



PRODUCER'S DIFFERENT FACES: EXPLAINING GOVERNANCE MECHANISMS IN BEEF AGRI-SYSTEMS

Fernanda K. Lemos - fernandaklemos@gmail.com University of São Paulo – Brazil, School of Economics and Business, Av. Luciano Gualberto, 908, 055900-900 São Paulo, Brazil.

Prof. Decio Zylbersztajn - dzylber@usp.br University of São Paulo – Brazil, School of Economics and Business, Av. Luciano Gualberto, 908, 055900-900 São Paulo, Brazil

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Resumo

Inspirados nos laços de confiança e como eles tem influenciado as relações entre produtores e a indústria de transformação na agroindústria da carne bovina, este artigo discute a eminência dos sub-sistemas estritamente coordenados (SSECs) e suas múltiplas formas contratuais, duas dimensões para se capturar valor de mercado. Nós pesquisamos as características dos fazendeiros através de uma survey com 91 respostas obtidas para mostrar o surgimento dos SSECs através da identificação de diferenças de suas características em relação ao Sistema Agroindustrial padrão (SAG). Duas regressões logísticas foram realizadas e estudadas. A primeira referente ao SSEC para a União Europeia e a segunda para atender o mercado interno de qualidade. Nós comparamos ambas com o SAG Brasileiro e nossos principais achados de pesquisa foram a importância do estabelecimento de contratos e incentivos econômicos. Além disso, como os aspectos de confiança e laços relacionais são importantes, além das questões da força institucional para fazer valer a eminência dos SSECs e sua permanência no mercado.

Palavras-chave: Mecanismos de governança, coordenação, agro-sistema da carne, características dos produtores.

Abstract

Drawing inspiration from trust ties and how they influence Brazilian beef relationship between farmers and slaughterhouses, this paper discusses the emergence of strictly coordinated sub-systems as multiples contractual forms and their dimensions in order to capture value in the market. We research farmers profiles due to survey data with 91 producers in order to show the rise of strictly coordinated sub-systems (SCSSs) by establishing their internal characteristics differences with agribusiness system (SAG). Two logistics models were segregated and studied. The first European Union SCSS and Quality SCSS oriented to domestic market. We compare both with Brazilian SAG and our key findings is the importance of contracts to establish SCSS and economic incentives involved. In addition, the SCSSs different characteristics and emergence business history provided us findings about the importance of trust aspects, relational ties and institutional strength in order to enforce SCSS' emergence and permanence on the market.

Key words: Governance mechanisms, coordination, beef agri-system, producer's characteristics



1. Introduction

Brazilian beef industry is well known due the evolution of their internal supply to global market. Although almost 80% of Brazilian production supplies the domestic market, the country has the larger bovine livestock in the world, 13,8% of the total and it's the largest exporter country (ABIEC, 2018). However, the heterogeneity of transactions in this particular agribusiness system stimulated us to conduct our study searching how does producer's characterization can explain governance mechanisms in beef agri-systems.

The relationship of Brazilian slaughterhouses and producers has changed in the past two decades and new forms to transact emerged in to attend domestic and foreign markets (Lemos & Zylbersztajn, 2017). Wever (2012) states that the literature on transaction costs economics (TCE) has paid little attention to the complexity of coordinated mechanisms that underlie governance structures. Prior studies have argued that different strategies and organizational governance emerged from different institutional context and the need of adaptation, creating strictly coordinated sub-system (SCSS) to satisfy a specific demand (Zylberztajn & Farina, 1999).

Although Brazil é the largest exporter and second greatest market in bovine beef consumption, in terms of quality Bovine supply system meets, predominately, public regulations which are sufficient to supply the internal market and most of foreign ones. Most of Brazilian beef exported (76,5%) in 2016 was *in natura* bovine beef and 59,62% of this total went to emerging countries, where quality barriers to trade are covered by Federal Inspection System. However, SCSSs were created to accomplish exports to developing countries and some new SCSSs to internal market emerged also. European Union rules to trade were especially important to this movement that distinguishes SCSSs and the SAG in Brazil.

The role of trust in market relationships emerges as a facilitator pictured much attention on several disciplines. Economists and sociologists signalized trust as a preconditioner for market exchange (Arrow, 1974; Granovetter, 1985; Beckert, 2006). In the literature of supply chain, trust is presented as a key point on coordination between the agents (Adams & Goldsmith, 1999). More precisely the authors reinforce the relation of two companies to create share controlled strategic alliances to attend some demand. On the matter Fritz and Fisher (2007) says that a trust relationship between companies minimize transaction costs, increases knowledge because of conjoint work and decreases risks. However, this concept is used as an alternative mechanism of governance (market to hierarchy), based on emotional and cognitive premises of individuals.

We discuss the role of trust applied to transaction costs economics in agribusiness supply systems. In other words, how trust can positively create strictly coordinated sub-systems (SCSS) and reduce transaction costs to attend demands. We researched the characteristics that distinguish producer's profiles of SCSSs and a typical agribusiness system (SAG) in beef agro-system. *Our goal is explain governance structures emerged from coordination mechanisms adopted by producers to supply different demands.* To identify that, we interviewed 91 Brazilian producers using a closed online questionnaire. Two different analysis were conducted to compare quality SCSSs and SAG. The first analysis contrasts SCSS formed to supply European Union market and the SAG. The second, contracts the SCSSs that emerged in the internal market to attend quality demand and the SAG.

Our findings contribute to the literature in refine the effect of going global on governance structure of supply systems. For example, how different are the characteristics of producers that faced going to market opportunity with institutional barriers – cultural, cognitive e regulatory



ones. Going global also affected how producers faces the coordination mechanisms to supply quality markets. They also help to identify problems in coordination due to failure in designing internal institutions. Third, these ideas contribute a better understanding on SCSSs functioning (Zylbersztajn & Farina, 1999), by evidencing a social view of the coordination based on tangible trust aspects.

2. A social-economic view of Agribusiness System

Before describing beef Agribusiness Systems (SAG) based on transaction cost economics it's important to stress that other approaches emerged as a complement, to explain how transaction costs can be minimized. This section provides an explanation how this approach can be used in SAG framework. We based our proposal in the light of transaction costs economics and internationalization theories. So, changes in regulations and requirements in international trade can affect the institutional environment and consequently governance structure on organizations (North, 1990, Williamson, 1985).

