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# Contractual relationships in the Hungarian milk sector

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## Abstract

**Purpose** – The purpose of this paper is to analyse farmers' contracting choice in the Hungarian milk sector, employing transaction cost economics framework.

**Design/methodology/approach** – The authors focus on some key determinants of farmers' contracting choices using milk producer survey data. Different semi parametric and semi non parametric discrete choice models are applied to investigate the type of contracts, duration, number of contractors, incentives provided in the contract and business history of farmers and buyers.

**Findings** – Main results confirm that contract-specific investment is a strong predictor explaining contract choice and contract design. Although trust is an important factor, the authors' estimations however report some counterintuitive results. Farm size is also significantly associated with contracts and contractual arrangements. Vulnerability to opportunistic behaviour also depends on partner change switching costs and farmers' bargaining power.

**Originality/value** – This is a recent study that investigates the role of contracts between producers and processors, significantly contributing to the limited literature on contractual relationships in transition agricultures.

**Keywords** Transaction costs, Contracts, Agriculture, Milk, Milk products, Hungary

**Paper type** Research paper

## 1. Introduction

There is a wealth of literature on the role of contracts in agri-food chains. Most theoretical and empirical research however focuses on developed countries' agriculture (e.g. Bogetoft and Olesen, 2002; Goodhue *et al.*, 2004; Fraser, 2005; Fernández-Olmos, 2008) whilst studies concentrating on the role of contracts in Eastern European transition agriculture are limited (Fertő, 2009). It is usually assumed, that in transition countries public institutions are ineffective when it comes to ensuring contract enforcement, while price systems are generally still inefficient. The absence of enforceable contracts longer term business relationship between farmers and food processors or retailers has become extremely difficult. Therefore, finding new long-run partners, for relation-specific investments has been associated with high transaction costs for market players. In those sub-sectors where any type of production contracts does exist, agricultural producers face hold-up problems (e.g. delayed payment for delivered products, or *ex post* price reduction by retailers). Although food processors and retailers have significant market



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power, they also struggle to establish long-term relationships with farmers. Given this legal environment, one should expect that contracting parties would not rely on formal contracts, but rather to be preferred to oral agreements or spot markets.

The aim of this paper is to identify and explain farmers' contract choice and contract design among various supply channels in transition agriculture by examining the Hungarian dairy sector using survey data. Applying discrete choice models, we present an empirical analysis of the key determinants of contracting choice based on transaction cost economics (TCE). The remainder of the study is organised as follows. The second section briefly reviews the literature on transaction cost economics and its implications on contracts, while section 3 provides an overview on the Hungarian dairy sector. Survey design and the variables are described in section 4, while results are presented in section 5. The last section summarises and offers some conclusions on the implications for the market mechanisms of Hungary's milk sector.

## 2. Transaction costs theory and contracts

The theoretical framework for the analysis of the various aspects of producer – buyer (processor or retailer) relationships can be divided into two groups. The first approach is contract theory; the second one is based on the transaction cost economics. Transaction costs economics (TCE) claims that firm's vertical boundaries decisions are determined by characteristics associated with efficiency of the chosen form of organisation (Williamson, 1985). Williamson (1991) identifies three alternate forms of transaction governance: market, hybrid and hierarchy. The core prediction of the TCE is that the governance mode (market, hybrid and hierarchy) that minimises transaction costs is the preferred option. Transaction costs include the costs of negotiating and writing contracts and the costs of monitoring and enforcing contractual performance. The theory focuses on identifying the characteristics of transactions that are best suited to a particular governance mode. The principal attributes of transactions, according to TCE are asset specificity (AS), uncertainty (U) and frequency (F). Together, these three attributes determine the following relationship (Ménard and Valceschini, 2005) – signs show the predicted impact of a positive variation of each characteristic on transaction costs:

$$TC = f(AS, F, U) \quad (1)$$

The main general hypotheses of TCE in the relevant empirical literature are the following. First, as asset specificity increases, hybrids and hierarchies become preferred over markets. Second, when asset specificity is present to a considerable degree, uncertainty raises the transaction costs associated with market governance. Third, when both asset specificity and uncertainty are high, hierarchy is the most cost-effective governance mode.

