Examining Market Power in the Finnish Dairy Chain

Abstract

This study examined whether processors and retailers have market power in the Finnish dairy chain. Both the dairy processing and the retail sector are highly concentrated in Finland, and market imperfections in the chain are not well known. The results indicate that the retailers have market power over the consumers in the retail market but the processing market is competitive. According to the results, the retailers employ full mark-up in the retail market. It is emphasised that market power in the Finnish dairy chain should be further studied with different approaches to gain more evidence for market power.

Keywords: **Bilateral oligopoly, Finnish dairy chain, GMM**

1 Introduction

During 2007–09, the producer and the consumer price of dairy products increased more on average in Finland than elsewhere in the Eurozone (Kotilainen et al., 2010). In the Finnish dairy chain, the retail sector was able to increase its share from the consumer price by nearly four percent during 2008–12, whereas the share of the dairy industry remained unchanged. Unlike in other food chains in Finland, the processing sector has had stronger position towards the retail sector in the dairy chain. On the other hand, increase in the volume of the private label products has caused revenues to transfer from processing sector to the wholesale–retail sector (Peltoniemi et al., 2015).

Market power in the dairy chain has been extensively studied elsewhere but the Finnish chain is not yet well known. Among others, dairy chains in the following countries have been examined: Brazil (Scalco & Braga 2015; Scalco & Braga 2014), USA (Cakir & Balagtas, 2012), Ukraine (Perekhozhuk et al., 2009) and Italy (Sckokai et al., 2013). The studies by Ulvinen (2006) and Kotilainen et al. (2010) analyzed the Finnish dairy chain and they considered period before 2010. Neither of the studies applied structural econometric models. Ulvinen (2006) provided Lerner-index values for the dairy processing, the food wholesale and the retail sector. The estimated values were low and she concluded that the sectors are competitive despite the high degree of concentration. On the other hand, Kotilainen et al. (2010) found that the degree of competition decreased during 2001–07. In addition, Čechura et al. (2015) studied oligopoly power of European dairy processing sector and found that the Finnish dairy processing sector is characterized by an oligopolistic structure.

The Finnish dairy chain is particularly interesting and important subject. This is because, firstly, the degree of concentration is distinctive in retail and dairy processing sectors in Finland which creates a bilateral oligopoly setting. Therefore, no presumptions about price taking behavior are justified and for this reason a bilateral oligopoly approach might be more appropriate for examining market power along the Finnish dairy supply chain. Secondly, the dairy sector is highly important for the Finnish food and agricultural sector in terms of revenue and exports. It also needs to be mentioned that the dairy processing sector is virtually owned by producer cooperatives. One of the implications from this is that the producer price of milk in Finland is among the highest in the EU. Thus, studying the Finnish dairy chain may provide valuable information for assessing and planning food and agricultural policy.

In this study, the Finnish dairy chain was analyzed using bilateral oligopoly approach by Schroeter et al. (2000). The bilateral oligopoly approach was selected because it was crucial to relax the assumptions about price taking behavior in the processing market. The objective of the study was to determine whether processors and retailers have any market power in the dairy chain and to measure it if it is present. The analysis was limited to the processing and the retail market of dairy products with the main emphasis on the processing market. New Empirical Industrial Organization (NEIO) provided the methodological framework for the study.

For brevity, wholesale and retail sector are considered as a joint sector in the context of the empirical analysis. The rest of the paper is organized as follows. Chapter 2 provides an outlook on the dairy processing and the retail sector in Finland. Chapter 3 presents the approach to the empirical analysis as well as the method and the data used in the estimation. The results are presented in Chapter 4 and Chapter 5 provides conclusions and discussion.

2 A Review on the Dairy Processing and the Retail Sector in Finland

The dairy processing sector has been highly significant part of the Finnish food industry. It has provided products with high value-added and the dairy products have been the only food items with positive trade balance throughout the EU era (Jansik, Niemi & Toikkanen, 2015; see also Peltoniemi et al., 2015). The Finnish share of total turnover in the Baltic Sea region has decreased, and domestic dairy firms have lost their shares to foreign ones in the Finnish market (Jansik, Irz & Kuosmanen, 2014). According to Jansik (2014), however, the future of the sector remains uncertain because the increasing level of competition and imports may cause domestic production to decrease in the era after the milk quota system.