Williamson (1996) stated that there a relation between the attributes of products and services offered and governance structures. That's the key point to minimize transaction costs between agents involved on transactions, considering the risks and benefits established. Once the supply system is seen as an extended enterprise, the concept of hierarchy of Oliver Williamson (1975) of hierarchy is explored to explain the SAG and the emergence of SCSS, because the firm is not only considered as a nexus of contracts, but also the contracts are defined by their specific governance modes. And those modes can vary from market to hierarchy.

In agribusiness systems (SAG), the works of Davis and Golberg (1957) and Golberg (1968) are taken as references, in which they discuss the dependent relations between input agents, production, transformation industry, distribution channels and the consumer. Golberg (1968) presents tree main characteristics: (1) the focus of agricultural firm is amplified; (2) it highlights intersectoral relations and interdependent economic relations proposed by Leontieff and Market-Share Matrix; (3) his study warns about the decrease of agricultural production in importance to economy, in face of other sectors. Other authors also advanced this literature in Europe, but SAG studies differ from chains or supply systems approaches by incorporating institutional and organizational environments such as institutions and associations (Zylbersztajn, 2000). The following Figure 1 presents the concept of SAG.

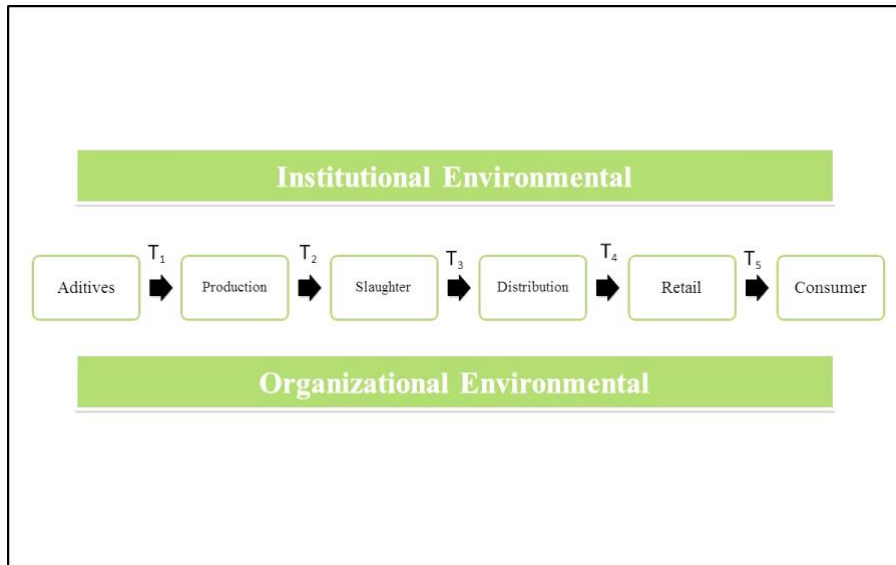


Figure 1 – Agribusiness System (SAG)
Source: Zylbersztajn (2000, p.14)

The coordination understood between the agents is the capacity of transmitting information (Zylbersztajn & Farina, 1999). Transaction characteristics (asset specificity, uncertainty, frequency) stated by Williamson (1985), needs to be known to achieve efficiency in coordination process (Zylbersztajn, 2000). Hobbs & Young (2000) add that products' characteristics are attributes affecting uncertainty and transaction costs. The literature of SAGs consider that three main elements are present in the constitution of an SAG: (i) contracts between firms is the way hierarchies are defined and their mechanisms of control and incentives; (ii) SAG is affected by the ability of leading the internal activities between agents, and transnational transactions can be more complex due to differences between institutions; (iii) we can rarely see an SAG with a single dynamics, because different companies compete for resources and consumers.

By the definition of SAG, the Strictly Coordinated Sub-systems (SCSSs) are defined a nexus of linked contracts coordinated through distinct mechanisms (Zylbersztajn & Farina, 1999). The authors highlighted some aspects that characterize these structures:

- SCSS can have different governance structures for efficient management. Economic incentives and control mechanisms are necessary to “enforce” such connections between agents and coordinate them to capture market value.
- SCSSs are directly affected by the institutional environment that governs them – “the rules of the game”, as conceptualized by Douglas North (1990).

The issue of institutional quality environment and its relationship with protection mechanisms established by Monteiro and Zylbersztajn (2012) model indicates the impact on the choice of governance strategies. The most efficient governance structure will be established by the hierarchical coordinator agent considering the asset specificity involved to capture the value of attributes (as defined by Barzel, 1996) and reduce their transaction costs (Williamson, 1985).



In Agribusiness System literature, institutional shocks are related to the need of the whole system quick adaptation on the direction of a subsystem strictly coordinated (SSSC) to attend a specific demand (Zylbersztajn & Farina; 1999). The literature suggests that contractual system will adapt by two methods: (1) shaping organizational strategy; (2) formal institutions to support efficiently supply systems to enforce the coordination and to help to implement the necessary contractual adaptations with agents involved.

Although the literature set this basis to define SCSS and how they emerge to capture value, the role about trust was dealt by Adams and Goldsmith (1999) approach. Trust is needed when dealing with coordination in supply chains. The study of Coleman and Zylbersztajn (2012) shows how the lack of guarantees in Brazilian beef-cattle system can influence on coordination. Our proposal is a social approach of agribusiness literature aligned with the existence of a coordinator agent that designs the strategy and the structure of governance transmitting to the other agents involved the necessities of adaptation process.

Applying governance to SAGs and SCSSs means recognizing that value generation is the result of cooperation between economic agents operating in different sectors of the economy. The coordination of agents for value creation is not a spontaneous act between the parties, it is a nexus of interests and investments for the results to be distributed. Thus, value sharing presupposes that there are incentives for cooperation to happen, (1) if they are sufficient, it is necessary to define a mechanism to share the value generated; (2) if the agents fail to define the incentives or mechanisms of governance, the value to be generated will not be captured, remaining in the public domain. In the first case, when the incentives are sufficient, two strategic actions take place simultaneously:

- (a) interactions happen between the coordinating agent of the SCSS and a third agent, which represents with whom the hierarchical coordinator transacts;
- (b) interactions happen with the agents that will be part of the SCSS.