The various aspects of contracts, including contract decision, duration and contract design are also central theme in the TCE (Lyons, 1996). However, the structure of contractual agreements may vary with the objectives of the contracting parties, underlying production relations, and the nature and size of informational and strategic impediments to contract formation and enforcement. As a consequence, the theory provides no unique structure for the specification and testing of contract design hypotheses (Masten and Saussier, 2000). But previous theoretical and empirical research provides some testable hypotheses. Contracts include the costs of writing,

enforcement, and potential inflexibility, therefore in the absence of sufficient benefits, these costs may be a deterrent to formal contracting. The main insight of TCE is that the benefits of writing a contract should depend positively on each trading partners' vulnerability to opportunistic behaviour. Frequently tested hypotheses on contract choice in empirical TCE literature are as follows:

*H1.* The likelihood of formal contracting increases with value of specific investments.

It should be mentioned however, that writing a formal contract does not depend exclusively on the asset specificity. Lyons (1994) emphasises some other factors influencing contract choice, detailed in the following hypotheses:

*H2.* The size of firms will be positively associated with the propensity to write formal contracts. Large firms can easier bear the costs of writing a formal contract, since they can spread the overhead of employing legal specialists.

*H3.* Trust is negatively associated with the formal contract. The greater the expectation that trade will continue in the future, the less reliant a contractual relationship will be on legal enforcement. Non-legal enforcement requires the incentive of expected future profits. If partners trust each other, there will be less need to sign a formal contract.

The vulnerability of a trading partner to opportunistic behaviour is closely related to asset specificity. The exposure of opportunism however, may have some other dimensions including the partner change switching costs and bargaining power of players. Thus, we add the following two hypotheses to our analysis:

*H4.* The likelihood of formal contracting increase with value of switching costs of trading partner.

*H5.* The likelihood of formal contracting decreases with level of bargaining power.

*H1* can be extended to the various aspects of contract design including duration, contract complexity, business history (length of contractual relationships). More specifically we are interested on the impact of asset specificity on contract design. Thus:

*H6.* The likelihood of the long-term contractual agreements increases with the value of relationship-specific investments.

*H7.* Increasing asset specificity leads to more complex contracts between partners.

Similarly, we may apply *H3-H5* for duration, contract complexity, and business history:

*H8.* Higher level of trust is positively associated to long term contracts and contractual relationships.

*H9.* The likelihood of complex contracts is decreasing with higher level of trust.

*H10.* The higher the switching costs, more likely to observe long term contracts and contractual relationships.

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- H11.* The higher the switching costs, more likely to observe increasingly complex contracts.
- H12.* The higher level of bargaining power, the less likely to observe long term contracts and contractual relationships.
- H13.* The higher level of bargaining power, the less likely to observe more complex contracts.

However, the extension of *H2* to contract design is less unambiguous, thus we do not have a priori expectations.

### 3. Dairy sector in Hungary

After the fall of the socialist economic system, restructuring process in the Hungarian dairy sector began. One of the most notable phenomena was an exceptional decrease of the number of dairy farms. In the 1995-2007 period, the number of dairy farms in Hungary decreased by 59 per cent leaving approximately 7,500 dairy farms in the sector. The fall in the number of dairy cows was an immediate consequence. The cow stock dropped from almost 500,000 in 1992 to 323,000 in 2007. Now, Hungarian raw milk production amounts to roughly 1.8 billion litres (around 180 litres *per capita*). In Hungary, milk is predominantly produced by agricultural enterprises. In 2005 their share in number of dairy cows accounted for 67 per cent whereas family farms' share was 33 per cent. The average herd size in agricultural enterprises was 295 whilst on individual farms only 6.2.

The transformations in the processing sector during the transition period, lead to a quick consolidation of the industry. The number of dairy processing companies decreased from roughly 170 in 1996 to 58 in 2007. As a consequence, the concentration ratio increased, the C5 index reaching 60 per cent already in 2001, remaining around this level ever since. Hockmann and Voneki (2009) analyse the possibility of tacit collusion on the Hungarian raw milk market using a structural equation model. They find that processors were able to exploit significant oligopsony power, but the opportunities to benefit from this favourable position have been eroded over time due to the emergence of alternative marketing channels.