Currently, the sector is dominated by cooperatives and almost all the raw milk in Finland is collected by dairy cooperatives. Valio, the biggest dairy firm in Finland, is owned by 17 dairy cooperatives. According to its statistics, Valio collectes around 85% of the milk produced in Finland (Valio, 2014). Another remarkable firm in the market is Arla which is a subsidiary company of Arla Foods. In addition to Valio, firms like Hämeenlinnan Osuusmeijeri, Maitomaa and Satamaito are owned by dairy cooperatives. Kaslink Foods and Juustoportti are significant privately-owned firms. Nestlé and Unilever produce most of the Finnish ice-cream. Table 1 presents some of the largest dairy firms in Finland and their respective market shares in 2014. Valio held 69.2% of the market and Arla slightly over 15%. Together they had 84.3% of total revenues in the sector.

Table 1. Seven largest dairy firms in Finland and their market shares

	Turnover (M€)	**Market share**	**Cumulative concentration**	**Employees**
Valio	1714.0	69.2 %	69.2 %	3734
Arla	373.0	15.1 %	84.3 %	281
Hämeenlinnan Osuusmeijeri	69.5	2.8 %	87.1 %	82
Kaslink Foods	58.1	2.3 %	89.4 %	111
Maitomaa	54.5	2.2 %	91.6 %	52
Maitokolmio	42.3	1.7 %	93.3 %	80
Satamaito	46.3	1.9 %	95.2 %	57
Whole industry	2476.5	100.0 %	100.0 %	4902

Source: Statistics Finland a & Kauppalehti

Recently, the sector went through two considerable events. In 2012, Finnish Competition and Consumer Authority accused Valio of predatory pricing in fluid milk products and imposed a considerable penalty payment to the company. The authority was able to prove that Valio aimed to drive Arla Ingman, which is currently Arla, out from the market by setting its prices below the production costs. This also forced smaller companies to set their prices at the unprofitable level

(Kilpailuvirasto, 2012). Another considerable event was the trade embargo against Russia in 2014. In 2013, the sector made its record in revenue and in exports to Russia. Nevertheless, dairy products were most affected as the food exports were suspended (Jansik, Niemi & Toikkanen, 2015).

Two trends can be recognized in Finnish food retail. Firstly, the number of outlets and the amount of revenue have grown in the sector of specialized food retail. Secondly, discount stores and private label products have become more popular due to increased price sensitivity. The share of private labels has grown rapidly in dairy products. In addition, the threat of imports and narrowed selection have increased competition among the suppliers and decreased their margins (Jansik, Niemi & Toikkanen, 2015). Currently, two domestic companies, K- and S-group, dominate the Finnish retail sector. Concentration has increased steadily over the years, and two firm concentration ratio was 78.6% in 2015 (Table 2).

Table 2. The market shares of some Finnish retail companies in selected years

	1990	2005	2015
K-group	40.5 %	33.9 %	32.7 %
S-group	15.9 %	35.9 %	45.9 %
T-group	23.8 %	-	-
Tradeka / Suomen Lähikauppa	14.4 %	10.8 %	6.4 %
Spar	-	6.2 %	-
Lidl	-	3.7 %	9.0 %
Others	5.4 %	9.5 %	6.0 %
CR2	64.3 %	69.8 %	78.6 %

Source: Finnish Grocery Trade Association (2016), Finnish Food Marketing Association and the Kehittyvä Kauppa magazine (2006) & Niilola et al. (2003)

3 Methods

The approach by Schroeter et al. (2000) was adopted for the empirical analysis. It is based on three basic market structures, and each structure is modelled as a nonlinear system of equations. The models are then compared. Full mathematical derivation of the models is provided by Schroeter et al. (2000) and by Scalco and Braga (2015). Quantity, processor price and retail price are endogenous variables in the models. The homogeneity of products and fixed-proportions transformations, e.g. transportation and storage in retail level, are assumed. The assumptions justify the same variable for quantity in processing and in retail market. In each of the models, retailers may have market power over consumers but there are three possible scenarios when it comes to the market power in processing market.