In the first strategic action (a), the coordinating agent is seeking to capture value from attributes in the public domain, or under the domain of competitors, which will be negotiated with third parties. When identifying an opportunity arising from institutional shocks, new technologies or changes in relations throughout the SAG, the hierarchical coordinator understands that it needs a differentiated governance mechanism to capture the property rights associated with the value of the observed attributes. As introduced by Foss and Foss (2001b) and Barzel (1997), in order to construct and appropriate market value, the coordinating agent's action aims at raising the level of its profit and reducing the dissipated value. However, the value capture action is seen by the authors in relation to their competitors and when it is an SCSS, strategizing represents a new relationship with a third-part agent.

The second strategy action (b) of the hierarchical coordinating agent is the establishment of relationships with the other internal agents that must compose the SCSS. In this situation, the hierarchical coordinator (i) draws up a coordination strategy aligned with the negotiation with the third-part agent and the characteristics of the transaction; (ii) identifies the agents that can participate in this system based on the relationship and characteristics of the production system; (iii) negotiate the distribution of risks and results between agents.

Preckel et. Al, (2004) discuss the role of the hierarchical coordinator in establishing internal relationships and the distribution of risks and benefits. The objective is to establish a governance structure in SCSS that allows the capture and protection of the observed value efficiently, thus saving transaction costs. Organizational failures that may emerge at the



implementation stage are the result of an inappropriate contractual design between the agents, which can generate an unstable SCSS or even subject to ex-post opportunistic behavior (Zylbersztajn, 2014). Williamson (1996) proposes that the relationship between governance attributes and structures is the source for the minimization of transaction costs to be achieved when the relationships between the SCSS agents in terms of risks and benefits are established.

The most efficient governance structure for the SCSS will be chosen by the hierarchical coordinating agent based on the relationship between the degree of asset specificity involved in capturing value of the attributes and their transaction costs. The cases studies conducted by us in 2016 with the three major slaughterhouses in Brazil, placed internationally, confirmed this relation of coordination between agents and the construction value. Trust and relational aspects between the agents were some of our findings that we mean to confirm on this study based on farmers responses.

3. Research design

Considering the study cases (Lemos & Zylbersztajn; 2017) about the slaughterhouses and their coordinator play, in this paper, we analyze the differences in farmers profile between SCSSs and a typical beef agribusiness system (SAG). This type of analysis was also conducted by Mondelli and Zylbersztajn (2008) that researched arrangements direct coordinated and those with intermediation; Anderson e Schmittlein (1984) in *"Integration of sales force: an empirical examination"*; Anderson e Coughlan (1987) in *"International Market entry and expansion via independent or integrated channels of distribution"*; Peng e York (2001) in *"Behind intermediary performance in exports trade: transactions, agents and resources"*.

We intend, in other words, to evidence the differences on transactions based its characteristics, the mechanisms discriminants of governance structure stated by Williamson (1996) and trust interference, considered as a reputational aspect. European Union exports cases were selected by institutional and regulatory differences that distinguishes the SCSS and the SAG, as Zylbersztajn and Farina (1999) described before. The quality arrangements to supply domestic market are validated on the same perspective of SCSS-EU, characterizing which types of producers are part of them.

Hypothesis

The hypotheses were formulated based on attributes that distinguish governance structures: transaction (asset specificity, frequency and uncertainty), incentive intensity, administrative controls. The reputational aspects were also considered as a consequence of the findings presented on the cases studies and the path dependence of the relationships between cattle ranchers and refrigerators (Caleman & Zylbersztajn, 2012).

Specific investments

[...] "The willingness of consumers to pay a premium for quality and safe products from the point of view of human health and the environment represents an incentive to invest in the production and processing links" (Mondelli & Zylbersztajn, 2008).

This statement provides a positive environment by allowing producers to invest in production technologies to make the animals genetically homogeneous and weight coverage at a younger age. In Brazil, the need to attend to international markets and their norms has boosted this movement of production development and processing (ABIEC, 2016). The product transacted by the processor-producer can be classified into several categories according to the number of



months, sex, fat finishing, breed, certification and have the traceability documentation (MAPA, 2016).

Mondelli and Zylbersztajn (2008) in their study about Uruguay SAG showed that production was a result from the different sub-systems and their investments on nutrition, reproduction and sanitary systems, as well as product value management. The relationship established by the author is that young animals need a higher degree of investment in specific assets. This finding when related to slaughterhouses, guides their strategies to supply different markets and demands.

Taking into account that European Union requires some institutional documents, quality and specific nutrition investments, there is a bilateral dependence created between the slaughterhouses and farmers. This leads to the hypothesis that transactions with the European Union involve a high degree of specificity of physical assets - investments in genetics, nutrition technologies, animal health and properties and their controls, average age of slaughter.

Hypothesis 1 - The greater physical assets specificities involved in the transaction, the greater the probability of the transaction being coordinated in a contractual arrangement that requires strict coordination.

Hypothesis 1a - The greater physical assets specificity involved in the transaction, the greater is the probability of the transaction being coordinated in a contractual arrangement to European Union.

Hypothesis 1b - The greater physical assets specificity involved in the transaction, the greater is the probability of the transaction being coordinated in a contractual arrangement to internal quality market.

Uncertainty

The dimension that makes impossible perfect contracts. TCE indicates uncertain environments are linked with more coordinated structures like vertical integration. The scenario draw between Brazilian farmers and slaughterhouses propitiates the environment of uncertainty, especially because of lack of trust in buying and selling relations.

The perception of risk or uncertainty is potentialized by previous conflicts (Caleman & Zylbersztajn, 2012). Uncertainty may also be associated with some factors like demand, quality, impossibility of measuring individual efforts, or technological aspects (Williamson, 1985). It should be noted, however, that exports and the development of programs and protocols for each type of animal make this environment more transparent, opening the dialogue between farmers and slaughterhouses, generating the following hypotheses:

Hypothesis 2 - Formal contracts support are positively related to the SCSSS.

Hypothesis 2a - Formal contract is positively related to European Union SCSSS.

Hypothesis 2b - Formal contract is positively related to quality oriented SCSSS.

Hypothesis 3 - The strictly coordinated arrangements (SCSS) imply a lower level of conflict.

Hypothesis 3a – The lower percentage of disputes between farmers and the slaughterhouse, the greater is the probability of being part of a quality oriented SCSS.

Incentives and mechanisms of control

Incentives and mechanisms of control are the instruments used for alignment between the parties in SCSSs. Williamson (2010) had already pointed out those critical dimensions in the alignment of governance structures. Incentives places *ex-ante* mechanism to guarantee



coordination, by leading actor align their production in accordance of both side interests. Mechanisms of control in the other hand, places *ex-post* measurements tools used to confirm transactions veracity characteristics.