The retail level however, followed a different path than the upstream levels of the sector. Due to several factors (privatisation, the emergence of multinational retail chains, high number of small private entrepreneurs) at the beginning of the transition period, the number of retail units rocketed from 25,000 in 1990 to 60,000 by the end of the decade. This trend was reversed after 2000 with a fast concentration process (by the end of 2007 the number of retail units fell back to 45,000), the main actors of the retail level becoming the super and hypermarkets. Now, the five largest retail companies account for two-thirds of grocery sales, whilst the ten largest for 90 per cent, thus Hungary has a relatively high retail concentration amongst the New EU Member States, being close to the EU average.

### 4. The sample and key variables

To investigate producers-processors contracting characteristics and to test the determinants of contracts, a questionnaire was designed and data were collected from Hungarian milk producers from each county. The aim was to obtain a database so that

proxy variables could be constructed. The sample of 300 for the postal survey was selected from the 1,900 members of the Hungarian Dairy Product Council (HDPC) consisting of 528 joint companies and 1,368 producers delivering directly to processors. To eliminate extreme values, (too small or too large farms) we exclude the upper and lower 10 per cent of the sample, based on the quota quantity. On the basis of milk quota, HDPC's members own 75 per cent of the total quota quantity. All members have some kind of contractual relationship(s) with the processors. 68 questionnaires were correctly filled and processed. The questions were classified into six groups with special respect to basic data of the farm, characteristics of contract(s) applied, bargaining power (of the producers), (changes of) relationships with trading partners, (specific) investments, as well as access to information. The preparation of the survey was assisted by the HDPC.

The five dependent variables correspond to the five contracting choices analysed in this study:

- D1.* Type of contract. The dependent binary variable takes the value of 1 if the contract is based on written agreement only, and 0 if contract is oral.
- D2.* Duration of contract. The dependent binary variable takes the value of 1 if the contract is for more than a year, and 0 if shorter.
- D3.* Business history. The dependent binary variable takes the value of 1 if the contractual relationship between farmer and processor is longer than a year and 0 otherwise.
- D4.* Incentive is proxy for contractual complexity. This variable reflects the intentions for contractual safeguard using various incentives. The dependent binary variable takes the value of 1 if the contractor provides incentives (price premiums, fodder, cooling equipment, etc.) and 0 otherwise.
- D5.* Number of contractors. The dependent variable measures the number of organisations the farmer has contractual relationships with (1, 2 or 3).

To provide consistency of our results we employ the same set of variables for all aspects of contracting. We focus on two set of variables. First, we assess the importance of asset specificity, trust and firm size.

Contractinv is a binary variable, measuring asset specificity. Takes the value of 1 if there have been contractual relation specific investments on the farm (i.e. investments whose purpose is explicitly is the improvement of market business relationships), and 0 otherwise.

Cownumber measures the size of the farm using the herd size as proxy.

We asked farmers about the reasons for selling milk to a particular buyer. The respondents evaluated the importance of specific factors, including trust. Level of *trust* towards the contractor is ranging values from 1 to 5.

Switching cost (switching) is measured by farmer's perception on the possibility of partner change (values from 1 very easy to 5 very difficult)..

Bargaining power (whether the particular farmer can influence the purchase price) is measured by the variable pinfluence (values from 1 – never to 5 – often).

Therefore, the theoretical model tested is:

$$\text{Prob}(D1, \dots, D5) = f(\text{explanatory variables})$$

Table I presents the descriptive statistics of the explanatory variables (number of observations, mean, standard deviation, minimum and maximum values).

A number of interesting findings are derived from the descriptive statistics. Contract related variables show the importance of trust (high, above 4 average), 38 per cent of farms have contract specific investment. The average farm in the sample is fairly large, with almost 130 cows. Switching costs are rather moderate (3.2), while the limited possibilities of farmers to influence prices (average 1.5 of maximum 4) imply considerable bargaining issues.

