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VERTICAL COORDINATION
BY CONTRACTS IN AGRIBUSINESS:
AN EMPIRICAL RESEARCH
IN THE HUNGARIAN DAIRY SECTOR

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Vertical Coordination by Contracts in Agribusiness: An Empirical Research in the Hungarian Dairy Sector

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SZABÓ G. GÁBOR – BÁRDOS KRISZTINA

**SZERZŐDÉSES VERTIKÁLIS KOORDINÁCIÓ AZ
ÉLELMISZER-GAZDASÁGBAN:
EMPIRIKUS KUTATÁS A MAGYAR TEJSZEKTORBAN**

Összefoglaló

A magyar mezőgazdaság üzemszerkezetének és vertikális koordinációs mechanizmusainak alapvető átalakulása, illetve az EU-csatlakozás számos kihívás elé állítja a tej termékpálya szereplőit. A hosszútávú szerződések rendszere egyrészt a megfelelő támogatás-elosztás, másrészt a hatékony marketingcsatorna működésének lenne a feltétele. A különböző termelői szervezetek, főként tejszövetkezetek, termelői csoportok, amelyek számos gazdasági és társadalmi előnyt jelentenek a termelők számára több országban, sajnos nálunk csak igen csekély számban és kezdetleges formában alakultak meg. A magyar tejszektor vizsgálata a tejpiacon – feltehetőleg az állami, illetve a magán koordinációs mechanizmusok működésének elégtelensége miatt - megfigyelhető válságok miatt aktuális. A kutatás alapvető célja a tejtermékpálya feldolgozó-termelők közötti szerződéses rendszerének vizsgálata, illetve a koordinációs mechanizmusok hatékonyságának elemzése volt. A kutatás alapját a hazai és nemzetközi szakirodalom áttekintése képezte, eredményeképpen átfogó képet nyertünk a tej termékpálya-elemzésekről, leírásokról, illetve megfogalmaztuk hipotéziseinket. A 7 hipotézis teszteléséhez nyílt és zárt kérdéseket tartalmazó kérdőívet állítottunk össze, amelynek segítségével - 2005. második negyedében - felmérést végeztünk a magyarországi tejtermelők körében. Összesen 300, zárt és nyitott kérdéseket tartalmazó kérdőívet juttattunk el a Tej Terméktanács segítségével.

vel postai úton a termelőknek, amiből 65 értékelhető kérdőív érkezett vissza. Az általuk nyert eredményeket strukturáltuk, elektronikusan rögzítettük, majd SPSS-szoftver használatához megfelelő formátumba konvertáltuk. Az adatbázist többváltozós adatelemzési technikáknak vetettük alá (klaszteranalízis, regressziós becslés, többdimenziós skálázás, stb.). A klaszterek számának eldöntéséhez hierarchikus klaszterezést alkalmaztunk. A kezdő klaszterek számának megadását a hierarchikus klaszterezés és a dendrogram eredményeire alapoztuk. Így az eszközspecifikus beruházás, ármeghatározottság és az alkupozíció bizonyult szignifikánsnak az esetek három részre osztásában, az irányítási struktúra szempontjából. Az egyes klaszterek főbb, elsősorban szerződéses szempontok szerinti tulajdonságait feltártuk. A csoportátlagok összehasonlítása alapján arra az eredményre jutottunk, hogy nincs eltérés a partnerváltás jellegét és számát illetően a teljes mintában, illetve az egyes alcsoportokban. Ettől eltérően, az adott bevőknek való értékesítés okai különböznek az egyes klaszterekben, a legfontosabb szempontok a megbízhatóság, az érvényes szerződés és a földrajzi közelség. A fenti, csoportképző változókat további vizsgálatoknak vetettük alá, így lineáris regresszió segítségével megvizsgáltuk ezen változóknak a szerződés időtartamára gyakorolt hatását. Az egyes változók t-értékeit figyelembe véve sem az eszközspecifikus beruházás, sem az alkupozíció, sem pedig az ár meghatározottsága nem játszott szerepet a szerződés időtartamának meghatározottságában. Mivel a szerződéses jellemzőkre alkalmazott változók ugyanazt az elméleti fogalmat mérik, ezért lehetőség volt számukat sokdimenziós skálázással csökkenteni. A skálázás célja a válaszadók közötti különbségekről információ nyerése, a dimenziók csökkentésével. Az illeszkedés jósága mind kettő, mind három dimenzió esetében jó, ezért úgy találtuk, hogy a szerződéses kapcsolatok jellemzésére alkalmazott hat változó számát kettőre, illetve háromra csökkenthetjük, anélkül, hogy az általuk hordozott információtartam sérülne.

Kulcsszavak: Szerződések, tejszektor, irányítási struktúra, vertikális koordináció, élelmiszer-gazdaság, termelői csoport, szövetkezés, tranzakciós költségek gazdaságtana, Magyarország

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**VERTICAL COORDINATION
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IN THE HUNGARIAN DAIRY SECTOR**

BY

SZABÓ G. GÁBOR – BÁRDOS KRISZTINA

Abstract

In some cases spot markets failure to govern to whole or a part of the marketing channel effectively and contractual relations are gaining more importance. It is especially true in case of agricultural markets, since these markets became more differentiated and market players are vulnerable in most of the cases. Examination of Hungarian dairy sector is an actual issue, so that one could understand how contractual systems work in the situation when crises appear thanks to governance insufficiency. Our research's aims are to present a theoretically structured framework of contracting arrangements of milk producers based on Transaction Cost Economics' (TCE) predictions and economics of contracting and an empirical analysis of the key determinants of governance structure between farmers and dairy processors in Hungary. The source of the research is a theoretical argument based partly on review of Hungarian and international literature on relevant market channels, economics of contracting and governance structures. These gave the theoretical determinants of testable propositions. In the framework of a postal survey in the second quarter of 2005 we carried out a survey among milk producers. A total of 300 questionnaires containing closed and open questions were sent out for milk producers, 65 of them could have been evaluated. The results have been structured, electronically converted for applying SPSS-software. The data base has been analysed by employing multivariate techniques (cluster analysis, linear regression, multidimensional scaling, etc). First, to be able to decide the number of clusters, we applied a hierarchical clustering. The formation

of starting clusters was made by giving the number of the future groups which based on hierarchical cluster method and dendrogram. Hence asset specific investment, price determination and bargaining power proved to be significant in dividing the cases into three groups focusing on governance structure. We revealed the main characteristics of clusters focusing on contracting attributes. Groups' means comparison obtains the result that there is no significant difference in partner change, neither in the whole sample nor in the sub-groups. Unlike from this, the reasons for selling to a particular buyer are different in the clusters, the most important factors are reliability, valid contract and the ones based on geographic reasons. The variables mentioned above were suitable for further investigations, so with the help of linear regression we attempted to see their effect on the contract period. Taking into consideration the t-values of the variables, neither asset specific investment and bargaining power, nor price determination have role in the explanation of contract period. Since the variables applied in the whole survey measure same theoretical concepts, we had the possibility to reduce their number by multidimensional scaling. The aim of this scaling is to gain information about the differences among the respondents reducing the dimensions of the variables. The goodness of fit was good in case of three and two dimensions, so we found that the six-dimensional space can be reduced into two or three dimensions without giving up the differences among cases.