The situation of UE SCSS and their institutional requirements had shown that coordination emerged facing economic incentives and rules to trade, as well as in production side leading to a new form of coordination that diverges from SAG. This situation presented in the case studies (Lemos & Zylbersztajn, 2017) lead to hypothesis 4.

Hypothesis 4 - The greatest the economic incentives involved an specific transaction, the greatest is the probability of farmers being part of an SCSS.

Hypothesis 4a - The greatest economic incentives involved on a Traces transaction, the greatest is the probability of farmers being part of the EU- SCSS.

Hypothesis 4b - The greatest economic incentives involved on quality transactions, the greatest is the probability of farmers being part of an SCSS.

Hypothesis 4c - The greatest economic incentives involved on quality transactions, the greatest is the probability of farmers being part of the UE-SCSS.

Reputation Aspects

The hole of trust can be translated as reputational aspects and the frequency of transactions. When the actors involved in transactions create ties of trust, a cooperative relationship is observed (Granovether, 1973). We considered as a reputational aspect the *frequency of the transaction* (Williamson, 1985, 1996 and Coleman & Zylbersztajn, 2012) analyzed by the time of adherence to quality protocols (Coleman & Zylbersztajn, 2012). Also, we analyzed the role of associations when the "ties are considered weak", as a characteristic that distinguishes UE-SCSS and quality oriented SCSS to internal market.

Hypothesis 5 – Being part of an association is positively related to SCSS.

Hypothesis 5a – Being part of an association is positively related to UE-SCSS.

Hypothesis 5b – Being part of an association is positively related quality-oriented do SCSS.

To test all hypotheses, we used a logit function with a binary variable - to be part of the Traces list (1) or not (0), which determines the UE-SCSS. We also applied the same logic to quality (1) or not (0). Table 1 lists the attributes surveyed by the questionnaire variables proposed to farmers.

Table 1: Variable researched

Attribute	Variables	Type	Signal	References
Dependent Variable (UE-SCSS)	Which is the % of land designated to traces list? (this variable was transformed in binary)	Continuous		Normative Instruction n. 17 (MAPA, 2016)
Dependent Variable (Quality)	Do you participate of any quality program?	Binary		Zylbersztajn & Farina (2005)
Physical especification	In a scale of 0 to 7, which 0 is the smallest and 7 the greatest, how much do you invest in genetics?	Likert	+	Mondelli & Zylbersztajn (2008)
	In a scale of 0 to 7, which 0 is the smallest and 7 the greatest, how much do you invest in animal nutrition?	Likert	+	
	In a scale of 0 to 7, which 0 is the smallest and 7 the greatest, how much do you invest in sanaty?	Likert	+	
Mechanisms of control	Do you have any formal control of animal deaths and their causes?	Binary	+	Traces requirements



Uncertainty	In the last 3 years, which was the frequency (%) of disagreements with the slaughterhouses?	Continuous	-	Caleman & Zylbersztajn (2012)
	Is the relation improved facing a contract?	Descriptive	+	
Incentive Intensity	How much is the incentive received for being part of Traces list?	Contínuos	+	Caleman & Zylbersztajn (2011)
	How much is the incentive received by the quality programs that you attend?	Contínuos	+	
Reputation aspects	Do you participate of one or more association?	Descriptive	+	Caleman & Zylbersztajn (2012)
Control variables	Generation of the family in the business	Ordinal	-	Caleman & Zylbersztajn (2012)
	Total of cattle head worked	Continuous		
	Participation of the activity in family income.	Continuous		
	Level of study	Descriptive		
	Activities developed	Descriptive		
	Technologies of nutrition applied	Descriptive		
	Technologies of reproduction applied	Descriptive		

Data Collection

The sample was calculated based on the universe of *Lista Traces*, which an ex-ante monitoring process is done by European Community. The last publication of this list that determine the farms that can export was published in September 30 of 2015 and contain 1700 farms (MAPA, 2015). We utilized 90% of trust level, and 5% off error, that guided us to a sample of 93 farms. The questionnaire was structure based on the variables and the previous cases studies works with the slaughterhouses.

Data collection was conducted by internet and by the author in agribusiness events. We utilized *QuestionPro* system to collect the data that happened between August and December 2016.

4. Data Analysis

We analyzed the data thought two logistics regression due its utility to predict the probability of the sub-systems being observed in function of the variables elected by TCE model and reputation aspects.

The first model aims to investigate the factors that distinguishes farmers that participate of UE-SCSS and the typical SAG. On the other hand, the second model aims to stablish the factors that distinguishes farmers of the quality SCSS oriented to domestic market and the typical SAG. The analysis was realized using Stata13 software on the valid results obtained by 91 questionnaires with Brazilian farmers in all States of the country. We think that some assumptions characterized below need to be in the light of this paper, especially considering that we had already conducted study cases with slaughterhouses:

- i) UE- SCSS establishment is related to imposed requirements on internal system though formal international institutions;
- ii) We consider that those imposed requirements imply specific investments for farmers and slaughterhouses. In other words, transaction costs are higher for the entire system because of discoordination. This situation demands strict coordination for the protection of property rights over attributes required.
- iii) Quality-oriented SCSSs also require strict coordination between actors due the need of specific investments to capture value in domestic market (Zylbersztajn & Farina, 2005).



- iv) Farmers develop informal institutions to improve coordination. The motivation aspects are higher bargaining power and guarantees of attributes payment, as already pointed out by Coleman (2012), in other words, a low down on risks for the system.
- v) Future market contracts are related to the production system and represent demand predictability for slaughterhouses and costs feasibility for farmers.

Data descriptive analysis

There are challenges to set up an SCSS in order to capture and protect property rights value (Lemos & Zylbersztajn, 2017), so we analyze the data to describe: i) the farmer's profile; ii) transactions characteristics; iii) which are the mechanisms that characterize the SCSSs. Tables 2 to 4 presents the study result:

Considering farmers' profile, Table 2 presents that more than 80% of the analyzed group researched have a high education level, and their income that is heavily dependent on beef production activity. The farmers also have an advanced technological level - 90% of the sample have their animals slaughtered in less than 36 Months, uses feedlots and pasture termination technologies, and artificial insemination techniques; 70% of farmers are the owners of the properties analyzed and only 12% perform exclusively the breeding activity.