Table II reveals most contracts being formal, written ones, however the length of these contracts is mostly for only a year only. The large majority of farmers have only one contractor at a given time, whilst 16 have two and only 1 has contractual relationships with three processors. The large proportion of farmers (73 per cent) delivers milk to the processor. This statistic, combined with the low bargaining power of farmers may indicate processors' oligopsony power. The role of incentives is evident, 57 farmers are taking advantage of buyer provided support. And finally, the frequency of business history variable emphasises the importance of long-term business relationships.

## 5. Results

In order to examine the relationships between contract existence and contract design, we estimated various binary and ordered models. The discrete-choice models are typically estimated by maximum likelihood, after imposing distributional assumptions with respect to the error term. Semi parametric literature however emphasise that parametric estimators of discrete choice models are known to be sensitive to departures from distributional assumptions. Various estimators have been developed for correcting this restrictive nature of parametric models. In this paper we apply the semi-nonparametric approach of Gallant and Nychka (1987) and Stewart (2004) for ordered models, whilst parametric maximum likelihood approach of Klein and Spady (1993) for binary models.

Variable	No. of Obs.	Mean	SD	Min	Max
contractinv	68	0.382	0.489	0	1
cownumber	68	129.602	158.980	6	720
trust	68	4.073	1.374	1	5
switching	68	3.264	1.472	1	5
pinfluence	68	1.411	0.717	1	4

**Table I.**  
Descriptive statistics of  
explanatory variables

Value	Type of contract	Duration	Number of contracts	Incentive	Business history
0	19	54	–	13	12
1	51	16	51	57	58
2	–	–	16	–	–
3	–	–	1	–	–

**Table II.**  
Frequency of dependent  
variables

5.1 Type of contract

The estimated coefficients of the semi parametric ML model with respect to the choice between oral and formal (written) contracts are presented in Table III. All variables are statistically significant, with an unexpected sign. Confirming *H1*, contractual asset specificity (contractinv) has positive impact on formal contract. In relation to *H2*, the farm size variable (cownumber), has a significant and positive influence upon formal contract choice with expected sign, i.e. larger farmers are more likely to choose written contracts than smaller ones. *H3* positing negative relationship between farm size and formal contract is not supported, trust negatively influences oral contract. We may argue that written contract requires higher level of trust, while oral contract can be breached more easily. The switching costs positively influence the formal contract supporting *H4*. The significant and negative coefficient of pinfluence confirm *H5*, indicating that better bargaining power on influencing prices is negatively associated with written contracts.

5.2 Duration of contract

The determinants of whether the contract agreement is valid for more than a year are presented in Table IV. The contract specific investment has no significant impact on contract duration, thus *H6* is not supported. The positive and significant coefficient of cownumber suggests that larger farms prefer long-term contracts. *H8* is not rejected since trust positively influences the duration of contract. High switching costs have positive impact on the duration of contract, validating *H10*. The ability of farmer to influence purchase prices is more likely with shorter contracts rather than longer ones, supporting *H12*.

**Table III.**  
Semi parametric  
maximum likelihood  
estimation: type of  
contract

Variable	Coefficient
contractinv	2.358*
cownumber	0.047*
trust	0.940*
switching	1.174*
bargain	-7.852*
<i>n</i>	68
Loglikelihood	-29.780

**Notes:** \*Significant at 1 per cent

**Table IV.**  
Semi parametric  
maximum likelihood  
estimation: duration of  
contract

Variable	Coefficient
contractinv	0.199
cownumber	0.014**
trust	1.472**
switching	0.994*
bargain	-4.617**
<i>n</i>	68
Loglikelihood	-26.064

**Notes:** \*Significant at 5 per cent; \*\*Significant at 1 per cent



### 5.3 Business history

Table II shows that most farmers have a longer than a year business relationship with the downstream industry. However, only 30 per cent of have longer term contract. This implies that longer business relationships are not necessarily contributing to longer term contracts. Results suggest that contract specific investments positively influence business history confirming *H6* (Table V). Positive and significant coefficient of cownumber implies that larger farms prefer longer business relationships. Interestingly, trust and switching costs are insignificant. Our estimations support *H12*, bargaining power decreases the length of business history. This indicates that farmers are easily changing business partners if they think they will be able to influence purchase prices through new partners and contracts. Note, that significant variables provide qualitatively the same results as for contract duration.