Keywords: Contracts, dairy sector, governance structure, vertical coordination, agribusiness, producers' group, co-operation, transaction cost economics, Hungary

JEL Codes: Q13, L14, L22

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1. INTRODUCTION AND BACKGROUND

Vertical co-ordination has been an important topic in the agricultural marketing literature since the beginning of the industrialization of agriculture. Recent literature has distinguished two extreme co-ordination mechanisms: spot markets (external co-ordination) and vertical integration (internal co-ordination). Instead of discrete governance structures Peterson and Wysocki (1997) define the term of a vertical co-ordination continuum that moves from external mechanisms to internal mechanisms with three transitional stages (contracts, strategic alliances, formal co-operation) between two extreme polar forms. Since agricultural markets become more differentiated, open market transactions does not always prove to be the most appropriate form for the exchange of goods. Contractual relations are gaining more importance.

Crises in Hungarian dairy sector can be traced back to co-ordinational insufficiency:

1. *failure of public coordination means*: owing to permanent problems, state is forced to intervene by constituting additional legal rules (e.g. decree on loss reducing, etc.), whereas market coordination should prevent failures.
2. *unsatisfactory level of market coordination processes*:
 - lack or partial presence of cooperatives, producers' groups and other interest enforcing and bargaining organizations,
 - problem of market structure: failures of competition due to dominant and growing bargaining power of retail chains,
 - due to the lacking, non-suitable effect of high consumer prices on producers' prices, the production is ineffective, the income from dairy production is uncertain, therefore there is a lack of the necessary level of investments. These factors contribute to a further increase of costs which raises consumer prices, causing a lower level of consumption and so on.

Examination of crises appearing in Hungarian dairy sector is an actual issue, so that one could understand how contractual systems work in this situation.

The structure of the paper is organized as follows: *after introduction*, the *second section* sets the theoretical background and main research aims of the paper. *Section third* briefly reviews the literature with special respect on the economics of contracting and its linkage with TCE in the specific context of vertical co-ordination in agriculture. Dairy sector and its special features from the point of EU-accession are in the focus of *fourth section*, concentrating on transactions between milk producers and processors. Analytical framework for empirical analysis is set up in *section five*, illustrating the survey by its methods, questionnaire design, characteristics of the sample and key variables. *This section* also presents multivariate analyses with their methodological characteristics, containing descriptive statistical evaluation of variables applied. The section comprises main empirical findings and their interpretation in line with theoretical arguments. *Finally* we draw conclusions and outline some directions for further research.

2. THEORETICAL BACKGROUND AND MAIN RESEARCH AIMS

Our research's aims are to present a theoretically structured framework of contracting arrangements of milk producers based on Transaction Cost Economics' (TCE) predictions and economics of contracting and an empirical analysis of the key determinants of governance structure between farmers and dairy processors in Hungary. The main purpose of the paper is to analyse the effectiveness of co-ordination mechanisms from the importance of contracting practice and explain the latent dimensions of contract motivation under the condition of adopting EU-market environment. The *source of the research is a theoretical argument* based partly on review of Hungarian and international literature on relevant market channels, economics of contracting and governance structures. These gave the theoretical determinants of testable prepositions. After carrying out a *unique survey* - administrated by the authors in the second quarter of 2005 - the research could have been turned back to the questions how contracts are arranged, what kinds of diversifications exist in contracting practice and what are the driving forces behind the chosen governance structures. Primary importance was given of developing a model framework based on multivariate analysis technique, which enabled us to prove or reject our hypotheses, supporting a priori statements and theoretical presumptions by empirical proofs from the dairy sector.

3. SELECTED LITERATURE REVIEW ON TCE, VERTICAL CO-ORDINATION AND ECONOMICS OF CONTRACTS WITH REFERENCES TO AGRIBUSINESS

3.1 Basic characteristics of TCE

The new institutional economics and particularly TCE have renewed the neo-classical theory of corporate economics; this also led to the expansion of the transaction cost concept a way beyond corporate theory. The theory recognizes that the exchange processes create transaction costs and to minimize these costs adequate, supporting market institutions must be set up. There are many forms of market institutions and transaction costs, therefore the range of those mechanisms that coordinate the exchange of goods and services is fairly wide – starting from spot market (or wholesale market) via different contractual agreements to the total vertical integration that is called vertical coordination continuum by Peterson and Wysocki (1997).

TCE provides an appropriate frame and starting point for the following features: the explanation of vertical coordination forms; the exploration of reasons for the market participants' behaviour (e.g. Frank-Henderson, 1992; Loader 1997); the study of the efficiency of transactions within the given

institutional frames; the justification of the existence of economic institutions with a special focus on the enterprise (Williamson 1979; Kapás 2000).

One can differentiate two approaches within the transaction cost theory: *the governance approach and the measurement approach*. The similarity between these two concepts is that both attempt to identify those factors that influence the formation of distinct organizations resulting from the development of transaction costs. The professional literature dealing with the governance approach focuses on the characteristics of transactions, while the measurement approach literature concentrates on the costs of measuring product features.

3.2 Vertical integration and transaction cost theory in the food economy

What is the *reason for the applicability of TCE* in agriculture economy? As we have already mentioned, according to Williamson (1985) there are *three contractual features* influencing the size of the costs accompanying transactions: (1) transaction specific investments, (2) uncertainty accompanying the transaction, (3) frequency of transactions. Transaction cost theory is based on three behavioral assumptions: bounded rationality, opportunism, risk neutrality. In case of agricultural products/produce the most distinctive product feature is perishability. This fact implies several contractual risks, for example the opportunistic behavior of one of the contracting parties, or the so called hold-up problem that “comes up if one contracting party tries to exploit the other party’s vulnerability connected to his asset specific investments” (Royer, 1999 p.49.).

