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Contract production on the Finnish cereal market

Background

This study analyses a current role of contract production on the Finnish cereal market. Contract production has a long tradition in Finland and it has been described as a first step towards more coordinated food chains. In contract production farmer and cereal buyer agree quantity and variety of cereal produced. In some cases price and variety is also decided in advance. By means of contract production supply chain has stronger control for quality, quantity and delivery. Agriculture is being transformed from an industry that produces and processes commodities to one that manufactures specific attribute products for unique end-use markets i.e. from growing raw material to manufacturing biologically based specific attribute raw materials (Boehlje 1999). Changing consumer demand is also driving the evolution away from open market coordination to tighter vertical linkages (Sporleder 1992). Tighter coordination on the supply chain guarantee homogeneity and quality of products delivered by hundreds, even thousands of independent producers (Menard 2000). This paper describes critical points of the cereal supply chain as well as farmers' motives and incentives for contract production. The paper also defines main components of the optimal contract design from the farmers' point of view: determinance of the price, length of a contract, determinance of different premiums, price-premium relationships and binding commitments.

Cereal production in Finland has some special charasteristics compared to many other countries. Production costs in cereal production are higher in Finland than in many other EU countries, mainly due to the climatic conditions. Average yield level is low (table 1). The average farm size of 25 hectares is also quite small. While the average size of farms has grown, the size of base barcel has not. The small average farm size combined with the distance and size of arable areas poses great challenges for logistic and information systems in Finnish cereal chain.

As a result of the Agenda 2000 policy reform direct subsidies play increasingly important role on farmers' total incomes. It is not sure whether farmers has incentives to improve the efficiency of cereal production in the new policy situation. Despite the fact that support package compensates farmers income, there remains the problem of lacking stimulus for production. Such a policy creates a challenge for cereal supply chain to motivate farmers to produce high quality crop for the market.

This study is concerned with contract production between a farmer and cereal merchandisers as well as between a farmer and the processing industry. The aim of study is to design an innovative governance structure and to clarify principal-agent relationships in cereal supply chain.

Cereal market in Finland

Total yield in Finland lies normally between 3,5-4,0 million tonnes. During the last years the quantity of cereals entering to the market has been laid between 1,5-1,8 million tonnes (table 1). About 80 % of that amount is produced under contractual arrangements. The Finnish cereal market is small and concentrated, and there are only few bigger cereal trader and industrial organizations buying cereal. Farmers' possibilities to compare different buyers are scarce. A contract usually includes the quantity, species and, in some cases the variety. A farmer can also make a forward

contract, in which the price is determined in advance. On the Finnish cereal market there are typically two business orientations; logistic alliances in which the trade is organised by cereal merchandisers, and a partnership relationship between farmers and the industry.

Table 1. Total yield, average yield and the cereal quantity coming to the trade

Year	Total yield (Million kg)	Average yield (kg/ha)	cereal coming to the trade (million kg)	%
1996	3666,6	3444	1662	45,3
1997	3758,3	3418	1835	48,8
1998	2737,5	2400	1499	54,8

Table 2. Cereal purchases from farmers in year 1996-1998 milj. kg.

	1996	%	1997	%	1998	%
Trader						
Wheat	318,1	76	295,3	78	283,3	75
Rye	43,5	76	32,3	73	21,6	71
Barley	665,5	83	822	87	609,3	83
Oats	355,9	93	459,9	97	325,6	92
Industry						
Wheat	100,6	24	81,1	22	93,2	25
Rye	14	24	11,8	27	8,7	29
Barley	138,2	17	116	13	122,7	17
Oats	25,4	7	12,9	3	29,1	8

Farmer can make a contract with both cereal merchandisers and industry, and there is also possibility of selling the crop to the intervention. The cereal merchandisers is mainly organized by trader. Traders' share for cereal purchases in 1996-1998 lied between 71-92 %, depending on the cereal variety. Traders have the greatest share in coarse grains. Industry buys yearly 8-29 % of the yield. Farmers direct contracting with industry is mainly based on malt barley and bread cereal contracts. The share of the intervention is only 1-2 %.