In the first structure, processing market is assumed to be competitive. This structure is called Bilateral Price-Taking (BPT). In this case, the marginal revenue of retailers equals retail price if retailers have no market power over consumers. If retailers do have market power over consumers, their marginal revenue is lower than the retail price. The net marginal revenue of retailers determines their input demand. It is obtained by subtracting marginal revenue from marginal cost. The equilibrium condition for the processing market in the BPT model implies that the marginal cost of processors equals the net marginal revenue of retailers. This condition also determines the processor price.

The BPT system consists of Equation 1, 2 and 3 which are shown below.

$$p_r = -[\lambda(a_1 + a_3x_3) - (b_1 + c_1) - c_3v_3]q + (b_0 + c_0) + b_2w_2 + c_2v_2 + \sum_{i=1}^{n} c_{0i}d_i + (\eta + \mu) \quad (1)$$

$$p_r = a_0 + a_1q + a_2x_2 + a_3x_3q + \epsilon \quad (2)$$

$$p_p = c_0 + c_1q + c_2v_2 + c_3v_3q + \sum_{i=1}^{n} c_{0i}d_i + \mu \quad (3)$$

In Equation 1, 2 and 3, terms x_2 and x_3 denote demand shifters, term w_2 denotes retailers' marginal cost shifter and terms v_2 and v_3 denote processors' marginal cost shifters. Terms p_r and p_p denote retail price and processor price, and q denotes quantity. Variables d_i, $i=1...n$ are dummy variables which capture additional shocks in the supply. Terms a, b and c are parameters. Terms ϵ, η and μ are stochastic error terms. Parameter λ is the conduct parameter which shows the degree of retailers' market power over consumers.

In the second structure, processors are price takers while retailers are allowed to have market power over processors. This structure is called Manufacturer Price-Taking (MPT). Retailers face processors supply which is determined by the processors' marginal cost of production. If retailers have oligopsony power, their marginal expenditure is higher than the processors' marginal cost. In the MPT model, the equilibrium condition for the processing market implies that the net marginal revenue of processors equals their marginal expenditure. The processor price is determined by the marginal cost of processors.

The MPT system consists of Equation 4, 5 and 6 which are shown below.

$$p_r = -[\lambda(a_1 + a_3x_3) - (b_1 + (1+\delta)c_1) - (1+\delta)c_3v_3]q + (b_0 + c_0) + b_2w_2 + c_2v_2 + \sum_{i=1}^{n} c_{0i}d_i + (\eta + \mu) \quad (4)$$

$$p_r = a_0 + a_1q + a_2x_2 + a_3x_3q + \epsilon \quad (5)$$

$$p_p = c_0 + c_1q + c_2v_2 + c_3v_3q + \sum_{i=1}^{n} c_{0i}d_i + \mu \quad (6)$$

Parameter δ is the conduct parameter which shows the degree of retailers' market power over processors. If the parameter is restricted to zero, the MPT model reduces to the BPT model.

In the third structure, retailers are price takers while processors are allowed to have market power over retailers. This structure is called Retailer Price-Taking (RPT). Processors face the input demand of retailers which is determined by the net marginal revenue of retailers. If processors have oligopoly power, their marginal revenue is lower than the net marginal revenue of retailers. In the RPT model, the equilibrium condition for the processing market implies that the marginal cost of processors equals their marginal revenue. In this case, the processor price is determined by the net marginal revenue of retailers.