Transaction cost theory states that asset specificity and the closely related hold-up problem are the reasons for vertical coordination in the agriculture economy. When describing different marketing systems as characteristics of agriculture economy we can trace the topic of transaction costs, since costs are at the same time the causes for the formation of relation systems among different levels. The combination of the new institutional economics, the concept of total supply management, theories originating from marketing can be usefully applied in the study of agriculture marketing systems, especially when agriculture economy is driven by market forces instead of political decisions. Masten (2000, p. 190) says that the exploration of transaction costs illustrative of agriculture economy is still to be carried out.

In the agricultural economy, *TCE is basically used for analyzing two issues* (e.g. Aust, 1997; Banker-Perry, 1999; Boger, 2001; Hobbs, 1997; Loader, 1997; etc.): to study the *different forms of agricultural organization forms* and to provide *explanations for the causes of vertical coordination*. In the former case the question is in which circumstances which type of business organizations are dominant in a given country’s agricultural structure. As a specific example: why is the family farms the dominant business organization type in the agriculture in the industrialized countries (Szakál, 1993; Fertő-Szabó, 2003).

The second question *studies the different phases of vertical coordination*, namely the relations between the farmers, processors, as well as wholesalers and

retailers that are the total supply chain (Young-Hobbs, 2000). In the analysis of the causes for vertical integration apart from TCE the results of modern market theories (modern industrial organization) are also applied (Fertő, 1996). The application of TCE is becoming more and more popular in the empirical studies dealing with vertical coordination in agriculture (Frank-Henderson, 1992; Hobbs, 1996; Szabó, 2002).

3.3 Empirical studies on vertical co-ordination and transaction cost issues in agriculture

The industrialization of the agriculture economy and integration of certain supply chain levels greatly contributed to the spreading of tighter forms of vertical coordination. Hobbs (2000) claims that the above trend in agriculture moves shows different values in individual sub-sectors. The factors influencing transaction costs as defined by Williamson are applied to the agriculture sector in Hobbs' (2000) work. She argues that those transaction costs related to certain product features that are also directly influenced by economic regulations are determinant in vertical coordination. In accordance with Hobbs' reasoning it is evident that transaction costs bear relevance in agriculture, since if we relate Williamson's features to the agricultural sector (e.g.: uncertainty – perishability; weather; frequency – seasonality; specification – place of production, processing tools, etc.) they become even more valid.

Hobbs (1997) in her seminal paper analyzes those transaction costs variables that have a significant effect on the cattle-breeders' decision whether to sell deadweight, direct-to-packer or liveweight, live-ring auction ways. With the help of transaction costs economics Tobit's analysis seeks the answer to what influences the producers' decision in choosing one of the above-mentioned distribution channels in the United Kingdom and whether transaction costs have any impact on decision making.

With the help of multinomial logit model Boger (2001) analyzes the *Polish pig meat market's distribution channels and contracts* and identified the following contractual forms: none (63.2%), relational contract (23.6%), neoclassical contracts (13.2%).

Up to 2005 there have been only a limited number studies examining the problems of vertical coordination in the agriculture of transition economies (Bárdos 2003, 2004; Boger, 2001; Kopeva – Krusteva, 2002; Fertő-Szabó 2002, 2003, Fertő – Szabó – Bárdos, 2004; Juhász, 1999, Szabó M., 1999, 2000; Szabó – Fertő 2004a,b; 2004, Szabó M. – Tóth J. 1998).

Among other papers dealing with *vertical co-ordination issues of Hungarian dairy supply chain*, Szabó M. – Tóth J. (1998) examine market development and government policy in milk/dairy sector, giving an insight analysis into the organization of the whole supply chain, including a detailed (marketing) channel mapping.

Szabó M. (1999, 2000) analyzes vertical coordination of the dairy farms in Hungary, and he states that it is basically attained via price mechanism with the help of marketing contracts.

Recently, Fertő et al. (2005) deal with new the governing structure of milk/dairy sector and its policy issue consequences regarding small and medium entrepreneurs.

Popovics – Tóth (2005) analyse characteristics of the Hungarian dairy sector and its structural changes and examine price transmission mechanism of the Hungarian.

Kopeva – Krusteva (2002) examined the regulation and vertical connections of the *Bulgarian dairy sector* in the lights of the EU accession. They underlined that joining to the EU requires well developed market segments, which is particularly important in the dairy sector, which is one of the most important ones in Bulgaria.

Concerning other branches of agriculture, Bárdos (2004) examined the Hungarian beef sector and according to her results, on the basis of the models, it can be stated that the effects of certain transaction costs variables (bargaining power, information costs, negotiation costs, etc.) determine market decisions in a contradictory way and they are not significant in all cases. Her research results confirm the *importance of the role of transaction costs in the explanation of the behavior of the Hungarian beef sector*.

Fertő and Szabó G. G. (2002) with the means of multinomial logit model studied the justness of the hypothesis that examines whether transactional costs and asset specification play a role in choosing the given marketing channel in the *Hungarian fruit and vegetable sector*. The results of the model support the hypothesis. Certain transaction costs variables are significant in choosing the marketing channel and they create the empirical connection between the coordination based on price mechanism and the coordination “forced” by transaction costs.

There are papers dealing with the *role and use of contracts in the wine sectors* in Europe and worldwide. Fraser (2004) examines *wine grape supply contracts used in the main grape growing regions of Australia*. Lower quality regions place a greater reliance on grape quality assessment, higher quality ones place greater emphasis on explicit winery involvement and direction vineyard management.

Montaigne – Sidlovits – Szabó G. G. (2005) present and analyze *contracting relationships and contract design considering the economic transition and quality development in the Hungarian wine industry* throughout the most important wineries, wine and sparkling wine producers. They examine the partnership between wine growers and merchant enterprises with the use of transaction costs theory.

3.4 Definition, roles and types of contracts in agriculture

According to MacDonald et al (2004): “Agricultural contract” refers ... to contracts used to arrange for the transfer of agricultural products from farms to downstream users such as processors, elevators, integrators, retailers, or other farms.”(MacDonald et al, 2004: 3).

MacDonald et al (2004) argued that “Contracts may be seen as a device to limit price and income risks (*risk-sharing approach*), or they may be regarded as a means to reduce the cost of using spot markets to arrange transactions (*transaction-cost approach*).”

In our study we use the latter on focusing mainly transaction cost characteristics of vertical co-ordination and contracts.

Contracts can be structured to be able to exercise market power through restricting entry, limiting price competition and they may also facilitate discriminatory pricing (MacDonald et al, 2004).

The above authors define *four methods of organizing transactions* in the US:

1. spot (or cash) markets,
2. production contracts,
3. marketing contracts and
4. vertical integration.