Theory

Cereal contract production can be described as a contractual relationship between farmer and cereal buyer. Generally the problem of motivating a person to act on behalf of another is known as the principal-agent problem. The principal's objective is to maximise his utility knowing that the agent is free to reject the contract entirely and that the contract must give the agent an incentive to choose the desired level (Rasmusen 1989). Principal's problem is to design a contract that induces the agent

to act an behalf of the principal's interest. The principal can solve this problem by use of incentives. Through hidden action the activity choice is not observable to the principal. Thus, the principal, who has to pay the agent for his contractual activity, can make the payment depending on the realized gain but not on the activity chosen (Keser & Willinger 2000).

The study utilises approaches which are related to the information economics: transaction cost, vertical coordination and contracting. Transaction costs have been studied, for example, by Williamson (1979). Frank and Hendersson (1992) identified transaction costs as a factor in U.S. food industry vertical coordination. The specific factors necessary to develop successful vertical cooperation in the food system are studied by Galizzi & Venturini (1997). Contracting and imperfect information in the food system have been investigated by Sheldon (1996).

Transaction costs are considered as one of the main motives for coordination. Transaction cost includes both coordination and motivation costs. The choice of the coordination may be be discouraged by relatively high idiosyncratic investment resulting from asset specifity. Such specifity in crop production may be, for example, investments in harvester and drying. Another significant argument for vertical coordination may be the nature of the resource dependency (Sporleder 1992). In the Finnish circumstances it could mean that the competitiveness of cereal chain is dependent on raw materials produced in Finland.

The main problem of economic organization (motivation problem) arises because individual's private interests are rarely perfectly aligned with those of other parties involved. Theoretically, motivation problems arise because not all plans can be described using a complete contract. Such a contract would specify precisely the distribution of realized cost and benefits in each contingency so that each party individually finds it optimal to abide the contracts terms (Rasmusen 1989). A complete contract would solve the motivation problem. A contract can be seen as a mechanism to achieve binding commitments, which the parties can rely on in their planning. The problems of actual contracting are due to difficulties in modeling of complex human behavior and economic imperfections, namely due to bounded rationality, opportunistic behaviour, imperfect commitment and asymmetric information.

There are various types of exchange arrangements. In the open market system price is the primary coordinating mechanism. Several market instruments are used in the Finnish cereal market today – internet-trade and trade between farmers are examples for open price system. Marketing contracts, warehouse contracts and contract production between farmer and both industry and trade are examples of contracts used in the Finnish cereal market. According to the fundamental theorem of welfare economics, if market-clearing prices can be found and certain other conditions are satisfied, the market allocation is guaranteed to be efficient (Milgrom & Roberts 1992).

Traditionally contractual arrangements have been an instrument for both parties to reduce the risks. Stiglitz (1974) has studied for optimal incentive compensation contracts in sharecropping. According to Stiglitz the sharecropping system may result in the economy not being productively efficient, i.e. the effective labour/land ratio may differ on different plots of land. On the other hand sharecropping system is adopted because of its incentive effects and its risk-sharing features. He also noted two main difficulties (a) the presence of conflicts of interest and (b) the difficulties in providing correct incentives.

More integrated supply chains have better risk handling including price risk, quantity, quality and timing of delivery. Coordination control over supply chain and transparency for the supply chain increase. The principal and the agent both have to face the market risk. Substitution exchange

mechanism such as open markets, contracts and vertical integration affects both amount of risk from these sources as well as the distribution of risk (Sporleder 1992). By means of contractual relationship the price risk may be shared.

Data and some insights into the results

The data given in the study are based on information obtained from AERI bookkeeping farms and on interview with key persons directly involved in the merchandise of cereals. AERI bookkeeping farms includes totally about 1000 farms of which about 100 are specialized in crop production. Altogether 152 farms answered to the questions.