The RPT system consists of Equation 7, 8 and 9 which are shown below.

$$p_r = -\left[\left(\gamma + \lambda(1+\gamma)\right)(a_1 + a_3x_3) - \left(b_1(1+\gamma) + c_1\right) - c_3v_3\right]q + (b_0 + c_0) + b_2w_2 + c_2v_2 + \sum_{i=1}^{n} c_{0i}d_i + (\eta + \mu) \tag{7}$$

$$p_r = a_0 + a_1q + a_2x_2 + a_3x_3q + \epsilon \tag{8}$$

$$p_p = -[\gamma(1+\lambda)(a_1 + a_3x_3) - (b_1\gamma + c_1) - c_3v_3]q + c_0 + c_2v_2 + \sum_{i=1}^{n} c_{0i}\, d_i + \mu \tag{9}$$

Parameter γ is the conduct parameter which shows the degree of processors' market power over retailers. If the parameter is restricted to zero, the RPT model reduces to the BPT model.

In this approach, a fourth model is also estimated. It nests all the three models, and it is hereafter called NST. It allows comparing the models through parametric restrictions. The NST system consists of Equation 10, 11 and 12 which are shown below.

$$p_r = -\left[\left(\gamma + \lambda(1+\gamma)\right)(a_1 + a_3x_3) - \left(b_1(1+\gamma) + (1+\delta)c_1\right) - c_3(1+\delta)v_3\right]q + (b_0 + c_0) + b_2w_2 + c_2v_2 + \sum_{i=1}^{n} c_{0i}d_i + (\eta + \mu) \tag{10}$$

$$p_r = a_0 + a_1q + a_2x_2 + a_3x_3q + \epsilon \tag{11}$$

$$p_p = -[\gamma(1+\lambda)(a_1 + a_3x_3) - (b_1\gamma + c_1) - c_3v_3]q + c_0 + c_2v_2 + \sum_{i=1}^{n} c_{0i}\, d_i + \mu \tag{12}$$

If parameter γ is restricted to zero, the NST model reduces to the MPT model. Likewise, if parameter δ is restricted to zero, the NST model reduces to the RPT model. The NST model reduces to the BPT model when both parameters are restricted to zero. The estimation was performed using Generalized Method of Moments (GMM). The stationarity of the variables and the residuals were tested with the Augmented Dickey-Fuller (ADF) test and parametric restrictions with the Wald test. Model and Moment Selection Criteria (MMSC) by Andrews and Lu (2001) were used for the model selection. [1]

The consumer price of meat products and disposable income were used as demand shifters, i.e. x_2 and x_3. Wages in the retail sector served as retailers' marginal cost shifter, i.e. w_2. Wages in the food processing sector and the producer price of raw cow milk were used as processors' marginal cost shifters, i.e. v_2 and v_3. The consumer price of dairy products served as an approximate for the retail and the producer price of the dairy processing sector was used as an approximate for the processor price. The latter shows the development of prices in the domestic market including both domestically produced and imported products. The volume of production in the dairy processing sector was used as an approximate for the quantity.

Two dummy variables were included to capture additional shocks in the supply. The first variable captured the impact of the global food crisis in 2007–08. At that time, also other commodity prices increased, and the cost of production became more expensive due to higher input prices. A starting

[1] There are three criteria which are named after the traditional information criteria. $\boldsymbol{MMSC\!-\!BIC}$: $J(b,c) - (|c| - |b|)\ln n$; $\boldsymbol{MMSC\!-\!AIC}$: $J(b,c) - 2(|c| - |b|)\ln n$; and $\boldsymbol{MMSC\!-\!HQIC}$: $J(b,c) - Q(|c| - |b|)\ln\ln n$. Note that $|b|$ is the number of parameters, while $|c|$ is the number of moment conditions. The term $J(\cdot)$ refers to the overidentification test statistic, the term n denotes the number of observations, and the term Q is some number greater than two. Following Andrews and Lu (2001) the value of 2.1 was chosen for Q.

and an ending point for the period were selected based on changes in the prices. The processor and the consumer price started to increase rapidly in November 2007 and to decrease in September 2009. The second dummy variable covered the period of Valio's predatory pricing. According to the report of Finnish Competition and Consumer Authority (Kilpailuvirasto, 2012), Valio started it in March 2010 and ended it in December 2012. The variables are listed in Table 3.