Main elements of marketing contracts are: delivered quantities, product specification and compensations and quality control. It has a so called basic price formula as well. Production contracts contain assignment of responsibilities and products, compensation, contract length and delivered quantities. (MacDonald et al, 2004)

Based on the contractual features (Williamson, 1985) *classical, neoclassical and relational contracts* can be distinguished depending the possibility to renegotiate the whole or at least parts of the contracts. Marketing contracts show the features of classical contracts, but – depending on contract period – neoclassical characteristics can also appear.

Contracts can be categorized as *informal* (oral or handshaking) or *formal* (written) agreements. In case of strong social capital and cultural heritage, as well as stable legal environment, oral negotiations work fine.

One can distinguish contracts according to its term. Basically short, medium and long term contracts can be found in the agriculture. The length of the contract period depends on the volume of milk delivered, bargaining power of the producer and also the regulation by the state. In case of longer the contract period and tighter collaboration relational contracts are taking place.

Based on conditions fixed in a certain contract, we distinguish in Hungarian practice marketing (price, quantity, quality, term of delivery are fixed), productions contracts (up to a certain degree they regulate the production process as well), pre-financing or input-supplying contracts (buyer provides seeds, etc) and general or so-termed framework contracts (containing only general data, so it can rather considered as a declaration of intent).

Because of the circumstances (lack of trust and bargaining power on behalf of the producers etc.) in Hungary, most of the agreements are written contracts. Despite that fact, processors often arbitrarily change terms of contracts using their power and cause hold-up problems for the producers, who have relation-specific investments. Producers' organization (producers' groups, co-operatives etc.) can be solutions and increase bargaining power in a number of cases, at least as marketing tools.

4. **BRIEF DESCRIPTION OF THE EU AND HUNGARIAN DAIRY SECTOR**²

Dairy production is the foremost agricultural activity of EU, accounting for around 18% of the total value of the Community agricultural output. Since Hungary is full member of the EU, *milk and dairy products are part of the common market organisation*. Regulation, which comes into force in 1968, is unified and compulsory for each member state. *EU dairy sector can be characterised by close vertical coordination*, 66% of sales occur in the frame of some kind of contracts. Sales via cooperatives exceed 70%, but this differs in the member states. Support system presumes a well-operating marketing channel without malfunctions, which should be primarily established by effective coordination among market actors, partly by the cooperation of those with same

² Much more information and detailed analyses on the Hungarian dairy sector and its market development can be found in Szabó –Tóth (1998), Szabó M. (1999, 2000), Babella - Matóczy - Mile (2003), Szakály (2003), Fertő et al. (2005), Popovics – Tóth (2005) etc.

interest (e.g. cooperatives), partly by appropriate market operation. Instead of perfect competition, this market shows oligopolistic characteristics.

Import milk has an increasing market share. Most of the milk delivered to processing companies is belong to extra quality, but more and more small producers, failing to meet the high quality requirements sell their milk on the black or grey market. Table 1 contains data on the development of raw milk producer prices since 2000.

Table-1. Main data on sale of extra raw milk

	2000	2001	2002	2003	2004
Extra quality raw milk producer price - (HUF/kg)	63.72	68.83	70.72	70.20	62.46
<i>Quantity of extra quality raw milk purchased by processors (1000 liter)</i>	1, 415,789	1,478,045	1,469,281	1,517,654	1,517,513

Source: <http://www.tejtermek.hu/statisztika>

Hungary's EU accession has fundamentally affected the national quota handling and its institutional background. Domestic reference quantity is

1,947,300 t. In Hungary 90% of the total production based on dairy quota took place in some kind of contractual format.

Hungarian milk farms can be classified into three main groups from the point of concentration, technology, number of employments and heads/stock. Basic elements of market organization of milk and milk products are: intervention prices, quota system, supplementary state supports, quantitative regulation, producers' loss reducing support, etc. From the aspect from this paper it is important, that only the quota, as element of the regulation affects the producers, intervention and buying up affects them only indirectly, through the processors.

5. EMPIRICAL RESEARCH ON VERTICAL CO-ORDINATION BY CONTRACTS OF THE HUNGARIAN DAIRY SECTOR

5.1 The survey and the sample³

For the reason of investigating producers-processors contracting characteristics, a questionnaire was designed and data were collected from Hungarian milk producers covering each county. The aim was to obtain a database so that proxy variables could have been constructed. Survey data contain of nominal, ordinal, interval scales matching the corresponding theoretical indicator best. After sending out a total of 300 standardized questionnaires, the size of sample to be

³ Concerning size of the paper, Appendix 1 contains detailed tables of descriptive statistics.

evaluated was 65. 1900 members of the Hungarian Dairy Product Council served as a data base for postal survey, cutting the upper and lower 10% considering the quantity of the quota. The questions in questionnaires were classified into six groups, with special respect on economics and practice of contracting. The preparation of the survey was supported by the Hungarian Dairy Product Council so practical obstacles and inaccuracies might have been prevented. *A total of 84 variables have been applied.* The key measures were statistically evaluated. In order that we could study more than one phenomenon together we primary focused by the means of cross tabulation in descriptive statistics on marketing channels, bargaining power, determination and length/period of the contract. In the descriptive statistical analysis we primarily focused on the transactional relation between producers of milk and dairy processors. Uniformity is typical of the geographical distribution of the respondents. The response rate was 21.7%. The highest response rate was noticed in County Békés (10.8% of questionnaires come back from here), the second was County Győr-Moson-Sopron (9.2%), than County Fejér come with 7.7%. The lowest response rate was registered in County Jász-Nagykun-Szolnok, where from only 1 questionnaire suitable for evaluation come back. Equal distribution is typical in case of the addresses of producers.

Average stock of cows held by farmers participating in the survey was approximately 57; however particular values move between wide margins, the biggest farm has 643 cows. Similar standard deviation can be found in the case of quantity of milk sold, which average value in the sample was approximately 57,000 kg. The maximum volume of milk sold was 2,128,170 kg.

Most of the farmers examined are full time employees; the average number of workers is 11.4. The sex of the respondents is in most of the cases male; their average age is 38.5 year. They have got intermediate qualification. None of the respondents have lower qualification than skilled worker. The sociological characteristics of the sample are summarized in Table-2.

Table-2: Sociological characteristics of the sample

	Full /part time job	Number of employees	Sex	Age	Education
Reference interval	1: full time job 2: part time job	own value (persons)	1: male 2: female	own value (year)	7: university 1: lower than elementary school
Mean	1.06	11.34	1.19	38.46	4.69
Dispersion	0.235	22.329	0.393	21.16	1.749
Median	1	4	1	44	4.00
Minimum	1	1	1	30	2
Maximum	2	144	2	68	7

5.2 Multivariate analysis

5.2.1 Propositions in connection with governance structure

We applied three variables in order to separate governance structures: asset specific investment specified selling price and the characteristics of bargaining power. Table-3 demonstrates the presumed results of the organizations of milk transactions if we take into account the determinants asset specific investments, specified selling price and bargaining power and their effect on the change of governance structure.