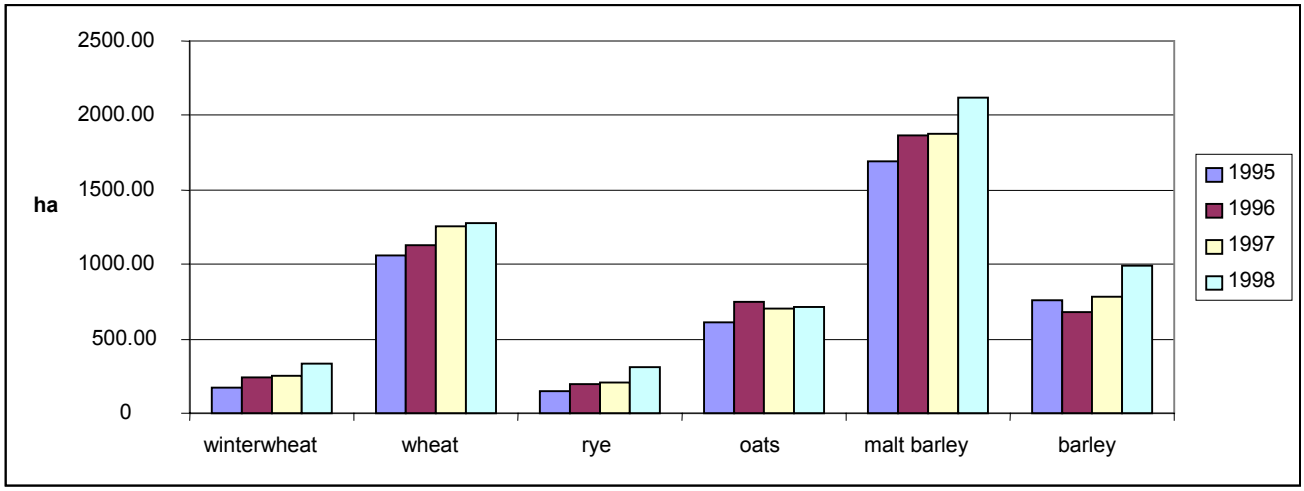


Figure 1. Development of the contract area in bookkeeping farms in 1995-1998.

Contract area has increased for the part of all cereals in bookkeeping farms during the year 1995-1998 (figure 1). In particular the area under malting barley contracts has grown. The production of malting barley is traditionally based on contract production. Bread cereals are also mainly produced under contractual arrangements.

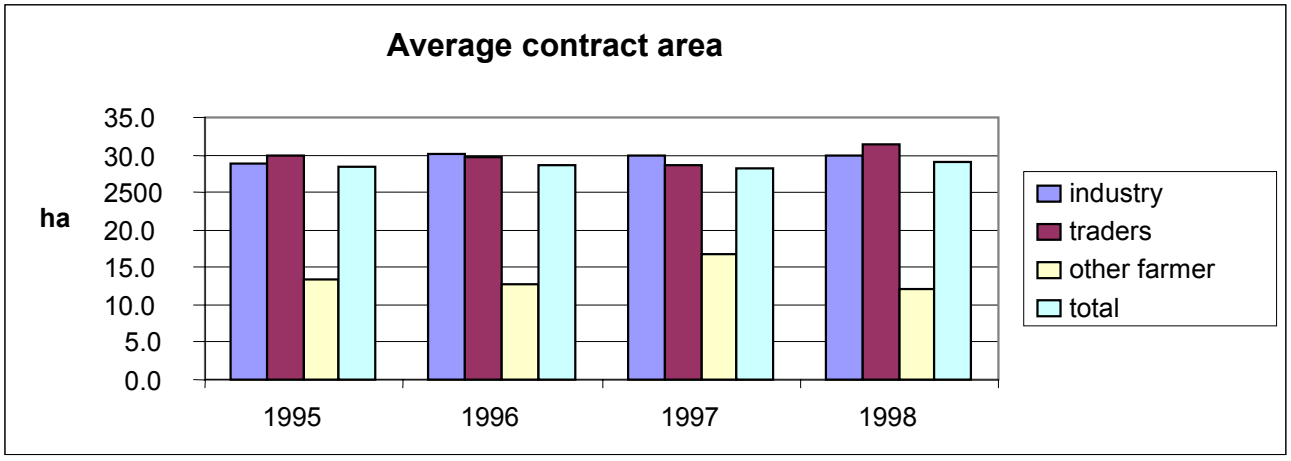


Figure 2. Average contract area.