Table 3. Variables and descriptive statistics

Variable	Definition	Mean	Minimum value	Maximum value	Standard deviation
q	Quantity of dairy products	93.3	65.7	128.5	14.0
p_p	Processor price of dairy products	103.4	91.0	114.8	7.3
p_r	Retail price of dairy products	103.2	88.4	118.1	10.0
x_2	Price of meat products	105.3	90.2	122.6	10.6
x_3	Disposable income	100.5	75.2	133.0	11.9
w_2	Cost of labor in the retail sector	99.3	70.0	139.3	16.0
v_2	Cost of labor in the dairy processing sector	101.3	83.8	129.7	10.5
v_3	Producer price of raw milk	103.5	81.2	125.9	12.0
d_1	Variable capturing the impact of the food crisis				
d_2	Variable capturing the impact of the predatory pricing				

* 2010=100 in all indices

Statistics Finland provided the dataset. The dataset used was time series data with 132 monthly observations covering the period from January 2005 to December 2015. The variables were obtained in index form, and they were deflated by dividing them by the consumer price index. The variables had 2010 as the base year. The retail price of dairy products was calculated by combining all the dairy product categories. In the aggregate series, all the individual categories were weighted using the same weights as in the general consumer price index. The weights were provided by Statistic Finland (Statistics Finland b).

4 Results

The overall performance of the final specification seemed plausible. Most of the variables were statistically significant and the signs of the coefficients were consistent with the economic theory. The results are presented in Table 4. The estimates were consistent between the models and the null-hypothesis of the overidentification test was not rejected in any of the models (Table 4). The systems were thus correctly specified.

Table 4. A summary of the results

Parameter	BPT	MPT	RPT	NST
λ	1.298 (0.000)	1.298 (0.001)	1.143 (0.001)	1.182 (0.006)
δ		0.018 (0.942)		0.129 (0.561)
γ			0.241 (0.219)	0.336 (0.116)
a_0	1.007 (0.000)	0.991 (0.000)	0.966 (0.000)	0.906 (0.000)
a_1	-0.557 (0.000)	-0.548 (0.000)	-0.523 (0.000)	-0.489 (0.000)
a_2	0.261 (0.130)	0.276 (0.123)	0.294 (0.103)	0.351 (0.053)
a_3	0.285 (0.000)	0.277 (0.001)	0.260 (0.002)	0.228 (0.005)
b_0	-0.334 (0.000)	-0.328 (0.000)	-0.290 (0.000)	-0.275 (0.000)
b_1	-0.341 (0.001)	-0.339 (0.005)	-0.268 (0.008)	-0.278 (0.017)
b_2	0.326 (0.000)	0.315 (0.000)	0.261 (0.000)	0.235 (0.000)
c_0	0.879 (0.000)	0.877 (0.000)	0.694 (0.000)	0.648 (0.000)
c_1	0.059 (0.105)	0.060 (0.106)	0.013 (0.825)	-0.003 (0.964)
c_2	0.013 (0.578)	0.016 (0.519)	0.147 (0.128)	0.185 (0.047)
c_3	0.078 (0.001)	0.077 (0.008)	0.107 (0.002)	0.103 (0.012)
c_{01}	0.072 (0.000)	0.072 (0.000)	0.075 (0.000)	0.073 (0.000)
c_{02}	-0.038 (0.000)	-0.039 (0.000)	-0.040 (0.000)	-0.041 (0.000)
P-value of J-statistic:	0.284	0.218	0.381	0.355

* P-values in parenthesis

According to the ADF test results (not presented in this paper), most of the variables, if not all of them, were I(1) processes, i.e. first-difference stationary. All the residuals in all the systems were stationary processes, i.e. I(0). Due to the stationarity of the residuals, the I(1) variables were cointegrated implying that the results were not spurious.