Table-3: Predictions on milk transaction features with special respect on governance structure

Governance structure	Asset investment	specific	Specified price	selling	Bargaining power
Spot market	No		No		No
Neoclassical contract	Yes				Yes
Relational contract	Yes		Yes		Yes

Based on Table-3 we employed three variables in order to test groups in the case of milk transactions. We assumed that concerning applied governance structure, the sample can be divided into homogeneous subgroups. We employed the following key variables:

INV_ASS (40): Have you invested in milk production in the last five years? (yes-no)

BARG_PR (28): Do you have any influence on selling price? (1-5)

CONC_PR (16): Is the selling price specified in the contract? (yes-no)

Hierarchical clustering

We applied cluster analysis, as a confirmatory analysis to reveal hidden structures in the sample on basis of theoretical consideration. i.e. how to *organize* observed data into meaningful structures. Cluster analysis is an exploratory data analysis tool which aims at sorting different objects into groups in a way that the degree of association between two objects is maximal if they belong to the same group and minimal otherwise. Given the above, cluster analysis can be used to discover structures in data without providing an explanation/interpretation. In other words, cluster analysis simply discovers structures in data without explaining why they exist.

The ranking was done on observed units. First to decide the number of clusters we applied a hierarchical clustering, the concrete reduction was performed by the furthest neighbor method. The reason for choosing this method was to obtain relatively closed clusters that are we wanted group elements to be very close to each other. The distance of the elements was defined by quadratic Euclidean distance method. It was chosen because we wanted the distance differences to be more emphatic due to squaring. The reduction process is shown in a dendrogram. This procedure is appropriate for explorative purposes and with the help of the dendrogram we can paraphrase our hypothesis relating to sample groups:

***Hypothesis-I:** We can put farmers participating in homogeneous milk transactions into three, significantly different subgroups from the point of governance structure.*

To test our hypothesis we used a non-hierarchical cluster procedure among which the partitioning methods creating disjunctive clusters are the most frequent ones.

Non-hierarchical clustering

The formation of starting clusters was made by giving the number of the future groups, which was based on hierarchical cluster method described above. With the help of this we tested our hypothesis concerning the number of clusters (*hypothesis I*) and the role of employed variables gathering governance structures in grouping the sample, i.e.:

***Hypothesis-II:** Variables regarding governance structure (asset specificity, bargaining power and contract determination) have a significant role in grouping/categorizing farmers in participating survey from the point of governance structure.*

As a first step we employed all the three variables in clustering and by F-test convinced us about the significance of the individual variables in grouping. Anova-table illustrates the results of F-test and their significance ($p < 0.05$). So this confirms our *hypotheses I and II* from the sub-group perspectives, i.e. three homogenous subgroups can be formed by the means of governance structure's variables.

Table- 4: ANOVA-table on the role of variables in subgrouping

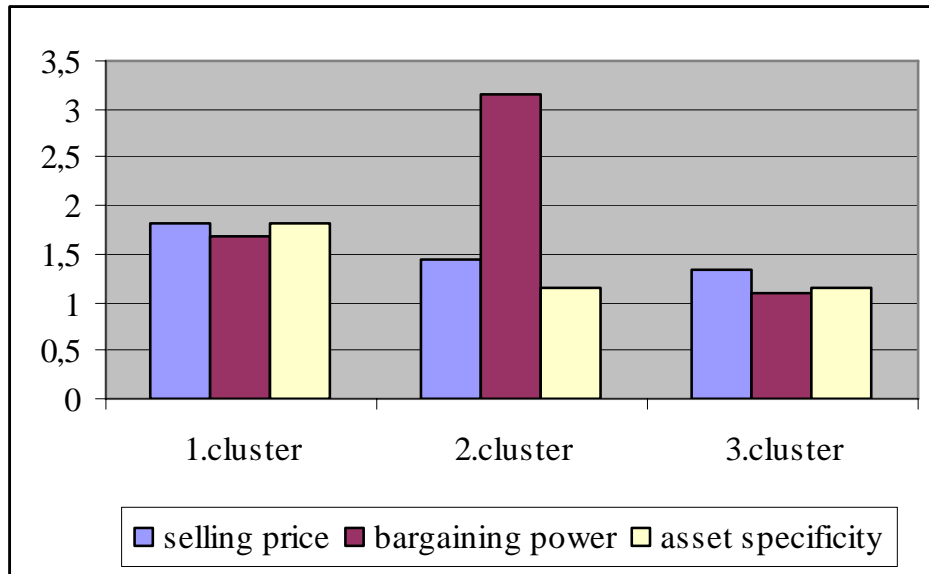
	F-test	Significance
CONCR_PR	5.4	0.007
BARG_PR	112.504	0.000
INV_ASS	16.281	0.000

Table-5: Statistical characteristics of clusters on basis of grouping variables

Variables and statistical indeces		1.cluster (n=12)	2. cluster (n=7)	3. cluster (n=45)
Contract: specified selling price (1: yes, 2: no)	mean	1.83	1.43	1.33
	median	2	1	1
	dispersion σ	0.89	0.535	0.477
Bargaining power (1: no bargaining power, 5: always have bargaining power)	mean	1.67	3.14	1.09
	median	2	3	1
	dispersion σ	0.492	0.378	0.288
Asset specific investment (1: yes, 2: no)	mean	1.83	1.14	1.16
	median	2	1	1
	dispersion σ	0.389	0.378	0.367

A low level of bargaining power characterizes the *first cluster* (n=12). A relatively low value of the specified selling price shows that the contracts signed by the members of this group do not contain fixed selling price. Simultaneously, hardly any investments in specific assets have been made. *Second cluster* (n=7) can be described by the high level of asset specific investment and strong bargaining power. The contracts specify selling prices in most cases. In spite of the high level of asset specific investment, extremely low bargaining power characterizes the largest *cluster* (*third*, n=45). The selling price is defined and included in the contract.

