57,3000	10,0	195

4.3. Hypothesis: *Based on the theory the following hypothesis was formulated*

It is expected that the probability of contracts breaches is:

a) Negatively related to the distance between farmers and the processing plant since in this case the plant is located in the urban area, therefore close to the market to which the production can be channeled. If on one hand monitoring is more intense for farmers close to the

processing plant, on the other hand incentives to channel the production to the market are stronger, reducing the self enforcing range.

b) Negatively related with the scale because the larger the area, monitoring by the industry s expected to be more intense with greater losses should the farmer breach the contract. Farmers also have incentives to maintain the relationship with the industry since a large proportion of their income depends upon the specific channel.

c) The impact of credit source in the transaction is twofold. First a negative relation results from reputation losses and sanctions expected from the bank. It is expected that farmers having access to credit face additional reputation incentives for their performance. At the same time it can be argued that farmers have incentives to breach the contract with the industry, sell the product in the market and repay the loan, thereby upholding their reputation with the bank. As such, the positive relation with the variable source of credit is expected in the model of limited dependent variable, meaning that the reputation effect with the bank is expected to prevail. d) A positive relation between the differences in prices is to be expected, since it narrows the contractual self-enforcing range. The larger the price difference the more incentive farmers have to hold up.[5]

4.4. Results

Table 2 presents the results from qualitative dependent variable models (model1),[6] using polled data, showing equivalent results. Significant coefficients of distance, origin of credit, quantity contracted and price differences have been found as well as the dummy variables showing the effects of the different groups. Table 3 presents both expected and observed results.

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[5] With respect to the groups of farmers no hypothesis has been formulated. The contrasts between G1 and G3 and G2 and G3 are unclear, since the larger scale offers incentives for good performance but also is more subject to incentives to sell in the market. We run the model without the dummy variables showing no differences in signals or in significance.

[6] We used pooled data and panel models with similar results.

Table 2 – Results from model 1 PROBIT and LOGIT analysis

Dependent Variable: conctract breach - *pooled probit* e *pooled logit*										
	PROBIT POOLED					LOGIT POOLED				
Variable	Coefficient		S. D.	Z	Prob. z	Coefficient		S. D.	z	Prob. z
QUANT	-0,00034	***	0,00012	-2,90	0,0040	-0,00060	***	0,00021	-2,87	0,0040
LDIST	-0,29240	***	0,03979	-7,35	0,0000	-0,49135	***	0,06689	-7,35	0,0000
BANCO	0,41197	**	0,19997	2,06	0,0390	0,64931	*	0,34881	1,86	0,0630
G2	0,80971	***	0,17688	4,58	0,0000	1,36519	***	0,29164	4,68	0,0000
G3	0,16824	*	0,09030	1,86	0,0620	0,30019	**	0,15304	1,96	0,0500
G4	1,57889	***	0,18957	8,33	0,0000	2,75749	***	0,34812	7,92	0,0000
DIFER	0,05797	***	0,00825	7,03	0,0000	0,09848	***	0,01406	7,00	0,0000
constant	-15,31800		0,12722	-6,41	0,0000	-26,07367		4,05979	-6,42	0,0000
Pseudo R2	0,1437					0,1441				
Obs	1523					1523				
Log likelihood	-846,95					-853,94				

Source: the authors *** 1% significance level; ** 5% significance level; * 10% significance level.

Table 3 – Expected and estimated coefficient's signals.

			Qualitative dependent Variable model		OLS - model	
dependent variable	explanatory	parameter	expected	estimated	expected	estimated
QUEBRA 50	QUANT	β_2	-	-	+	+
	LDIST	β_3	-	-	+	+
	BANCO	β_4	+	+	-	-
	PDIF	β_5	+	+	-	-

Source: the authors

In both models the scale shows a significant negative effect on the frequency level of contract breach as expected. Distance from the processing plant has presented a negative coefficient showing that the effect of the proximity to the market prevails over the monitoring effect. Considering that the period under study is characterized by high idle capacity, farmers close to the market tended to behave opportunistically. The positive effect of source of credit from the bank in the probability of

hold -up indicates that farmers tend to repay the bank even if sales to the industry have not taken place as contracted. Therefore the reputation value is greater with the bank than with the industry.

Positive and significant effect is shown related to the price difference, confirming the existence of incentives for opportunism when market prices rise above the prices defined ex-ante. The results of the dummies allow the analysis of the relation of different groups with the observation of contractual breaches. The results show that G1 presents smaller probability of breach than G2, G3 and G4. This might indicate that small farmers are more dependent on the industry, inviting further consideration of this information.

Model 2 presents the continuous dependent variable in both models, polled data and panel, and the results are shown in table 4.

Table 4 – Multiple Regression Results

Dependent Variable: contract breach (continuous) - Regression - *pooled* e panel										
	REG *POOLED*					**XTREG**				
Variable	Coefficient		Sd	T	Prob t	Coefficient		Sd	z	Prob z
QUANT	0,00003	***	0,00000	3,61	0,0000	0,00003	***	0,00000	4,04	0,0000
LDIST	0,06446	***	0,00894	7,21	0,0000	0,06919	***	0,00799	8,66	0,0000
BANCO	-0,16679	***	0,03889	-4,29	0,0000	-0,16898	***	0,03509	-4,82	0,0000
G2	-0,19444	***	0,04055	-4,79	0,0000	-0,18721	***	0,04004	-4,68	0,0000
G3	-0,04289	**	0,01907	-2,25	0,0400	-0,04313	**	0,01918	-2,25	0,0250
G4	-0,33772	***	0,03616	-9,34	0,0000	-0,34801	***	0,03505	-9,93	0,0000
DIFER	-0,01449	***	0,00173	-8,39	0,0000	-0,00126	***	0,00013	-9,88	0,0000
CONSTANTE	4,38369		0,50175	8,74	0,0000	0,55583		0,04855	11,45	0,0000
R2 adjusted	0,1842					Wald chi2		274,3600		
Obs	1523					Obs		1523		
						Grupos		1248		

Source: the authors *** 1% significance level; ** 5% significance level; * 10% significance level.