Table 2 – Producer profile

Cattle head			Position in the company		
Qtty.	%		Qtty.	%	
Until 1000	25	27%	Production Manager	12	13%
1.000 - 5.000	31	34%	Owner	65	71%
5.001 - 10.000	13	14%	Comercial Manager	5	5%
10.001 - 20.000	12	13%	Other	9	10%
More then 20.000	10	11%			
% Income			Nutrition Technology		
Until 20%	13	14%	Pasture termination	20	22%
20% - 50%	24	26%	Pasture termination with supplementation	65	71%
50% - 80%	28	31%	Feedlots	44	48%
More then 80%	26	29%			
Tradition			Reproduction Technology		
1a Generation	19	21%	Insemination	46	51%
2a Generation	28	31%	Reproduction time	12	13%
3a Generation	32	35%	Don't do the process	33	36%
4a Generation	11	12%			
< 4a Generation	1	1%			
Scholarity			Crédit use		
1o grade complete	3	3%	Yes	48	53%
2o grade complete	8	9%	No	43	47%
3o grade complete	41	45%			
Pós-graduation	37	41%			
Master/PhD	2	2%			
Idade de Abate			Slaughter per year		
Until 16 months	2	2%	Until 500	31	34%
16 and 24	25	27%	501 - 1.000	12	13%
24 and 36	55	60%	1.001 - 5.000	33	36%
< 36 months	9	10%	5.0001 - 10.000	10	11%
			More then 10.000	5	5%

As highlighted before, participating on an SCSS implies investments in specific assets, there are uncertainties related to supply and frequency of transactions. Table 3 brings the level of investments done by farmers in the mainstreams of livestock development. It also brings to light that there are locational specificity and uncertainties regarding the supply, mostly due to long lasting relational contracts (informal ones) established between farmers and processors.

We highlight that even if there is no formal contract, the level of problems reported in the last 3 years is considered as decreasing by farmers due to improvements in relationship of both sides.



Table 3 – Transactions Characteristics

Qtty. %			Qtty. %		
Relationship time			Nutrition investment		
No relationship	62	68%	Low	5	5%
> 2 year anos	12	13%	Medium	11	12%
2- 4 years	10	11%	Great	75	82%
More 4 years	14	15%			
% problems with the slaughter companies			Sanity investment		
Less 20%	72	79%	Low	10	11%
20% - 50%	9	10%	Medium	11	12%
50% - 70%	5	5%	Great	70	77%
More 80%	5	5%			
Slaughter local			Genetic investment		
Next to the ports	43	47%	Low	21	23%
Next to the production	48	53%	Medium	19	21%
			Great	51	56%

Contractual transactions corresponded for approximately 50% of the transactions surveyed. It was observed that there is a progress of the relationship programs presented in the case studies made for us in a preview study. We also noticed that being part of as associations or union indicates another type of control mechanism due to the certifications necessary for the commercialization. Among those, 34% of the farmers who participated in some association are part of the Rural Union, 21% of ASSOCON (Association of the feetlots) and 26% of associations linked to races and animal precocity. We emphasize that this relationship with associations and unions is an important factor linked with quality assurance, which is related to the reduction of uncertainties.

Economic incentives are a relevant aspect to induce SCSS used by slaughter companies. Tabel 4 indicates that, as also shows that quality incentives are related to development programs and represent only 35% of the total number of farmers, with the average of the incentives paid being R\$3/@. Economic incentives related to compliance with export regulations for the European Union accounted for 39.3% of farmers, averaging R\$ 2.2/@. Among 50 farmers that are part of the Traces List, 72% also participants of some quality program.

Table 4 – Alignment discriminant mechanisms

Qtty. %			Qtty. %		
Transaction contract			Incentives for Quality		
Formal Contract	21	23%	Yes	35	38%
Informal Contract	23	25%	No	15	16%
No contract	47	52%	Media	3	3%
Control Mechanims (Associations)			Traces list incentives		
Yes	42	46%	Yes	35	38%
No	49	54%	No	17	19%
Administratives controle (sanity)			Media	2,2	2%
Yes	77	85%			
No	14	15%			

1) Step 1: Logit model - delimitating UE SCSS (Or SSEC)

Our model presents as independent variables those that are related to farmers' profile, transactions' characteristics and the discriminant mechanisms of alignment to build the UE SCSS. Based on our preview study (Lemos & Zylberzstajn, 2017) we designed a model to be tested that includes the variables contracts, economic incentives (financial ones) and also some technologies in production process. Table 5 summarizes the basic statistics of the variables surveyed and Table 6 the comparison of models.



Table 5 – Basic statistics researched

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
SSEC	91	0.41	0.49	0	1
Investment in health	91	6.29	1.89	1	8
Investing in nutrition	91	6.54	1.31	3	8
Investment in genetics	91	5.2	2.44	1	8
Animal Death Control	91	0.84	0.36	0	1
Participation in associations	91	0.51	0.54	0	1
Contract agreement	91	0.27	0.44	0	1
Financial incentives for quality	91	0.25	0.43	0	1
Financial Incentives for being part of L.Traces	91	0.29	0.73	0	6
Problems with the refrigerator	91	14.93	22.9	0	100
Quality program	91	0.36	0.48	0	1
Family Tradition	91	2.38	0.96	1	5
Nutrition Technology	91	3.36	1.33	1	5
Reproduction technology	91	2.78	2.21	0	6
Working Heads	91	2.46	1.34	1	5
Participation in family income	91	2.69	1.04	1	4
Lands	91	76.1	24.1	10	100
Credit	91	0.50	0.5	0	1
Education	91	3.2	0.73	1	5
Volume Down	91	2.46	1.26	1	5
Volume Absorbed in Quality Programs	91	270.82	8191.19	0	40000
Age of slaughter	91	2.79	0.65	1	4
Production time	91	19.19	35.95	0	120

Table 6 –Logit model with producer characteristics that exporter to UE

Method	Logit	
Observations	91	91
SSSC (Coeficiente/Error)	Model A	Model B
Sanity Investment	-0,22 (0.18)	
Nutrition Investment	-0,49 0.30	
Genetics Investment	0.14 0.17	
Contract	3.04 (1.00)**	2.18 (0.76)**
Death control	-0,18 0.90	
Financial incentives to traces	6.18 (1.95)**	4.05 (1.16)**
Incentives to Quality	-0,93 1.41	
Tradition of the family	-0,31 0.36	
Nutrition Technology	0.89 (0.30)**	0.59 (0.24)**
Reproduction Technology	-0,37 (0.22)***	-0.29 (-0.14)**
Log Likelihood	-29,87	-33,97
LR Chi2	63.62	55.72
Prob>chi2	0.000	0.000
Pseudo R2	0.516	0.4505

Table 6 presents the study done from the data. The table presents the coefficients, standard error and level of significance of 5% (**) and 10% (***). In model (A) we have the regression with all the variables that compose the hypotheses presented in Table 6. Model (B), shows only the variables considered in the study proposed.