Figure-1: K-means clusters in the sample

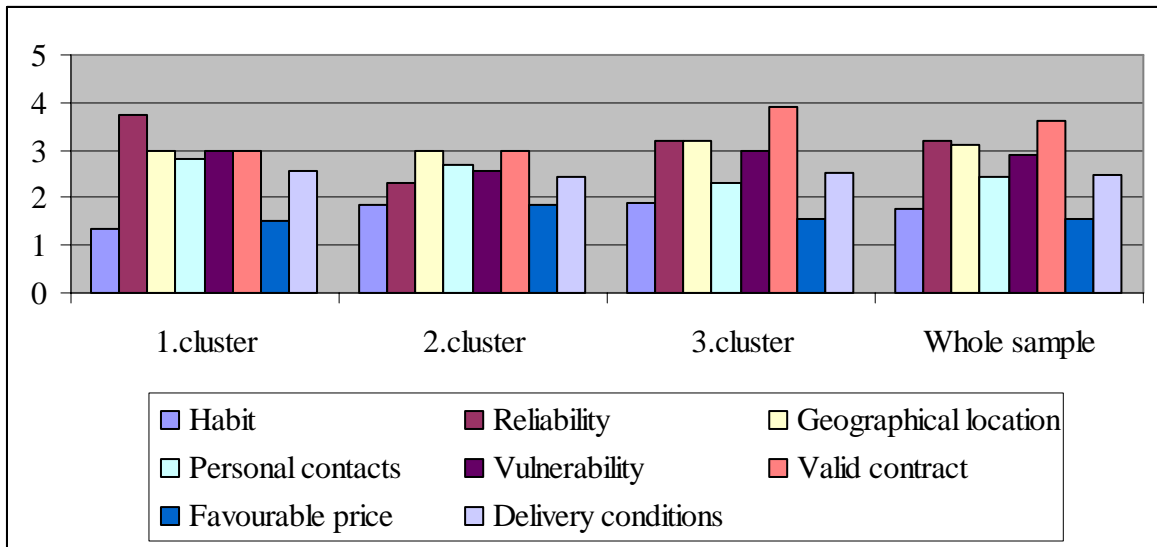


Next phase of our investigation is the exploration of selling reasons, within the clusters and in the whole sample, too. We applied a scale containing five different grades (1: not true, 5: totally true) to measure the reasons of selling. At cluster reliability, at cluster two geographical location, while at cluster three valid contracts have been proven the most empathic reasons for selling.

Table-6: Reasons for selling at individual cluster

Reasons for selling (1: not true 5: true)	1.cluster	2. cluster	3. cluster	Whole sample
Habit	1.33	1.86	1.89	1.77
Reliability	3.75	2.29	3.18	3.18
Geographical location	3.00	3.00	3.20	3.11
Personal contacts	2.83	2.71	2.31	2.43
Vulnerability	3.00	2.57	3.00	2.92
Valid contract	3.00	3.00	3.91	3.60
Favourable price	1.50	1.86	1.56	1.57
Delivery conditions	2.58	2.43	2.51	2.49

Figure-2: Reasons for selling at individual clusters



Our next hypothesis (III) to be tested says that the reason of partner change is the same in subgroups as in the total sample. (1: no partner change 5: very often change from 1995). After comparing intraclass and interclass means we found our hypothesis to be proven, so there is no difference in the in the frequency of partner change in the whole sample and in sub-samples.

	means
1st cluster:	1.25
2nd cluster:	1.57
3rd cluster:	1.33
Whole sample:	1.34

Linear regression on the variables of governance structure

With the help of linear regression we attempted to see the effect of significant group forming variables on contract period. The expected impact of variables having role in the formation of subgroups is summarized in *hypothesis IV*:

Hypothesis–IV: *Variables having a role in the formation of the subsample structure significantly influence the contract period.*

First we examined the goodness of fit by the mean of coefficient of determination which shows the tightness of correlation.

$$R=0.233 \text{ and } R^2=0.054$$

Considering the value of coefficient of determination, only 5% the variance of contract period is explained by the variables applied. The variables compressing governance structure indicators indicate that none of the variables have been proven to be significant. Test statistics and parameter estimations indicates (Table-7) that the hypothesis that these variables have significant role in determining contract period can be rejected at 0.05 percent significance level.

Table-7: Parameter estimation with linear regression

Variables	Standardized coefficient β	t- values	significance
Constant		9.006	0.000
CONCR_PR	-0.051	-0.406	0.686
BARG_PR	0.181	1.424	0.160
INV_ASS	-0.143	-1.128	0.264

Note: contract period is the dependent variable

5.2.2 Propositions in connection with contract characteristics

We applied a great number of variables in the survey in order that we could captivate the main factors influencing governance structure and contractual

features. In this phase we attempted to reduce the number of variables and set up *hypothesis V*, which says:

Hypothesis-V: *space composed by the whole set of variables of contracting features can be reduced to two or three dimensions and respondents can be separated on basis of the reduced dimensions.*

As previously demonstrated we applied 84 variables to measure governance structure characteristics and contract features. Since these variables measure the same two or three theoretical concepts, therefore there is an opportunity to reduce their number without giving up the results they compress.

By multidimensional scaling which has an explorative nature (Kovács, 2003) we gained information about the differences between the respondents on basis of applied contract. From a non-technical point of view, the purpose of multidimensional scaling (MDS) is to provide a visual representation of the pattern of proximities (i.e., similarities or distances) among a set of objects. The degree of correspondence between the distances among points implied by MDS is measured (inversely) by a *stress* function⁴. Our aim is to create an objective scale in a reduced-dimension space, i.e. the representation of the cases in a lower

⁴ $S = \frac{\sum_{r < s} (d_{rs} - d_{rs}^*)^2}{\sum_{r < s} d_{rs}^2}$. $S < 0.05$, goodness of fit is good, while $S > 0.20$ goodness of fit is satisfactory.

dimension space than the original, six-dimension space. In case of two or three dimensions the goodness of fit is good:

$$S_{3 \text{ dimensions}}=0.033$$
$$S_{2 \text{ dimensions}}=0.001$$

The following key variables form the original, six-dimension space and they are involved in MDS:

DEF_TIM:	Is the contract time defined?
CONTR_TIM	How long is the contract period?
CONTR_VAL	Since when is the contract valid?
CONCR_PR	Is the selling price specified?
CONCR_QU	Is the quantity to be sold specified?
CONCR_DEL	Are they days of delivery specified?

It is rather difficult to demonstrate in three-dimensional space the natural structures, so we illustrated it in two dimensions. There are two things to look for in interpreting an MDS picture: clusters and dimensions. Clusters are groups of items that are closer to each other than to other items. Dimensions are item attributes that seem to order the items in the map along a continuum. The axes are, in themselves, meaningless and the orientation of the picture is arbitrary. Figure-3 depicts the groups clearly can be isolated in the new, three-dimensional space, so we accept our *hypothesis V*.