The BPT model had the lowest value in MMSC–BIC and in MMSC–HQIC, but the RPT model had the lowest value in MMSC–AIC (Table 5). Parametric restrictions needed to be considered in order to choose between the BPT and the RPT model. The probability value of γ was 0.219 in the RPT model and thus insignificant (Table 4). In the case of the NST model, the probability value of the Wald test statistic was 0.199 for the null hypothesis that parameters δ and γ equal zero simultaneously (Table 6). The null hypotheses of the parametric restrictions were not rejected in any of the models and this leads to the conclusion that the BPT model should be considered as the best. This implies that the processing market is competitive.

Table 5. The MMSC values

	MMSC–BIC	MMSC–AIC	MMSC–HQIC
BPT	-36.81 *	-7.98	-21.28 *
MPT	-32.02	-6.08	-18.05
RPT	-34.31	-8.37 *	-20.34
NST	-30.21	-7.15	-17.79

Table 6. Test results for the parametric restrictions

Model		Wald statistic	P-value
BPT	$h_0: \lambda = 1$	0.66	0.417
MPT	$h_0: \lambda = 1$	0.56	0.452
RPT	$h_0: \lambda = 1$	0.16	0.687
NST	$h_0: \lambda = 1$	0.18	0.669
NST	$h_0: \gamma = \delta = 0$	3.23	0.199

The results indicated the presence of market power on the retail market. Parameter λ was statistically significant in all the models (Table 4). The estimate was 1.298 in the BPT model and ranged from 1.143 to 1.298 in the rest of the models. This implies that the retail market is collusive. The estimate exceeded the value of full mark-up, i.e. one, although the theory limits the value to be one at most. It thus became necessary to test further whether the value could statistically equal one. The probability values of the Wald test statistics varied from 0.417 in the BPT model to 0.687 in the RPT model (Table 6). None of the tests rejected the null-hypothesis, i.e. parameter λ equals one.

Parameter δ was 0.018 in the MPT model and 0.129 in the NST model (Table 4). However, the parameter was not significant in either case. This implies that retailers have no market power over processors. Estimates for parameter γ were 0.241 in the RPT model and 0.336 in the NST model. The probability value of the parameter was 0.219 in the RPT model and 0.116 in the NST model. The parameter was significant at the 12% level in the NST model which could be considered as a modest evidence for market power. However, the evidence should have been confirmed by the results of the RPT model and by MMSC but this was not the case as noted before. Thus according to the results, the processing market of dairy products is competitive but the retail market is characterized by high degree of market power.

5 Conclusions and Discussion

The results indicate that the retail sector has market power over the consumers, but there is no evidence for market power in the processing market. According to the results, the retailers employ full mark-up in the retail market implying collusive behavior in the market. The results of this study are consistent with the findings of Ulvinen (2006) as for the processing sector, but the results of Čechura et al. (2015) are not confirmed by this study.

To further study the existence of market power in the Finnish dairy chain, several different approaches could be considered. Applications with panel data would be particularly important as emphasized by Kaiser and Suzuki (2006). Different approaches should be used to relax some of the restrictive assumptions of the current approach, e.g. the linearity of cost and demand functions and time invariance. Instead of considering dairy products as a generic group, the research could focus on a certain product group, like fluid milk products. However, availability of appropriate data is expected to limit the future research.

The findings of this study further imply that the consumers are worse off. The high degree of market imperfection in the retail market of dairy products affects, not only to the dairy processing sector, but also to the milk producers. Peltoniemi et al. (2015) showed that the relative share of the wholesale–retail sector from the consumer price of dairy products grew during 2008–12. This finding supports the current conclusion, but market power should not be considered as the only reason for the grown margin. The question remains whether the prices of dairy products are about to decrease in Finland. To some extent, the correction already happened in 2015 (see e.g. Nielsen, 2016). However, public debate remains whether the retail driven discounts in the food prices were made at the expense of the retailers or the producers (see e.g. Ryynänen, 2016; MTV, 2015).

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