Analyzing logit regression B (model B), we understand that the model presents an adequate degree of adjustment ($X^2 = 0.4505$ and $p < 0$), considering the degree of significance at 95%; likelihood ratio and Hosmer-Lemeshow tests, to verify the fit quality of the model (Annex A), indicated that although 6 variables were excluded, the quality of fit was not changed at the 95% level of significance.

Some of the statistically significant variables are related to the research hypotheses presented, and as expected they presented a positive relation: economic or financial incentives, contracts



and nutrition technology. Another variable presented a negative relation, which describes farmers' profile: investments in reproduction. This may be related to the fact that husbandry and breeding activities can be performed by different farmers, but both are part of this SCSS. So, we can state that the related hypotheses (H2a) the contract adherence and (H4a) the economic/financial incentives related to the traces list, which are discriminant mechanisms of alignment of the governance structures. They were validated with the degree of significance of 5%.

The assumptions related to asset specificity (H1a), (H4c) economic/financial incentives related to quality, (H4a) carrying out health controls and (H5a) reputation do not help to explain farmers' profile in UE- SCSS. Regarding farmers' characteristics, the negative relation with the means of reproduction (techniques used) was identified, which may suggest that farmers' profile is those who only perform the fattening activity, since the intensity of nutrition technologies was also found as statistically relevant.

We also found that the variables related to investments - nutrition, genetics and sanity are not significant at 5% or 10%. It is assumed that when identifying that the technologies of nutrition and reproduction are relevant to explain the farmers' profile in UE SCSS, that the indicator has failed to capture the importance of the variables in relation to the others. It is also noted that quality programs and their incentives are not decisive for this distinction, but the opposite relationship may be true. The question of reputation measured by membership in a race association, as mentioned in the case studies, was also not identified as relevant. However, these issues should be addressed in SCSSs for quality meat.

Also, the logit models' analysis showed us that the coefficients express a marginal effect on the dependent variable, considering the other constant variables. For the interpretation of the results, it is necessary to perform the Odds Ratio analysis (Annex A). The results suggest the possibility of a system to be the UE-SCSS when a contract is established, keeping the remaining variables constant, the chance 752% greater in this case. However, when receiving economic incentives related to List Traces this factor is 57.73 times or 5.773 %, leading us to see how economic incentives were important for UE-SCSS emergence.

2) Step 2: Logit model – delimitating Quality- SCSS oriented to domestic market

We decided to include this second step in our research based on the cases study (Lemos & Zylberstjan, 2017). They brought that UE- SCSS influenced the emergence of SCSSs to attend the domestic quality market. However, "the rules of the game" of these two sub-systems are not the same, which indicates a new coordination structure and the possibility of different variables to define the quality-SCSS. It is interesting to investigate which variables are involved on Quality-SCSS and compare differences and similarities with UE- SCSS ones.

Table 7 presents the results of logit regressions obtained from data. The first regression was performed with all the variables of the model (A), the other model (B) only those resulting from the modeling from a level of significance at 95%. Differently of UE-SCSS logit regression, on step 2 model B, we didn't propose a closed model to be verified, we developed model B based on the results of model A, to verify if there is a quality-SCSS to domestic market and its characteristics or this was just a marketing proposition based on retail process.



Table 7 - Logit model with producer characteristics that are part of quality programs

Dependente Variable	Quality program (Yes = 1 No = 0)	
Method	Logit	
Observations	91	91
Qualidade(Coeficiente/Error)	Modelo A	Modelo B
Sanity Investment	0.94 (0.41)**	0.78 (0.36)**
Nutrition Investment	2.29 (0.95)**	1.98 (0.81)**
Genetics Investment	-0.65 (0.30)**	-0.5 (0.26)***
Contract	6.01 (2.06)**	5.23 (1.80)**
Number of animals	2.18 (0.80)**	1.89 (0.68)**
SSSC - Exporter to EU	3.47 (1.32)**	3.29 (1.32)**
Associations	2.27 (1.03)**	2.26 (0.99)**
Nutrition Technology	0.24 0.40	
Reproduction Technology	1.50 (0.52)**	1.31 (0.45)**
Problems with slaughterhouse	-0.18 0.23	
Log Likelihood	-17,37	-18,04
LR Chi2	84.44	83.11
Prob>chi2	0.000	0.000
Pseudo R2	0.7084	0.6972

Based on Table 7, we understood that regression B presents an adequate degree of adjustment ($X^2 = 83.11$ and $p = 0$). The likelihood ratio and Hosmer-Lemeshow tests to verify the fit quality of the model (Annex B), indicated that although 2 variables were excluded, the quality of fit was not changed at the 95% level of significance, being preferred the model B.

The results presented by model B shows us some statistically significant variables that are related to the research hypotheses, and that differ from the hypotheses confirmed in the first stage (UE-SCSS). As expected, there is a positive relationship between the UE-SCSS and the quality programs because this was already highlighted in the case studies. We find also positive relations with the establishment of contracts (H2b) and farmers' profile, the technological level on reproduction used and the number of heads worked.

The positive relationship between participation in associations and quality programs confirms the hypothesis (H5b) about the importance of reputational aspects to delimit and define SCSSs also observed in the case studies. However, the conflicts with slaughterhouses also was not point to be a determinant variable (H3b), as well as the sanitary controls. These SCSSs were not defined in any of the cases, studied before. The variable of economic/financial incentives related to quality programs was not part of the model, because it has 100% correlation. In other words, a quality- SCSS to domestic market implies to have some economic incentives on production.

We highlight the variables related to the specificity of assets due their significance, confirming Hypothesis 1 (b): investments in health, genetics and nutrition with some positive relation, at the level of significance of 95% and 90%, as indicated in Table 7. It is assumed that this fact stems from the numerous requirements and incentives provided by the programs described in the case studies.