Figure-3: Respondents location in three dimensions on the scatterplot derived by MDS

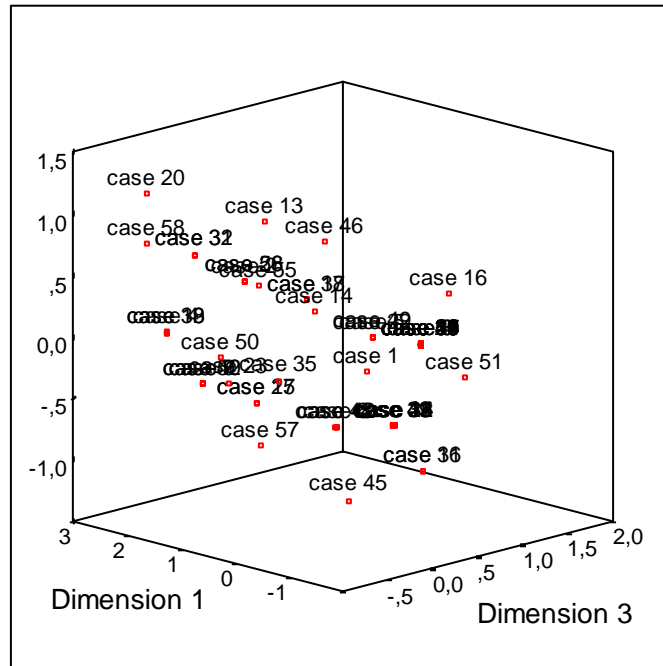
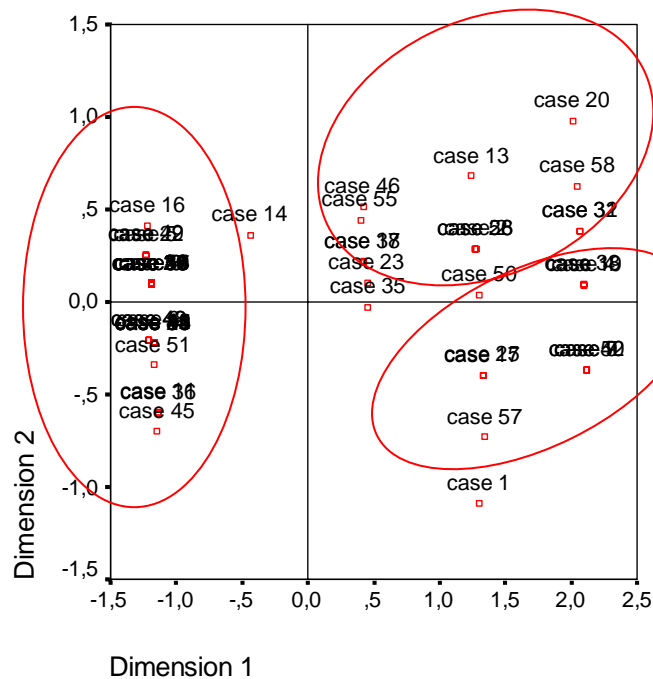


Figure-4: Result of MDS employing Euclidean distance calculation



We applied linear regression to test our last hypothesis, which captures the correlation between contract features and bargaining power.

Hypothesis – VI: *Change in bargaining power can be explained by the variations of contract features.*

Table-8 summarizes the results of linear regression.

Table-8: Parameter estimation by linear regression for the correlation between contractual relationships and bargaining power

Variable	Standardized coefficient β	t-value	Significance
Constant		1.638	0.107
DEF_TIM	-0.96	-0.684	0.497
CONTR_TIM	-0.68	-0.445	0.658
CONTR_VAL	-0.146	-1.001	0.321
CONCR_PR	-0.158	1.065	0.292
CONCR_QU	0.46	0.319	0.751
CONCR_DEL	0.017	0.124	0.902

Depending variable: bargaining power

Since t-values and significance levels show that none of the variables can be taken into consideration when we try to explain the variations in bargaining power, we reject our *hypothesis VI*. After that we tried to reveal any relationship between bargaining power and the volume of sold milk. Our *hypothesis VII* captivates this contact:

Hypothesis-VII: *The volume of sold milk has a positive, significant effect on bargaining power.*

Table-9. Relationship between the volume of sold milk and bargaining power

Variable	Standardized coefficient β	t-value	Significance
Constant		15.036	0.000
QUANT	0.224	1.792	0.078

Note: depending variable: bargaining power

On basis of parameter estimation one can see that the higher is the volume of milk sold, the better is bargaining power in determining contract conditions. We have to point out the role of cooperatives, producer groups in integrating small, individually week agricultural units. The development of market countervailing power – even regionally - through the disposal of the milk collected by the cooperatives can results in transformation towards free market competition (radiating price effect). This might promote the raise of members' income.

6. CONCLUSIONS

Our survey has contributed to the interpretation of contracting practice and governance arrangements between Hungarian milk producers and processors under the conditions of emerging a high quality market. Some advanced predictions of contract theory and transaction cost economics have been hypothesized and empirically tested by an overall survey in Hungarian dairy sector. Different methodological tools in the framework of multivariate analysis provided qualitative base to the explanation of the focal research questions. Cluster analysis delivers distinguishing results since we learned that different contracting practices co-exist depending on transaction characteristics in spite of the strictly regulated legal environment. The following table summarizes main hypotheses, methods used and results of the empirical research.

Table-10: Summary of results and methods employed

		Hypotheses	Methodology	Result
Governance structure	I.	We can put farmers participating in homogeneous milk transactions into three, significantly different subgroups from the point of governance structure	non-hierarchical clustering	✓
	II.	Variables regarding governance structure (asset specificity, bargaining power and contract determination) have a significant role in grouping/categorizing farmers in participating survey from the point of governance structure.	K-means clusters, F-tests	✓
	III.	The reason of partner change is the same in subgroups as in the total sample	K-means clusters, comparing means	✓
	IV.	Variables having a role in the formation of the subsample structure significantly influence the contract period.	linear regression	X
Contract features	V.	Space composed by the whole set of variables of contracting features can be reduced to two or three dimensions and respondents can be separated on basis of the reduced dimensions.	multidimensional scaling	✓
	VI.	Change in bargaining power can be explained by the variations of contract features.	linear regression	X
Cooperatives	VII	The volume of sold milk has a positive, significant effect on bargaining power.	linear regression	✓

We found to be proven that enhancing economic strength through building up countervailing power also raises the level of bargaining power regardless of the cluster membership. Producers' organisations, especially dairy co-operatives and producer groups mean a lot of economic (e.g. strengthening bargaining position) and social advantages (e.g. securing a great degree of independence of farmers) for producers in a great number of countries Unfortunately only a few and only in a very embryonic form have been set up in Hungary so far. The findings show how contracting arrangements can be segmented by asset specific

investments, bargaining power and price determination. Our results might be able to help some market and state institutions to differentiate policy design from reasonable theoretical assumptions with special respect of heterogeneous producers caused by transactional background and economic practice.