The scale effect is positively related to contract fulfillment. The positive coefficient between distance and contract fulfillment indicates that the more distant the farmer, the lesser opportunities he has to hold-up. The negative signal of the coefficient related to the source of credit contradicts the previous finding, indicating that farmers prefer to

breach contract with the industry and repay the loan to the bank. This particular point deserves further analysis.

The dummy variables to capture the effect of groups also reinforce the results from the limited dependent variable model.

5. Conclusions

The study of the historical evolution and the quantitative analysis of contract relations in the Brazilian tomato processing industry permit to conclude that:

- Conflicts are present and no relational contracts evolved. Private enforcement mechanisms are more important than public mechanisms. Qualitative analysis has shown the weak reputation of court performance in lowering transaction costs.
- The geographical relocation of the processing industry has been motivated both by technical reasons and by economy in transaction costs.
- The probability of contract breaches is greater when the distance between farmers and industry decreases. This because the particular industrial plant under study was located in town, therefore close to the market for fresh product.
- The probability of contract breaches with industry is greater when the farmer gets credit at the bank. This might be explained by the stronger enforcement power of banks where farmers have other contracts.
- The probability of contract breaches is higher and increases with the difference between the contract (ex-ante) prices and the market (ex-post) prices.
- The probability of contract breaches declines with scale, indicating that larger farmers tend to be more specialized, and/or monitoring costs are lower.

Relocation of industries usually is related to large coordination costs. Especially in the case of the food industry, since a large number of farmers have made specific investments to enter into a contractual relationship. The findings of this paper disclose that contractual architecture changes remarkably over time. Transaction costs motives seem to explain the

observed adaptations. Furthermore, the paper also raised anedoctical evidences of inefficient public enforcement mechanisms as an instrument to reduce transaction costs. Costs related to the improvement of the judiciary system must be weighed against gains in transaction costs however this is a subject for further research.

6. References

Alchian, A. and Woodward. S, 1988. The firm is dead; long live the firm. A review of Oliver Williamson's The Economic Institutions of Capitalism. Journal of Economic Literature, Nashville, v.26, p.65-79.

Camargo Filho, W.P. and Mazzei, A.R.1997. Tomate Industrial no Brasil. Informações Econômicas, São Paulo, v.27, n.10, outubro.

Farina, E.M.M.Q. and Cyrillo, D.C.1986. Padrões de Comercialização do Tomate Industrial no Estado de São Paulo. Relatório FIPE.

Farina, E.M.M.Q. and Reardon, T. 2000. Agrifood Grades and Standards in the Extended Mercosur: Their Role in the Changing Agrifood System. American Journal of Agricultural Economics, 5:1170-1176.

Hespanhol, R.A.de M. 1991. O tomate a caminho da indústria: a influência da Cica na Alta Sorocabana de Presidente Prudente. Dissertação de Mestrado. Instituto de Geociências e Ciências Exatas da Universidade Estadual Paulista, Rio Claro. 146p.

Hoffmann, R.1985. As mudanças no processo de trabalho nas culturas de tomate envarado e rasteiro no Estado de São Paulo. In: Hoffmann, R. *et al.* Inovações tecnológicas recentes na agricultura brasileira.

Klein, B.1992. Contracts and Incentives: The Role of Contract Terms in Assuring Performance. In Werin, L. and Wijkander, H. Contract Economics. Oxford, Blackwell, 359p.

Klein, B.; Crawford, R. and Alchian, A.1978. Vertical Integration, Appropriable Rents, and Competitive Contracting Process. Journal of Law and Economics, Chicago, v.21, October.

MacDonald,J. 2006. Agricultural contracting update: Contracts in 2003. USDA, Economic Research Service. Bulletin number 9.

Mazé, A. 2005. Contracts law and the range of self-enforcing contracts in agriculture: private institutions and multilateral-reputation mechanisms. Second French and German Talks in Law and Economics. Sarrenbruchen, Germany.

Menard, C.1996. On Clusters, Hybrids and other Strange Forms. The Case of French Poultry Industry. Journal of Institutional and Theoretical Economics, 152 (1): 154-183.

Menard, C.2002. The Economics of Hybrid Organizations. . Presidential Address. 6th Conference, International Society for New Institutional Economics, MIT, Cambridge, USA, September 27-29.

North, D.C.1990. Institutions, Institutional Change and Economic Performance. Cambridge University Press. Chapter 7.

Raynaud, E; Sauvée, L. and Valceschini, E.2002. Quality Enforcement Mechanisms and Governance of Supply Chains in European Agro-Food Sector. 6th Conference, International Society for New Institutional Economics, MIT, Cambridge, USA, September 27-29.

Sauvée, L.2000. Managing a brand in the tomato sector: authority and enforcement mechanisms in a collective organization. XIV Symposium on Horticultural Economics. Guernsey, September 12-15.

Zylbersztajn, D. and Farina, E.M.M.Q.2003. Dynamics of Network Governance: A Contribution to the Study of Complex Forms. Paper to be presented at the Symposium of Network and Chains in the Food Industry. University of São Paulo, Ribeirão Preto.