Complementing with probability analysis (Odds Ratio on Annex B), we observed that the when farmers are part on an association, their chance of being part of a quality program is increased



by 958%. In the case of belonging also to UE-SCSS 2,689% and when establishing a contract with slaughterhouses this goes to 18.792%. These aspects reinforce the importance of institutional aspects and how they influence new paradigms on other markets (the case of UE and Brazilian quality market), also the importance of some external agent to assure some control mechanisms of quality and how contracts are significant on coordinating these relations. The sensitivity analysis of model B for a 50% cutoff showed that the overall efficiency of the model was 92.31%, the sensitivity and specificity analyze for the same cutoff of 50% were 87.88% and 94.83%. The ROC curve is shown in Annex B.

5. Conclusions

Considering the results obtained by the two econometric models, it was contracts were validated as a variable that coordinates SCSSs. Contracts are able to reduce uncertainties involved in supply system and also, they can discriminate frequencies of supply, volumes, guaranties involved on trade. Economic and financial incentives, also validated by the model are considered a variable important to identify an SCSS emergence, this happens because they are the benefits received by agents for changing they daily process to coordinate to others demands and adopt specific assets that are necessary.

We highlight that problems between agents were not pointed as a key issue to discriminate SCSS and SAG. And based on this, we can conclude that the even slaughter companies invest on improving their relationship with farmers, and do some type of knowledge management programs, they do not distinguish the sub-systems. But this fact doesn't exclude the hypothesis that it works for improving the whole system, and of course reducing processes costs and transaction costs on the bases of SAG. This addresses another study to be conducted for measuring the costs and benefits for industry and producers of these changes that are pictured in Brazilian beef sector.

The role about associations and entities is presented only in quality-SCSS, this permits us concludes that when the institutional environment doesn't allow a strong definition on property rights (Barzel, 1997), new mechanism of trust to reinforce reputational aspects are needed and the associations plays this role on quality-SCSS to domestic market. The situation was not observed in UE-SCSS, as well as discriminating specific assets because the traces list imposed on Brazilian farmers and institutional rules to trade, simplifies the transaction by placing them.

The implication of this study for Brazilian private managers and public professionals on this chain shows that there is much to do like public policies to improve institutional environment that places property rights though the systems and also guaranties of sanitary and races aspects (eg. Brazil faces three times "weak beef" process on 2017/2018) to domestic market and also international one. Other implication that can be designed by the real existence of SCSSs, are the possibilities of different mechanisms of coordination to develop new markets, brands and improve investments, technological use on farms; and of course, it's very important that economic incentives are placed.

On production side it opens new forms to produce and trade with slaughter that provides guaranties thought contracts, economic incentives that justifies specific assests investments and new technologies' application. It also shows to production side that it's possible to construct a positive relationship with partners down and upside the system to provide strictly coordinated products. Down side the system, supply industry products it's also a positive conclusion that permits them to develop specific lines for nutrition,



sanity and advance with reproduction technics. And for them, as well, for slaughter industry, services can emerge to help on the coordination and improvements of the different systems that farmers want to be part of.

Other studies can be addressed on this thematic of SCSS, specially to the development of property rights on the system and the relation of the tolerance. It's well pointed by Coleman & Zylbersztajn (2012) that Brazilian beef system is to tolerate even with the role of technological improvements done in 1960-70 and its application on the field.

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Odds Ratio

Logistic regression

Number of obs	=	91
LR chi2 (4)	=	55.72
Prob > chi2	=	0.0000
Pseudo R2	=	0.4505

Log likelihood = -33.976616

ssec	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
incetraces	57.73745	67.446	3.47	0.001	5.849606	569.8868
tecnutri	1.818566	.4485799	2.42	0.015	1.121413	2.949118
reproduo	.7452537	.1092911	-2.00	0.045	.5590824	.9934189
contrato	7.526255	5.78427	2.63	0.009	1.668752	33.94424
_cons	.054002	.0543088	-2.90	0.004	.0075227	.387656

Note: 0 failures and 1 success completely determined.

Sensibility and specificity analysis of the model

Logistic model for ssec

Classified	True		Total
	D	~D	
+	26	5	31
-	12	48	60
Total	38	53	91

Classified + if predicted Pr(D) >= .5

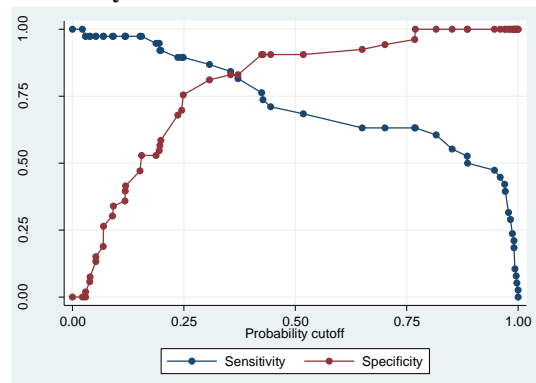
True D defined as ssec != 0

Sensitivity	Pr(+ D)	68.42%
Specificity	Pr(- ~D)	90.57%
Positive predictive value	Pr(D +)	83.87%
Negative predictive value	Pr(~D -)	80.00%

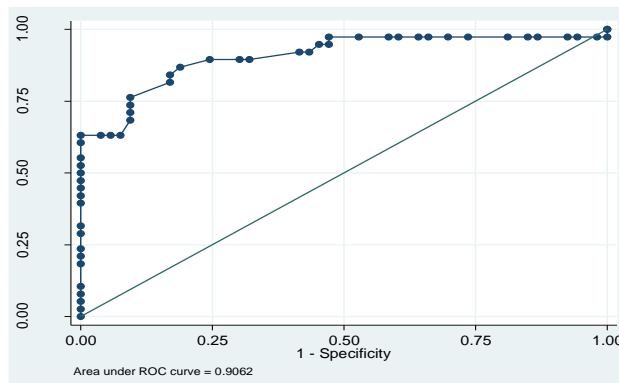
False + rate for true ~D	Pr(+ ~D)	9.43%
False - rate for true D	Pr(- D)	31.58%
False + rate for classified +	Pr(~D +)	16.13%
False - rate for classified -	Pr(D -)	20.00%

Correctly classified 81.32%

Sensibility curv



Roc Curv



VIF – “Variation Inflation Factor”

Variable	VIF	1/VIF
tecnutri	2.46	0.405750
reproduo	2.27	0.441339
contrato	1.58	0.630941
incetraces	1.36	0.733721
Mean VIF	1.92	