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8. APPENDIX-1: DESCRIPTIVE ANALYSIS OF THE SAMPLE

Figure-5: Number and rate of marketing channels in the sample

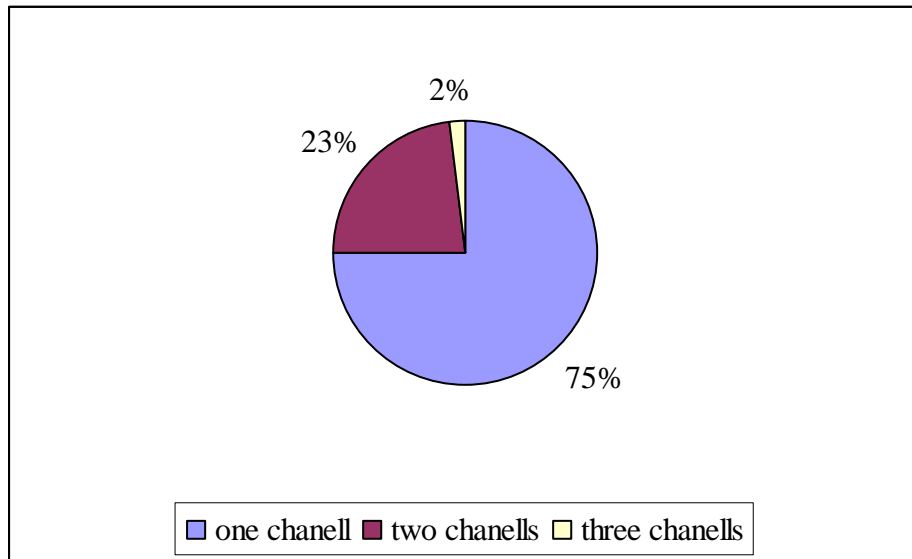


Table-11: Characteristics of contract length

Definition of contract period	Period of contract	
	one year contract	multi year contract
defined period	48	12
undefined period	0	1

Figure-6: Validity of contracts

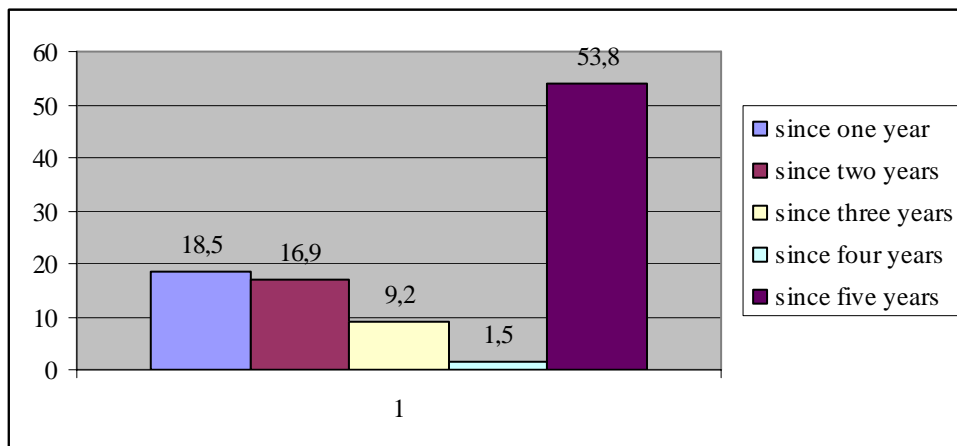


Table-12: Contract specification and flexibility

	Is the contract specified in terms of				Any quantitative difference allowed?
	Price of the raw milk	volume to be sold	day of delivery	date of delivery	
mean	1.44	1.08	1.22	1.38	1.78
median	1	1.00	1	1	1
dispersion	0,5	0.27	0.419	0.490	0.865
1	56%	92%	78%	62%	50%
2	44%	3%	22%	38%	22%
3	-	-	-	-	28%
reference interval	1:yes 2:no				1: < 10% 2: 10% 3: > 10%

Table-13: Relationship between bargaining power and price premium

		Bargaining power(v22) (1:bad 5: excellent)				Total	
		1	2	3	4		
Price premium (v28) 1: yes 2: no	1	Number of responds	13	2	2	1	18
		% of v22	72.2%	11.1%	11.1%	5.6%	100%
		% of v28-	28.3%	16.7%	33.3%	100%	27.7%
		% total	20.0%	3.1%	3.1%	1.5%	27.7%
	2	Number of responds	33	10	4		47
		% of v22	70.2%	21.3%	8.5%		100%
		% of v28-	71.7%	83.3%	66.7%		72.3%
		% total	50.8%	15.4%	6.2%		72.3%
Total	Number of responds	46	12	6	1	65	
	% of v22	70.8%	18.5%	9.2%	1,5%	100%	
	% of v28-	100%	100%	100%	100%	100%	
	% total	70.8%	18.5%	9.2%	1,5%	100%	

Table-14: Relationship between change of partners and its difficulty

		Difficulty of partner change (v34) (1:very easy 5: very difficult)					Total	
		1	2	3	4	5		
Number of partner change (v33)	1:	Number of responses		2	4	13	8	27
		% of v33		7.4%	14.8%	48.1%	29.6%	100%
		% of v34		66.7%	44.4%	59.1%	53.3%	55.1%
		% total		4.1%	8.2%	26.5%	16.3%	55.1%
no partner change	2:	Number of responses		1	5	9	7	22
		% of v33		4.5%	22.7%	40.9%	31.8%	100%
		% of v34		33.3%	55.6%	40.9%	46.7%	44.9%
		% total		2.0%	10.2%	18.4%	14.3%	44.9%
Total		Number of responses		3	9	22	15	49
		% of v33		6.1%	18.4%	44.9%	30.6%	100.0%
		% of v34		100.0%	100.0%	100.0%	100.0%	100.0%
		% total		6.1%	18.4%	44.9%	30.6%	100.0%

Table-15: Reason for selling

Reason for selling (1: not true 5: perfectly true)	Whole sample
Habit	1.77
Reliability (2)	3.18
Geographical location (3)	3.11
Personal contacts	2.43
Vulnerability	2.92
Valid contract (1)	3.60
Favourable price	1.57
Delivery conditions	2.49

Table- 16: Answers regarding investment

	Have you in the last five years		Do you intend to invest in	
	<i>asset specific investment?</i>	<i>relation specific investment?</i>	<i>the next year?</i>	<i>the next five years?</i>
mean	1.28	1.57	1.52	1.35
median	1	2	2	1
dispersion	0.451	0.499	0.504	0.481
reference interval	1:yes 2:no			

Figure-7: Difficulty of obtaining information