Average contract area of bookkeping has increased slighly from 28,4 hectares in 1995 to 29 hectares in 1998. Average area in contract for industry and traders are about the same, about 30 hectares, while the contract area with other farmer varied between 12,1 and 16,8 hectares.

The main problems of contract production are related to the risk and uncertainty. If the price is not determined in advance, both the seller and the buyer face price risk and uncertainty. If the price is determined in advance, uncertainty concerning a farmer's individual price level disappears but, obviously, the level of the market price remains unknown. In Finland especially climatically induced risks destabilize production levels and thus cause difficulties in fulfilling agreed contracts. Other main factors affecting the effectiveness of contract production are control measures concerning the cereal supply and information between the contract parties.

On the farmers side the study analysed the motives and incentives for contract production, and another main objective was to establish an incentive contract design. The main components for the contract are ordinary price, premium structure, relationship between ordinary price and premiums, length of the contracts, commitment of the contracts and minimum area for contract production.

According to the questionnaire price determinance in advance was important expecially for bread grains and malting barley contracting. Spot-market price was preferred for coarse grains. A year was regarded as an appropriate length of the contract period for all cereals. Higher premiums and lower market price were preferred in the case of malting barley, rye and wheat.

Farmers were also asked about the contract design for incentive contract structure. The most important incentive was the premium structure (Figure 3). Also the ordinary price and relationship between ordinary price and incentives plays crucial role.

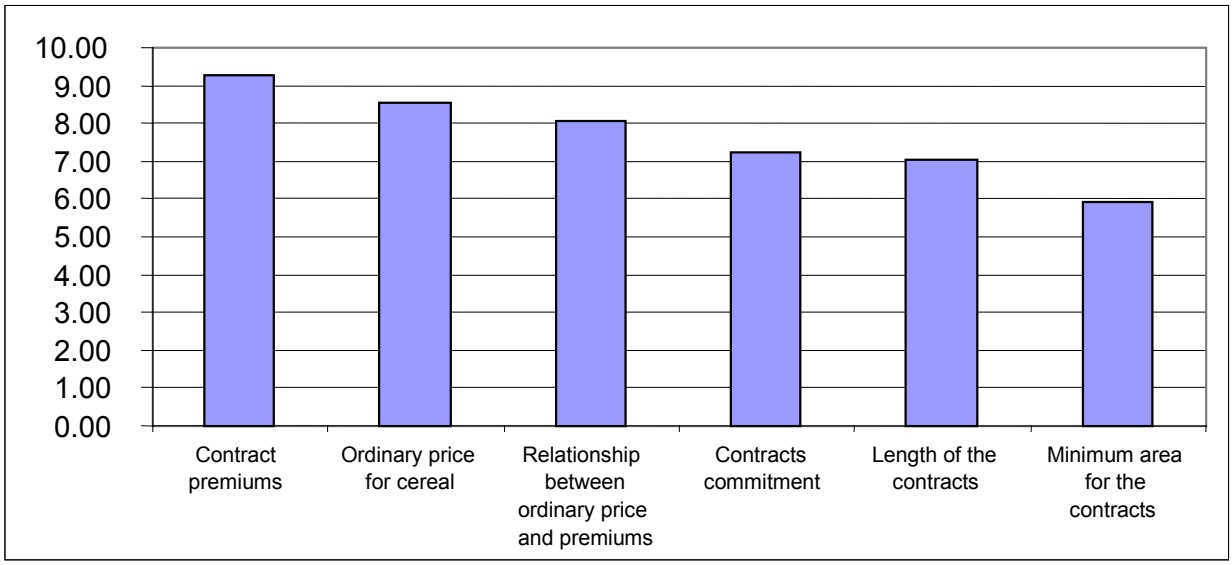


Figure 3. Farmers insights for the relevance of various elements for designing contract incentives (1=no importance… 10= very important).