ANNEX B – Models Logit SSSC- Quality Model Logit SSSC Quality



Model A:

Logistic regression
Log likelihood = -17.379884
Number of obs = 91
LR chi2(10) = 84.44
Prob > chi2 = 0.0000
Pseudo R2 = 0.7084

programaquali	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ssec	3.4715	1.326112	2.62	0.009	.8723683 6.070632
cabeastrabalhadas	2.180203	.8002323	2.72	0.006	.6117768 3.74863
associaes	2.270602	1.037927	2.19	0.029	.2363028 4.304902
invsanidade	.9476417	.4192853	2.26	0.024	.1258576 1.769426
invgen	-.6504781	.3051733	-2.13	0.033	-1.248607 -.0523494
invnutr	2.291472	.9563813	2.40	0.017	.4169991 4.165945
contrato	6.011678	2.06915	2.91	0.004	1.956218 10.06714
problfrig	-.0180711	.0232889	-0.78	0.438	-.0637164 .0275743
tecnutri	.2414819	.4027499	0.60	0.549	-.5478934 1.030857
reproduo	1.504263	.5274338	2.85	0.004	.4705118 2.538014
_cons	-34.64322	12.08097	-2.87	0.004	-58.32149 -10.96494

Note: 5 failures and 0 successes completely determined.

Model B:

Logistic regression
Log likelihood = -18.044752
Number of obs = 91
LR chi2(8) = 83.11
Prob > chi2 = 0.0000
Pseudo R2 = 0.6972

programaquali	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ssec	3.291986	1.23154	2.67	0.008	.8782118 5.70576
cabeastrabalhadas	1.89546	.6801122	2.79	0.005	.5624647 3.228456
associaes	2.260496	.991355	2.28	0.023	.3174757 4.203516
invsanidade	.7865262	.3696832	2.13	0.033	.0619604 1.511092
invgen	-.5038071	.263601	-1.91	0.056	-1.020456 .0128414
invnutr	1.98431	.8197385	2.42	0.015	.3776521 3.590968
contrato	5.236055	1.805959	2.90	0.004	1.69644 8.77567
reproduo	1.31547	.4561032	2.88	0.004	.4215244 2.209416
_cons	-29.99583	10.16728	-2.95	0.003	-49.92333 -10.06833

Note: 1 failure and 0 successes completely determined.

Likelihood-ratio test

Likelihood-ratio test

(Assumption: _ nested in LRTEST 0)

LR chi2(2) = 1.33

Prob > chi2 = 0.5143

Ajustment quality test

Logistic model for programaquali, goodness-of-fit test

(Table collapsed on quantiles of estimated probabilities)

Group	Prob	Obs_1	Exp_1	Obs_0	Exp_0	Total
1	0.0000	0	0.0	10	10.0	10
2	0.0006	0	0.0	9	9.0	9
3	0.0024	1	0.0	8	9.0	9
4	0.0299	0	0.1	9	8.9	9
5	0.1005	0	0.6	9	8.4	9
6	0.3009	1	2.1	8	6.9	9
7	0.7427	4	4.8	5	4.2	9
8	0.9488	9	7.5	0	1.5	9
9	0.9995	9	8.9	0	0.1	9
10	1.0000	9	9.0	0	0.0	9

number of observations = 91
number of groups = 10
Hosmer-Lemeshow chi2(8) = 82.80
Prob > chi2 = 0.0000

VIF Test

. vif, uncentered

Variable	VIF	1/VIF
invnutr	17.56	0.056957
invsanidade	11.27	0.088760
invgen	7.87	0.127102
cabeastrab-s	6.22	0.160659
reproduo	3.91	0.255919
ssec	2.48	0.403796
associaes	1.93	0.517689
contrato	1.93	0.517901
Mean VIF	6.65	



Odds Ratio

Logistic regression

Number of obs = 91
LR chi2(8) = 83.11
Prob > chi2 = 0.0000
Pseudo R2 = 0.6972

Log likelihood = -18.044752

programaquali	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]
ssec	26.89623	33.12378	2.67	0.008	2.406592 300.5939
cabeastrabalhadas	6.655611	4.526562	2.79	0.005	1.754993 25.24065
associaes	9.587842	9.504955	2.28	0.023	1.373656 66.9212
invsanidade	2.195756	.811734	2.13	0.033	1.06392 4.531677
invgen	.6042259	.1592746	-1.91	0.056	.3604307 1.012924
invnutr	7.274027	5.9628	2.42	0.015	1.458855 36.26916
contrato	187.9273	339.3891	2.90	0.004	5.454497 6474.782
reproduo	3.726503	1.69967	2.88	0.004	1.524283 9.110394
_cons	9.40e-14	9.55e-13	-2.95	0.003	2.08e-22 .0000424

Note: 1 failure and 0 successes completely determined.

Specificity and sensibility analysis of the model

Logistic model for programaquali

Classified	True		Total
	D	~D	
+	29	3	32
-	4	55	59
Total	33	58	91

Classified + if predicted Pr(D) >= .5

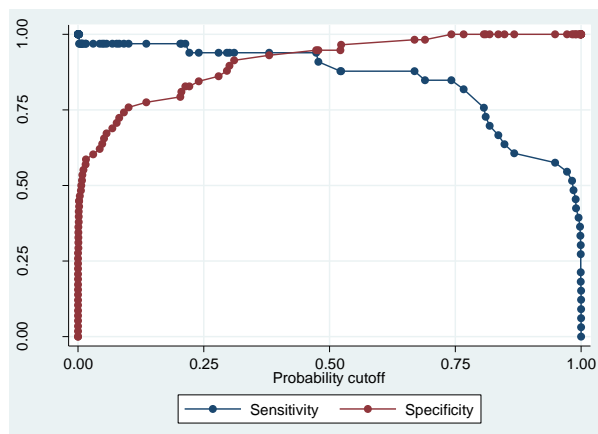
True D defined as programaquali != 0

Sensitivity	Pr(+ D)	87.88%
Specificity	Pr(- ~D)	94.83%
Positive predictive value	Pr(D +)	90.63%
Negative predictive value	Pr(~D -)	93.22%

False + rate for true ~D	Pr(+ ~D)	5.17%
False - rate for true D	Pr(- D)	12.12%
False + rate for classified +	Pr(~D +)	9.38%
False - rate for classified -	Pr(D -)	6.78%

Correctly classified	92.31%
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Sensibility Curv



Roc Curve