### 5.4 Incentive

The role of contract complexity via incentives provided is analysed in the Table VI. All variables are significant. Confirming *H7*, asset specificity has positive impact on the existence of incentives, implying that farmers with contractual specificity need for safeguard of their investments. Negative and significant coefficient of cownumber suggests that farmers delivering larger quantities of milk are less likely to be targeted by the contract specified incentives. Based on the positive and significant coefficient of trust, we may reject *H9*. Switching costs have negative impact on contract incentives thus rejecting *H11*. Our estimations support *H13*, bargaining power decreases the complexity of contract.

Variable	Coefficient
contractinv	5.277 *
cownumber	0.009 *
trust	-0.045
switching	0.230
bargain	-3.841 *
<i>n</i>	68
Loglikelihood	-25.968

Notes: \*Significant at 1 per cent

**Table V.**  
Semi parametric  
maximum likelihood  
estimation: business  
history

Variable	Coefficient
contractinv	1.200 *
cownumber	-0.003 *
trust	0.358 *
switching	-0.186 *
bargain	-0.749 *
<i>n</i>	68
Loglikelihood	-25.819

Notes: \*Significant at 1 per cent

**Table VI.**  
Semi parametric  
maximum likelihood  
estimation: incentive

5.5 Number of contractors

Empirical research usually assumes that contractual relations either are mutually exclusive between economic agents or focusing only on most important partner. However, farmers may sell their products to more partners. Table II shows that most farmers in the sample have one contract at a given time, few have two and only one has three parallel contracts. Thus, we investigate factors explaining the number of contracts.

The semi-nonparametric ordered probit model for contract numbers is presented in Table VII. Positive and significant coefficient of contractinv variable indicates that contract relating investments strengthen the business relationship between contractor and farmer, the latter choosing more parallel contracts. Size (cownumber) has negative sign, suggesting larger farmers make business with only one purchaser/processor whilst smaller ones can easily have several parallel contracts. Trust has a large significantly negative coefficient, indicating that if the buyer is trusted, there is no need for more contracts with other purchasers. Farmers with a low level of trust towards the downstream markets prefer more than one contract, thus spreading possible contract or contract enforcement related risks. Switching costs has significantly positive sign, suggesting that the higher switching costs lead to more contracts. Finally, larger bargaining power indicates more contracts.

6. Conclusions

The aim of the paper is to identify factors explaining contractual choice and contract design in Hungarian milk market using transaction costs economics framework. Despite the considerable concentration of milk processing industry and retail sector and an inefficient legal environment, the market oriented milk producer prefers formal contracts with stable long-term business relationships. Our results provide considerable support to the central hypothesis of the TCE, namely, that contract specific investment is a strong predictor explaining contract choice and contract design. Although trust is an important factor; our estimations report some counterintuitive results. We can argue that written contract and choosing longer duration of contract assumes a higher level of trust between trading partners, whilst oral and short-term agreements can be breached easier. Farm size is also significantly associated to contracts and contractual arrangements. In line with Lyons (1994), we find that larger farms prefer written contracts. Vulnerability to opportunistic behaviour also depends on partner change switching costs, and farmers' bargaining power. Our results shed some light on the importance of public institutions to provide

Variable	Coefficient
contractinv	1.034
cownumber	- 0.003**
trust	- 0.557***
switching	0.646**
bargain	- 0.183
n	68
Loglikelihood	- 34.747

Notes: \*Significant at 5 per cent; \*\*Significant at 1 per cent

Table VII.  
Semi-nonparametric  
estimation: number of  
contractors

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appropriate background for private enforcement mechanisms in improving contractual relationships between producers and processors. Contract provisions including various incentives may help to reduce the contractual default of trading partners.

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