Table 3. Farmers insights of elemets for incentive contract design.

	Price		**Price-premium relationship**		**Premiums**		
	market price	contract price	higher price lower premiums	lower price higher premiums	quality	contract fee	quantity premium
Wheat	3,5	3,85	3,62	3,13	4,62	3,89	2,79
Rye	3,49	4,18	4,01	3,02	4,66	4,08	2,84
Malt Barley	3,22	4,19	3,81	3,25	4,63	4,01	2,89
Coarse grains	3,60	3,55	3,92	2,80	4,53	3,80	2,72
Starch grains	3,08	3,57	3,88	3,17	4,51	3,80	2,73

(1= no relevance… 5=very relevant)

Conclusion and discussion

The goal of this study is to analyse contract production between farmer and cereal buyers. Contracting is one way to coordinate relationship between farmers and both industry and trade.

In Finnish agriculture the base problems for farmers are low yield level and high production costs. Small average farm size and the field structure creates also challenges for cereal chain. The base motives for cereal traders/industry concerns price risk, quality as well as quantity control. Due to the low cereal prices it might be a serious threat that farmers lack incentives to produce cereals of sufficient quality in terms of processors' requirements. By means of tighter coordination it might be possible to quarantee the homogenuity and quality for cereals. Contract production is one way to organize cereal chain. Also resource dependency may be main reason for tighter coordination in finnish cereal chain.

For farmers the contract production secures the marketing channel for cereal. There are also open-market systems, which are organized for example via internet. Transaction costs are usually hold as a main argument for coordination choice.

Contract production provides a possibility to deepen co-ordination between farmer and cereal buyers. The main task for an efficient contract is to solve the motivation problem between participants. It can be solved by means of effective incentives. Optimal contract design is one way to raise farmers motivation. The diversity of contractual arrangement is also motivated by obligation of transparency associated with quality and environment.

The pricing for cereals might have an evolution toward "real component value of the cereal for the processor". For example, in malt processing the homogenuity of the quality has a crucial role for and it might be important to motivate farmers for homogeneity in malt barley production.

Keywords: cereal market, supply chain, information economics, contracts, incentives

References:

Boehlje, M. 1999. Structural changes in the agricultural industries: How do we measure, analyze and understand them? American journal of agricultural economics 81:1028-1041.

Frank, S. and Henderson, D. (1992). Transaction Cost as Determinants of Vertical Coordination in the U.S Food Industries. American journal of Agricultural Economics (1992):74: 941-950.

Galizzi, G and Venturini, L. 1997. Towards a Theory of Successful Vertical Cooperation in the Food System.

Keser, C. & Willinger, M. 2000. Principals' principles when agents' actions are hidden. International Journal of Industrial Organization. 18 (2000) 163-185.

Menard, C. 2000. A New Approach to the Agro-Food Sector: New Institutional Economics. Chain Management in Agribusiness and the Food Industry: 11-20.

Milgrom, P. & Roberts, J. 1992. Economics, Organization & Management. 621 p. New Jersey.

Rasmusen, E. 1989. Games and information. An introduction to game theory. 478 p. Oxford UK.

Sheldon, I. 1996. Contracting, Imperfect Information and Food System. Review of Agricultural Economics. 18 (1996): 7-19.

Sporleder, T, L. 1992. Managerial Economics of vertically coordinated agricultural firms. American agricultural Economics Association.

Stiglitz, J. 1974. Incentives and risk sharing in sharecropping. Review of economic studies. 41:219-255.

Williamson, O. 1979. Transaction-Cost Economics. The Governance of Contractual Relations. Organizational Economics, ed. Barney, J and Ouchi, W. Jossey-Bass, London, 1986.